ISSN: 2304-0009
eISSN: 2307-7654

Bangladesh Critical Care Journal

Official Journal of Bangladesh Society of Critical Care Medicine

Volume 2, Number 1, March 2014

CONTENTS

From the Desk of the Editor

- Looking for an ideal coma scale: It is time to replace GCS. 1
  Mohammad Omar Faruq

Original Articles

- Comparing the APACHE II, SOFA, LOD, and SAPS II scores in patients who have developed a nosocomial infection 4
  Ahmed Haddadi, Mohamed Ledmani, Marc Gainier, Hubert Hubert, Joseph Tagne, P Lafaye De Micheaux
- Progression of severe sepsis to septic shock in under-five diarrheal children in an urban critical care ward in Bangladesh: Identifiable risks, blood isolates and outcome 10
  Mohammod Jobayer Chisti, Monira Sarmin, Tahmeed Ahmed, Pradip Kumar Bardhan, Hasan Ashraf Shafiqul Alam Sarker, Abu Sayeed Golam Faruque, Sumon Kumar Das, Mohammed Abdus Salam
- Territorial location of cerebral infarcts on imaging in patients with first ever stroke with diabetes 16
  Nirmalendu Bikash Bhowmik, Mohammad Saifuddin, Rajib Bhadra, Md. Rashedul Islam, Rumana Habib, Aminur Rahman, Md. Zahid Hassan, Md. Amirul Haque
- Antibiotic sensitivity pattern of urinary tract infection at a tertiary care hospital 21
  Rama Biswas, Raihan Rabbani, Hasan Shahrear Ahmed, Mohammed Abdus Satter Sarker, Nahida Zafrin, Md. Motlabur Rahman
- Childhood Deaths with a Co-Morbidity of Diarrhea and Severe Malnutrition: A Brief Insight in an Urban Critical Care Ward in Dhaka, Bangladesh 25
  Md Shakil Hossain, Sufia Islam, Mohammod Jobayer Chisti

Review Article

- EEG in ICU: A monitoring tool for critically ill patient 28
  Selina Husna Banu

Clinical Practice

- "Airway Pressure Release Ventilation" a step up care in ARDS 35
  M. Motiul Islam, Raihan Rabbani, M. Mufizul Islam Polash, Ahmad Mursel Anam

Case Reports

- Acute Shock in an Ambiguous Child 38
  Chanchal Das, Pranab Kumar Sahana, Nilanjan Sengupta, Mukut Roy, Deshmukh Ashish, Ranen Dasgupta
- Star Fruit Intoxication in Chronic Kidney Disease: Our Experience 40
  Farzana Shumy, Mohiuddin Ahmed, Ahmad Mursel Anam, M Mufizul Islam Polash, M Motiul Islam, Shahazadi Sayeeda Tun Nessa
- Sclerosing Encapsulating Peritonitis 42
  Sharmistha Roy, Tapash Kumar Maitra, Samiron Kumar Mondal
- Prolonged QTc: "Mind the Gap" 44
  Ahmad Mursel Anam, Raihan Rabbani, Farzana Shumy, M Mufizul Islam Polash, M Motiul Islam, ARM Nooruzzaman, Mirza Nazim Uddin
- An Unusual Presentation of Type 2 Diabetes Mellitus 46
  Mukut Roy, Pranab Kumar Sahana, Nilanjan Sengupta, Chanchal Das, Prashant Somani, Ranen Dasgupta
- Guillain –Barrè Syndrome following Hepatitis E 48
  Poly Sengupta, Rama Biswas, Hasan Shahrear Ahmed, Kaniz Fatema

Clinical Image

- Pseudo Sub-Arachnoid Hemorrhage 50
  Ahmad Mursel Anam, M Mufizul Islam Polash, Farzana Shumy, Mahmudul Hasan, Raihan Rabbani

Bangladesh Critical Care Journal

bsccmjournal.org

banglajol.info/index.php/BCCJ

Publication of Bangladesh Society of Critical Care Medicine

Dedicated to scientific & professional development of Critical Care Personnel

ISSN: 2304-0009

eISSN: 2307-7654

Volume 2, Number 1, March 2014

PUBLISHED BY:

Dr. ARM Nooruzzaman
Scientific Secretary
BSCCM

PRINTED AT :

A J Print Media
112/2, Fakirapool, Dhaka-1000
Mobile : 01715854378

Correspondence

Executive Editor; Bangladesh Critical Care Journal
Dept. of Critical Care Medicine, 6th Floor, BIRDEM Hospital,
122 Kazi Nazrul Islam Avenue, Dhaka - 1000, Bangladesh.
Email: editor.bccj@gmail.com; Web: bsccmjournal.org

Bangladesh Critical Care Journal

INFORMATION FOR AUTHORS

Manuscripts prepared following the "Uniform Requirements for manuscripts submitted to biomedical Journals" (http://www.icmje.org/urm_full.pdf) issued by ICMJE (International Committee for Medical Journal Editors) is acceptable to this journal for publishing. Authors are requested to follow the April 2010 update for latest information.

Editorial scope:

- The BCC Journal is intended to promote prompt publication of concise, scientific article based on the study in all fields of medical and health sciences with special predilection to matters concerning critically ill patients & ICU practice.
- Submitted manuscripts should not be previously publishedor currently being considered for publication elsewhere.
- All submitted articles will undergo double blind peer review as per recommendations by subject specific experts selected by editors.
- Reviewed manuscripts will be sent to the corresponding author for appropriate response if it is indicated.
- Acceptance is based on significance, originality, clarity and fulfillment of the criteria of the publication policy of this journal.
- The Editor-in-Chief will make all final decisions regarding acceptance.
- Selection of the reviewed and accepted manuscripts intended for publication in a particular issue will be decided by the Editorial Board.
- Hard copy of rejected manuscripts will be returned if accompanied by stamped or self-addressed envelope.
- Upon acceptance for publication the copyright of the paper automatically transfers to the BCCJ and will not be published elsewhere either in part or whole without written permission of the copyright holder.
- Review articles should be written by a subject expert.

Ethical aspects:

- Clinical trials should have been conducted according to the ethical standards laid down in the 1964 Declaration of Helsinki by World Medical Association; revised 2008 (http://www.wma.net/en/30publications/10policies/b3/17c.pdf).
- Manuscript must contain a statement in the method section that all interventional studies have been approved by the appropriate ethical committee after careful examination of the ethical aspects.
- Permission of the patients or their families to reproduce photographs of the patients where identity is not disguised.
- Author should obtain written permission to reproduce any table or illustration from any other source.

Manuscript submission:

The authors are requested to strictly follow the guidelines below for submission of manuscript to BCCJ for publication. The following documents with manuscripts are to be submitted for publication.

- A cover letter addressed to the Editor-in-Chief of the journal.
- A Title page.
- Abstract and key words in the first page followed by the text, prepared in the format of IMRaD.
- Authors may submit 2 hard copies of all documents and one copy in electronic form written in a CD with adequate labeling.
- Alternately author can submit directly in electronic format (*.doc format as attachment) through email.
- In case of electronic submission, formal cover letter signed by all the authors should be scanned & submitted along with the manuscript.

Cover letter:

- All authors must sign after seeing the manuscript with the statement that they are the only authors.
- It should contain a declaration that this manuscript has not been submitted elsewhere or currently not under consideration in any other journal.
- It should clearly indicate the publication type (Original/Review/Case report/letter etc.)
- Should also mention the expected benefit of the medical science from publishing of this article & the rationale of publishing the article in BCCJ.

Manuscript organization:

Typing

- Double spaced throughout with justified paragraph formatand 5cm margin form the header and 2.5cm margins in all other aspects
- Font type is Times New Roman with font size 12.
- Printed on a good quality A4 80 gm on one side of paper, or formatted as such in electronic format.
- Manuscript should have uniform style, carefully proofread for grammar, spelling and punctuation

- All pages should be numbered consecutively beginning from the title page & number should be placed at bottom center of each page.

Manuscript format

- In general, original articles should be divided into following sections:
- Title page, Abstract, Text, Acknowledgement, References.
- Tables, graphs, illustrations should be appropriately placed in the manuscript with legends & foot notes as expected in printed version.
- Each of the sections is to start on a separate page

Title page:

- Title of the article
- Names of all authors with their designation and institutional affiliations
- Name of the department and institute where the study was undertaken
- Name of the corresponding author with contact address, telephone number, email address
- Disclosure of conflict of interest if any
- Disclosure of sources of funding or sponsor
- A short running head
- 'Key words' representing the article and suitable for electronic search
- Number of tables given
- Number of figures given
- Word count of abstract/summary

Abstract/Summary:

- Structured with headings (Background, Objectives, Methods with statistical analysis, Result & Conclusion) for original works.
- Authors name should not be given.
- Preferably within 250 words.
- No abbreviations in the title and abstract except standard abbreviation.
- A non structured abstract is suggested for review article and case report.

Text:

- IMRaD Format
- Text should be arranged into following sections: Introduction, Methods, Results, Discussions, Acknowledgement, & References

Introduction:

- Statement of the problem with a short discussion of its importance and significance
- Review of the literature related to the problem with pertinent reference
- Objectives/ hypothesis/ benefits expected stated in 1-2 paragraphs

Methods:

- Study type, place and time
- Description of study variables
- Description of study subjects and grouping
- Selection criteria
- Approval of the interventional study involving human subjects by ethical review committee and description of the ethical aspects in such study
- Description of procedure, methods, apparatus, drugs or chemicals as applicable
- Description of statistical procedure with enough detail to enable a knowledgeable reader with access to the original data to verify the reported results

Results:

- Present result in logical sequence in text, table and illustration with most important finding first
- Describe without comment
- Restrict number of tables and figures needed to support assessment of paper
- Do not duplicate data in tables and figures

Tables:

- Simple, self explanatory with brief title, not duplicated in text
- Each table should be numbered in Romans and printed in appropriate place in the text
- Tables should be formatted by Microsoft word & presented with in the *.doc file, Not as a picture.
- Use of many tables is not encouraged

Illustrations:

- All illustrations must be numbered consecutively in Arabic numerals as they appear in the text
- Submit print photograph of each illustration along with its electronic file
- Figure number, title of manuscript, name of the corresponding author and arrow indicating top should be written on a sticky label affixed on the back of each photograph
- Scanned picture, graph, chart with title and figure number should be placed at the appropriate place as expected in the printed version and its original electronic file should be submitted separately also in the CD along with text or by separated file attachments through email.
- Photomicrograph should indicate the magnification, internal scale and the method of staining
- All drugs should be mentioned in their generic form. The commercial name may be used in parenthesis

Acknowledgement:

- Individuals, institution, sponsor, organization or bodies should be acknowledged in the article for their contribution or financial or any form of assistance to the work

References:

- For reference, use author number style (Vancouver) which is based on an ANSI standard adapted by the National Library of Medicine(NLM)
- References should be numbered consecutively in the order in which they are first mentioned in the text
- Identify references in the text, tables and legends by Arabic numerals in superscript
- All citations to electronic references should be presented in numbered references following the text
- The titles of the journals should be abbreviated according to the style used in Index Medicus
- Write names of 6 authors followed by et al. if authors' number is more than six.
- The reference list is not usually verified by the editorial staff or reviewer. It is the total responsibility of author to provide accurate information.
- Consult http://www.nlm.nih.gov/citingmedicine/ for full detail of the referencing system followed by BCCJ.
- Examples of common referencing is given below:
- **Standard journal article:**

Khalil M, Chowdhury MAI, Rahman H, Mannan S, Sultana SZ, Rahman MM, et al Splenic Mass and its relation to age, sex and height of the individual in Bangladeshi People. J Bangladesh Soc Physiol 2008; 3(1): 71-78.

- **Journal article with organization as author:**

  American diabetes Association. Diabetes update. Nursing, 2003 Nov; Suppl: 19-20.

- **Journal article with multiple organizations as author:**

  American Dietetic association; Dietitians of Canada. Position of Dietetic association and Dietitians of Canada: nutrition and women's health. J Am Diet Assoc 2004 Jun; 104(6): 984-1001.

- **Journal article with Governmental body as author:**

  National Institute on Drug Abuse (US); Caribbean Epidemiology Centre; Pan American Health Organization; World Health Organization. Building a collaborative research agenda: drug abuse and HIV/AIDS in the Caribbean 2002-2004. West Indian Med J. 2004 Nov; 53 Suppl 4: 1-78.

- **Standard book with initials for authors:**

  Eyre HJ, Lange DP, Morris LB. Informed decisions: the complete book of cancer diagnosis, treatment and recovery. 2nd ed. Atlanta: American Cancer Society; 2002. 768 p.

- **Contributed chapter of a book:**

  Rojko JL, Hardy WD. Feline lukemia virus and other retroviruses. In: Sherding RG, editor. The cat: diseases and clinical management. New York: Churchill Livingstone; 1989. p. 229-332.

- **Conference Proceedings:**

  Pacak K, Aguilera G, Sabban, E, Kvetnansky R, editors. Stress: current neuroendocrine and genetic approaches. 8th symposium on Catecholamines and Other Neurotransmitters in Stress: 2003 Jun 28-July 3; Smolenice Castle (place of conference), Slovakia. New York (place of publication): New York Academy of Sciences (publisher); 2004 Jun. 590 p.

- **Scientific and Technical Reports:**

  Page E, Harney JM. Health hazard evaluation report. Cincinnati (OH)(Place of publication: National Institute for Occupational Safety and Health (US) (Publisher); 2001 Feb.24 p (Total number of pages). Report No.: HETA2000- 0139-2824

- **Dissertation &Thesis:**

Entire Reference

Kempner JL. Aching heads, making medicine: gender and legitimacy in headache (title) [dissertation]. [Philadelphia]: University of Pennsylvania;2004.271p.

- Alam M. Study of Heart Rate Variability in Adolescent Athletes [M Phil thesis]. [Dhaka]: Bangabandhu Sheikh Mujib Medical University; 2008. 178p.

- **Part of Dissertation &Thesis:**

Mackowski MP. Human factors: aerospace medicine and the origins of manned space flight in the United States [dissertation]. [Tempe (AZ)]: Arizona State University; 2002 May. Part 2, Space medicine; p.188-377.

- Alam M. Heart Rate Variability in Adolescent Athletes [M Phil thesis]. [Dhaka (Bangladesh)]: Bangabandhu Medical University; 2008 July. Appendix (Name of the part) 4 (Number of the part), Classification of Physical Activity Intensity (Title of the part). p.7 (Location of the part).

- **Standard journal article on the Internet:**

  Kaul S, Diamond GA. Good enough: a primer on the analysis and interpretation of noninferiority trials. Ann Intern Med [Internet]. 2006Jul4 [cited 2007 Jan 4]; 145 (1):662-9.

  Available from: http://www.annals.org/cgi/reprint/145/1/62.pdf

- **Journal article on the Internet with organization (s) as author:**

  National Osteoporosis Foundation of South Africa. Use of generic alendronate in treatment of osteroporosis. S Afr Med J [Internet]. 2006 Aug [cited 2007 Jan 9]; 9(8):696-7.

Available from:

http://blues.sabinet.co.za/ WebZ/Authorize?

- **Journal article on the Internet with governmental body as author:**

  Centers for Disease Control and Prevention(US), National center for HIV/AIDS, Hepatitis, STD, and TB Prevention and control of tuberculosis in correctional and detention facilities: recommendations from CDC. Endorsed by the Advisory Council for the elimination of tuberculosis, the national Commission of Correctional Health Care and the American correctional Association. MMWR R Rep [Internet]. 2006Jul7 [cited 2007Jan 9]; 55(RR-9):1-44. Available from: http://www.cdc.gov/ mmwr/preview/ mmwrhtml/rr5509al.htm

- **Journal article on the Internet with no author:**

  Prevention strategies for asthma-secondary prevention. CMAJ [Internet]. 2005 Sept [cited 2007Jan 5]; 173 (6 Suppl): S25-7. Available from: http//:www.cmaj.ca /cgi/content/ full/ 173'6_suppl/S25

- **Journal article on the Internet without standard volume, issue or article number:**

  Jacobs JL, Lee MT, Lindberg M, Kamin C. Problem based learning, multimedia paucity of behavioral issue learning. Med Educ. Online [Internet]. 2005 [cited2005]: [5p]. Available from: http://www.med-ed-online.org/pdf/ 10000006.pdf

Editing and peer review:

- All submitted manuscripts are subject to scrutiny by the Editor in-chief or any member of the Editorial Board.
- Manuscripts containing materials without sufficient scientific value and of a priority issue, or not fulfilling the requirement for publication may be rejected or it may be sent back to the author(s) for resubmission with necessary modifications to suit one of the submission categories.
- Manuscripts fulfilling the requirements and found suitable for consideration are sent for peer review. Submissions, found suitable for publication by the reviewer, may need revision/ modifications before being finally accepted.
- The Editorial Board finally decides upon the merit of the reviewed and revised/modified submission.
- Reviewed accepted manuscript may be sent to the authors, and should be corrected and returned to the editorial office within one week. No addition to the manuscript at this stage will be accepted.
- All accepted manuscripts are edited according to the Journal's style.

Submission Preparation Checklist

As part of the submission process, authors are required to check off their submission's compliance with all of the following items, and submissions may be returned to authors that do not adhere to these guidelines.

- The submission has not been previously published, nor is it currently before another journal for consideration (or an explanation has been provided in Comments to the Editor).
- The submission file is in Microsoft Word 97-2003, *.doc file format.
- Where available, URLs for the references have been provided.
- The text is double-spaced; uses a 12-point font; employs italics, rather than underlining (except with URL addresses); and all illustrations, figures, and tables are placed within the text at the appropriate points, rather than at the end.
- The text adheres to the stylistic and bibliographic requirements outlined in the Author Guidelines.

Communication for manuscript submission:

Authors are requested to send new and revised manuscripts to the following address:

Editor-in-Chief
Bangladesh Critical Care Journal
Dept. of Critical Care Medicine,
6th Floor
BIRDEM General Hospital,
122 Kazi Nazrul Islam Avenue, Shahbagh,
Dhaka - 1000, Bangladesh.

Alternately by email to:

manuscript.bccj@gmail.com

With appropriate subject field & mail body describing the matter and the main manuscript as attachment in *.doc format.

All other form of electronic communication should be directed to

editor.bccj@gmail.com

Corresponding author should clearly indicate a reply address and preferably an electronic means of communication in the title page.

Copyright:

Bangladesh Crit Care J March 2014; 2 (1): 1-3

From the Desk of the Editor

Looking for an ideal coma scale: It is time to replace GCS.

Mohammad Omar Faruq

The evaluation of comatose patients in intensive care unit (ICU) is very much challenging. Within the complex spectrum of consciousness, scoring systems have been developed to obtain a fast comprehensive assessment of coma to facilitate communication among examiners as well as to monitor changes for therapeutic decision and to provide prognostic information. Assessment of coma is a core clinical skill for physicians. Scales have been constructed to improve communication among health care personnel and also to standardize examination of the unconscious patients. It also allows the grading of an unconscious patient over time which would indicate changes in clinical condition so that outcome may be predicted. Coma scales can also be used to facilitate data entry for clinical studies.

The assessment of comatose patients requires a comprehensive examination, interpretation of difficult laboratory tests which includes neuroimaging and electro encephalogram (EEG) on different occasions. An ideal coma scale[1] should be reliable, valid, easy to use, easy to remember and of course an indicator of patient outcome. Raters who examine patients should be able to test accuracy of an ideal coma scale. Such scales should not involve additional cards or tools and should be useful in variety of patients with acute neurological disease not exclusively traumatic brain injury. Medical intervention like endotracheal intubation should not make assessment of certain components unreliable. There should not be any scope for educated guess or pseudo scoring in an ideal coma scale and it should be easy to memorize all components of the scale. The scale should have internal consistency which means when component changes parallel changes should be seen in other components. Lower scores in an ideal scale should indicate higher chances in mortality or future disability in a patient. Above all an ideal coma scale should not be too simple or too complicated.

Clinicians should not forget that a coma scale may be less effective if confounders are present. A patient with aphasia, dementia or with a tracheostomy may have impaired verbal response. A patient with ocular trauma or periorbital edema will have impaired eye opening. An ICU patient who is on sedation or on neuromuscular junction blocker will not show appropriate brainstem reflexes. A patient who is on ventilator in ICU or a patient with pulmonary edema will not allow assessment of respiratory pattern in a comatose condition.

Historically coma scales originated in neurosurgical intensive care units. Charting neurologic status and physiologic functions at the bedside was a common practice but the need for a clinical tool prompted development of a grading system.

The earliest literature describing coma score or scale goes back in 1966, when a comprehensive scoring system called "Vital Sign Card" was developed by Ommaya[2], a neurosurgeon at the National Institute of Neurological diseases and Blindness at Bethesda, Mary land, USA. It was later known as Ommaya Coma Scale and it had total 41 scoring points distributed under 8 headings. The headings included level of consciousness, motor activity, pupillary status, corneal reflex, blood pressure, rate & type of respiration and rectal temperature. This scoring system was reported to be used only in author's institution.

In 1974, Teasdale and Jennett from Institute of Neurological Science, Glasgow, UK published the land mark article in Lancet[3] "Assessment of coma and impaired consciousness: a practical scale." The first version of the scale was known as the coma index but soon became known as Glasgow Coma Score (GCS) for the home of author's institution. The GCS was constructed mainly to improve communication between physicians and nurses when describing difficult state of impaired consciousness and to avoid ambiguous definition such as somnolence.

Teasdale and Jennett excluded certain tests from the scale (e.g. Brainstem reflexes) that they believed would be difficult for inexperienced junior doctors and nurses to perform or interpret. The GCS therefore assessed only motor, verbal and eye response. The GCS was initially was unnumbered system. The practice of assigning numbers to the response using "1" for the lowest score rather than "0" was introduced in a later publication[4]. Users of the GCS began creating sum scores for the 3 components (giving a total range of 3 to 15 points).

Since its introduction GCS has been used extensively. It has become the gold standard against which newer scales began to be compared. The GCS scale was rapidly adopted by physicians other than neurologists and neurosurgeons. It has been incorporated in Intensive care and trauma scoring systems to assess risk of in hospital mortality. GCS sum score also became a marker for prognosis.

Despite its broad acceptance, however GCS did not escape criticism[1]. First the score was skewed toward the motor part of the scale (6 items versus 4 for eyes and 5 for verbal). Second, the verbal component of the GCS is unusable in intubated and dysphasic patients. Third, abnormal brainstem reflexes, changing breathing patterns and need for mechanical ventilation could reflect severity of coma. Fourth, the GCS may not detect subtle changes in neurological examination.

In 1973 Sugiura from department of surgical neurology of University of Edinburg, UK devised a scale and it was named as Edinburg coma scale. As it was published in a Japanese Journal[5] it did not get international attention. In 1993 Sugiura et al modified the Edinburg Coma scale and developed Edinburg - 2 Coma scale (E2 CS)[6]. This scale rapidly became obsolete but claimed more sensitivity than GCS regarding patient's ability to follow commands.

In 1988, Born from Belgium modified GCS into Glasgow – Liege scale[7]. It added a set of tests of brainstem responses that

may disappear when the brainstem loses its function in a retro caudal direction.

In 1991 Brain Resuscitation Clinical Trial II Study Group introduced Pittsburg Brain Stem Score (PBSS) [1] incorporating brainstem reflexes.

In1984, Comprehensive level of Consciousness Scale (CLOCS) [8] was developed by dept of neurosurgery of University of Tennessee Health Science Center, USA. This scale was very comprehensive and included 197 options which was too comprehensive to be useful for clinical practice.

In 1988, Reaction level Scale (RLS 85)[9] was adopted in Sweden. It categorized patients as alert, drowsy or confused or unconscious with all categories followed by specific motor responses. The RLS 85 demonstrated greater accuracy than the GCS. However a strong correlation was found between RLS 85 and GCS.

In 1991, Innsbruck Coma Scale[10] was published in Lancet. This scale included brainstem reflexes and eliminated the verbal response. Retrospective study showed that the scale had greater predictive power for mortality than did the GCS.

All these alternative scales other than GCS rarely emerged in publications outside the institution or country where they originated and they never had widespread acceptance like that of GCS among neuromedicine specialists or neurosurgeons.

In 2005, Wijdicks et al from Mayo Clinic USA published a land mark scoring system in Annals of Neurology[11], the Full Outline of Unresponsiveness (FOUR) score, a new scale developed to provide a better and comprehensive assessment. The FOUR score included additional information, not assessed by GCS like brainstem reflexes, visual tracking, breathing pattern and respiratory drive. FOUR score scale has range of 0-16 scoring points as opposed to 3-15 scoring points of GCS.

As opposed to GCS (which has 3 components e.g. Eye opening, Best verbal response and Best motor response) FOUR score has 4 components namely Eye response, Motor response, Brainstem reflexes and Respiration.

According to its proponents, FOUR score gives greater neurologic information. It quantifies consciousness by examining eye and motor responses, brainstem reflexes and breathing pattern. It has been observed that FOUR score remains testable in neurologically critically ill intubated patients while intubation invalidates one of 3 components of GCS. FOUR score tests essential brain stem reflexes and provides information about brainstem injury that is unavailable with GCS. FOUR score recognizes locked in syndrome and points to signs suggesting brain death, uncal herniation. In these situations GCS has not been useful or reliable. Attention to respiratory pattern in FOUR score not only may indicate need for respiratory support in comatose patients but also provide information about respiratory drive. FOUR score further characterizes the severity of comatose patients with lowest GCS score. As a result probability of in hospital mortality is higher for the lowest total FOUR score when compared with that of GCS. FOUR score has been subjected to validation studies[11-16] in different scenarios like neuro ICU, emergency departments, medical ICU, comatose stroke patients in acute stroke unit , traumatic brain injuries etc. It has been compared with GCS in these validation studies and excellent inter rater agreements have been observed.

Looking into the history and evolution of coma scale, it appears that GCS so far stood the test of time for 30 years since its introduction until 2005 when it was challenged by the proponents of FOUR Score Scale. In spite of its draw backs GCS is still being used by clinicians of many institutions because of its simplicity of use. But it has lost its usefulness in severe neuro impaired patients more so in the settings of ICUs. At best we can conclude that GCS is probably more suitable for simpler non intubated patients without brainstem dysfunction. In conclusion FOUR Score has the potential to achieve wide spread acceptance among our physician community to become a universally acceptable gold standard Coma Scale.

Mohammad Omar Faruq
MD, FACP, FACEP, FCCM, FCPS .
Professor of Critical Care Medicine,
BIRDEM General Hospital and Ibrahim Medical College,
Dhaka, Bangladesh.
Email: faruqmo@yahoo.com

References:

1. Wijdicks EFM. Clinical scales for comatose patients: The Glasgow coma scale in historical context and the new FOUR score. Reviews in neurological diseases.2006 ; 3(3) : 109 – 117.
2. Ommya AK. Trauma to the nervous system. Ann R Coll. Surg. Engl. 1966 ; 39 : 317- 347.
3. Teasedale G, Jennett B. Assessment of coma and impaired consciousness: A practical scale. Lancet . 1974 ; 2(7872) : 81-4.
4. Teasedale G, Jennett B. Assessment and prognosis of coma after head injury. Acta Neurochir (wien). 1976 ; 34 : 45 – 55.
5. Sugiura K, Whatmore WJ, Gillingham FJ. The state of consciousness as a prognostic guide after severe head injury. No Shinkei Geka. 1973. 1 : 475- 479 (in Japanese).
6. Sugiura K, Muraoka K, Chishiki T, Baba M. The Edinburg - 2 Coma scale: A new scale for assessing impaired consciousness. Neuro Surgery. 1983; 12 (4): 411- 415.
7. Born JD. The Glasgow – Liege scale: Prognostic value and evolution of motor response and brainstem reflexes after severe head injury. Acta Neurochir (Wien). 1988; 91: 1 - 11.
8. Stanczak DE, Whise JG 3rd, Gouview WD. Assessment of level of consciousness following severe neurological insults. A comparison of the psychomotor qualities of Glasgow coma scale and comprehensive level of consciousness scale. J. Neurosurg. 1984; 60: 955 – 960.
9. Starmark JE, Stalhammer D, Holmgren E. The reaction level scale (RLS 85), manual and guidelines. Acta Neurochir (Wien). 1987; 91: 12 – 20.

10. Benzer A, Mitterschiffthaler G, Murosi M, Luef A, Puhringer F, De La Renotiere K, Lehner H, Schmutzhard E. Prediction of non survival after trauma : Innsbruck coma scale. Lancet. 1991 ; (338) : 977- 978.

11. Wijdicks EFM, Bamler WR, Maramattom BV, Manno EM, Mc Celland RL. Validation of new coma scale: The Four score. Ann. Neurol. 2005; 58 : 585 – 593.

12. Iyer VN, Mandrekar JN, Danielson RD, Zuvkof AY., Elmer JL, Wijdicks EFM. Validity Four score coma scale in the medical intensive care unit. Mayo Clin Proc. 2009; 84(8): 694 – 701.

13. Kervic J, Jelinek GA, Knott J, Weiland TJ. Validation of full outline of unresponsiveness (FOUR) scale for conscious state in the emergency department : comparison against the Glasgow coma scale. Emerg. Med. J. 2011; 28 : 486 – 490.

14. Stead LG, Wijdicks EFM, Bhagra A, Kashyap R, Bellolio MF, Nash D, Enduri S, Schears R, William B. Validation of a new coma scale , the FOUR score in the emergency department. Neurocrit. Care. DOI 10.1007/s 12028 – 008 - 9145 – 0.

15. Sadaka F, Patel D, Lakshman R. The FOUR score predicts outcome in patients after traumatic brain injury. Neurocrit. Care. DoI 10.1007/s 12028 – 011 – 9617 – 5.

16. Idrovo L, Fuentes B, Medina J, Gabaldon L, Ruiz – Ares G, Abenja MJ, Aguilar – Amat MJ, Martinez – Sanchez P, Rodriguez L, Cajorla R, Martinez M, Tafur A, Wijdicks EFM, Diez – Tezedor E. Validation of FOUR score (Spanish version) in acute stroke : An inter observer variability study. Eur. Neurol. 2010; 63 : 364 – 369.

Bangladesh Crit Care J March 2014; 2 (1): 4-9

Original Article

Comparing the APACHE II, SOFA, LOD, and SAPS II scores in patients who have developed a nosocomial infection

Ahmed Haddadi[1], Mohamed Ledmani[2], Marc Gainier[3], Hubert Hubert[4], Joseph Tagne[5], P Lafaye De Micheaux[5]

Background: *There have been numerous scores intended to evaluate the severity of patients' condition upon admission and during their intensive care unit (ICU) stay. However, to our knowledge, no study has ever evaluated the predictive abilities of these scores among nosocomial patients during their ICU stay. The aim of our study is to compare the predictive performances of the Acute Physiology, and, Chronic Health Evaluation (APACHE II) score, Simplified Acute Physiologic Score (SAPS II), Logistic Organ Dysfunction (LOD), and Sequential Organ Failure Assessment (SOFA) scores among intensive care patients who have developed a nosocomial infection.*

Methods: *The study is monocentric and retrospective. The APACHE II, SAPS II, LOD, and SOFA scores were reported from the third day of the patient's hospital stay, preceding the diagnosis of the first nosocomial event up to the third post diagnosis day.*

Results: *Out of 46 patients contracting at least one ICU-acquired infection, the multiple analyses indicated that on the day of diagnosis, the SOFA score is the most predictive (odds ratio [OR]: 12.3; 95% confidence interval [CI]: 2.33–64.91). The second most predictive was the APACHE II score (OR: 8.29; 95% CI: 1.43–48.14). The third and fourth most predictive were the LOD score (OR: 4.06; 95% CI: 0.81–20.26) and the SAPS II score (OR: 2.26; 95% CI: 0.55–9.24), respectively.*

Conclusion: *The analysis of the receiver operating characteristic areas under the curve of the reported scores in the present study showed that the best predictive performance is in favor of the SOFA score.*

Keywords: *intensive care, risk factors, nosocomial infections, ICU mortality, severity scores*

Introduction

Whatever their specialty (surgical, medical, or both), intensive care units (ICUs) have to take care of patients with life-threatening conditions as a result of one or even several organ failures. These departments register the highest mortality rates[1] and the highest amounts of nosocomial infections.[2]According to several studies,[3,4] this high rate of nosocomial infections is matched with an increase in therapeutic activity and high severity scores. Indeed, these high severity scores give an evaluation of the seriousness of each case due to comorbidities and due to severe illness; they are also a good indication of the patient's response to therapy.[5-9] The use of these measures during admission or during the ICU stay is a common practice; these measures are also frequently used in most of the reviews that have studied nosocomial risk.[10,11]

1. Ahmed Haddadi; Research Unit EA 2694 Public Health, Epidemiology, and Quality of Care, Medical University, Lille, France
2. Mohamed Ledmani; Research Unit EA 2694 Public Health, Epidemiology, and Quality of Care, Biostatistics Laboratory, Lille, France
3. Marc Gainier; Timone University Hospital's Intensive Care Unit, Marseille, France
4. Hubert Hubert; Research Unit EA 2694 Public Health, Epidemiology, and Quality of Care, Institute of Public Health, University Lille, Lille, France
5. P Lafaye De Micheaux; Department of Mathematics and Statistics, University of Montreal, Montreal, QC, Canada.

Corresponding Author:
Ahmed Haddadi;
Research Unit EA 2694 Public Health
Epidemiology and Quality of Care, Medical University, Lille, France.
Ahmed.haddadi@univ-lille2.fr

Among the severity scores most frequently used among patients in intensive care, we must point out the following points. First, the Acute Physiology, And, Chronic Health Evaluation (APACHE II) score's calculation is only based on 12 physiological variables associated with the patient's age, and it pertains to a certain number of comorbidities. Calculated on the most pejorative values during the first 24 hours in intensive care, these 12 physiological variables, taken apart, constitute the Acute Physiologic Score (APS).Use of the APACHE II score is still a bit difficult and quite empirical; however, its prognostic capacity during the first 24 hours of stay in intensive care is evident.[12]Second, the Simplified Acute Physiologic Score (SAPS II) is a simplified system that evaluates severity. It is based on a critical overview of the first APACHE system.[13] Third, the Logistic Organ Dysfunction (LOD) score was developed by Le Gall et al,[13]using the same database that was used to develop the framework of the SAPS II score. Finally, the SOFA score is different from the others because of its sequential capacity in evaluating the incidence and the severity of the organ dysfunction.[14-16] However, it can be noted that these four scores have numerous similarities, as they evaluate the same organs.[17-20]

There is a huge range of scores when evaluating the severity of patients during admission or during their stay in intensive care. However, as far as we know, no study has ever compared the predictive performance of these scores among a population of nosocomial patients and during their stay in intensive care. The aim of this study is to evaluate the performance of the APACHE II, LOD, SOFA, and SAPS II scores for their prediction of mortality in nosocomial patients during the patients' stay in intensive care.

Materials and methods

This study is monocentric and retrospective in nature. It took place at Timone University Hospital's ICU, which is one of the most important hospitals in Southeast France. Equipped with 1,069 beds (793 for adults and 276 for children), it is Europe's third-largest hospital.The ICU contains nine beds. Admissions are processed directly by the emergency unit or by the Mobile Emergency Unit. Patients can be transferred from other hospitals either by internal admissions or through the specific request of another service. The approval of the ethics committees was unnecessary when conducting this study; all information related to the identity of the patients will remain confidential.

Out of a total of 565 patients hospitalized from January 1, 2011 to June 30, 2012, 291 patients, aged ≥16 years and staying in the ICU for at least 3 days were included in the study. Among the 291 selected patients, 41 were not included due to missing data. Amongst the 250 remaining patients, 46 developed at least one nosocomial episode. Infected cases were determined based on bacteriological samples. It was decided that the day of collection would be designated as the first day of infection, and we only took into account the first nosocomial episode. The collection of data was performed according to a standard format. We systematically recorded each patient's age, sex, dates of ICU admission and discharge, number of days spent at the ICU before the start of the first nosocomial infection, total number of days spent in hospital, clinical settings (comorbities, reasonsfor hospitalization), origins of the patient, type of pathology, type of infection, and pathogenic causal agents. We reported every invasive procedure (intubation, tracheotomy, urinary catheter, central catheter, or sedation), and the duration of the use of antibiotics before and after the nosocomial incident occurred. The LOD score, the SAPS II score, and the SOFA score were calculated in advance, 3 days before the day of the infection diagnosis and 3 days afterwards.

Statistical analysis

To identify which of the four scores best predicts a fatal issue among our study group, we calculated the odds ratios (OR) and 95% confidence intervals (95% CI) for variables associated with mortality. All of the significant risk factors studied during the univariate analysis with *P*-value <0.20 were introduced in the four univariate logistic regression models.

For each measure, APACHE II, LOD, SOFA, and SAPS II scores were calculated on days D–3, D–2, D–1, D+1, D+2, D+3;in addition, the specificity, sensitivity, the global predictive accuracy, the positive predictive value (PPV), and the negative predictive value (NPV) were determined. The cut-off point for mortality prediction during the ICU stay was determined for each score once the Youden index (sensitivity + specificity–1) was maximal (under the constraint that specificity does not equal one, and that the sensitivity is not zero, to avoid over fitting). It should be noted that the Youden index evaluates the efficacy of the performance of a test diagnosis. It is lowered to 0 for a very weak performance and is close to 1 for a high performance. A calculation of the area within the receiver operating characteristics (ROC) curve was performed 3 days before the day of diagnosis of the nosocomial infection, and up to the third day after the date of the diagnosis (D–3, D–2, D–1, D0, D+1, D+2, and D+3). All analyses were performed using R statistical software (Wirtschafts University, Vienna, Austria), and a 5% statistical significance level was chosen.

Results

The data from our study were based on a total of 46 patients, aged 18 years and over, with a minimum stay in the ICU of 3 days, from July 1, 2011 to June 30, 2012.It can be noted that, among the top-ranking community-acquired infections in intensive care, the number one infection is pneumonia, which is contracted under mechanical ventilation at a rate of 47.82%, and this is followed by lung infections (21.73%). Bacteriemias and urinary infections rate 17.39% and 10.87%, respectively. All of the infected patients (100%) were given antibiotics. The overall morbidity rate was 23.91%. The demographic and clinical data are reported in Table 1 and Table 2.The objective values of the SAPSS II, APACHE II, SOFA, and LOD scores measured on days D–3, D–2, D–1, D+1, D+2, D+3, and D0 (which is the day of nosocomial infection diagnosis) are reported in Tables 3, 4, 5, and 6.

Table 1:
Description of the exogenous quantitative variables

	N	Minimum	Average	Std Deviation	Median	Maximum
Age	46	18	56.09	14.73	56.00	84
LOS	46	3	19.11	12.40	17.00	69
D.ICU-AI	46	3	6.63	4.30	6.00	27
MV	46	0	15.00	11.28	12.00	63

Abbreviations:D.ICU-AI, diagnosis day of intensive care unit acquired infection; LOS, length of stay; MV: mechanical ventilation.

Table 2:
Description of the exogenous qualitative variables

	Modalities	Percentage (in%)
Gender	Female	37.0
	Male	63.0
Death	No	76.1
	yes	23.9
Origins	Other	67.4
	Medical	32.6
Med/Chir	Medical	87.0
	Chirurgical	13.0

Table 3:
Description of the SAPS II score

	N	Minimum	Average	Std Deviation	Median	Maximum
SAPSII D-3	34	26	44.24	11.57	42.00	69
SAPSII D-2	46	21	43.67	13.13	42.00	73
SAPSII D-1	46	22	44.15	11.51	44.00	70
SAPSII D0	46	22	44.46	12.51	44.00	73
SAPSII D+1	43	22	43.44	11.81	42.00	73
SAPSII D+2	43	22	40.91	12.57	38.00	73
SAPSII D+3	40	16	39.10	11.84	38.00	73

Table 4:
Description of the LOD score

	N	Minimum	Average	Deviation	Median	Maximum
Lods D-3	34	2	5.56	2.44	6.00	11
Lods D-2	46	2	5.54	2.56	5.00	11
Lods D-1	46	1	5.72	2.46	5.50	11
Lods D0	46	2	6.13	2.22	6.00	12
Lods D+1	42	2	5.62	2.39	5.50	12
Lods D+2	42	2	5.43	2.38	5.00	11
Lods D+3	40	2	5.18	2.41	5.00	11

Table 5:
Description of the APACHE II score

	N	Minimum	Average	Deviation	Median	Maximum
APACHEII D-3	35	11	22.09	8.00	22.00	50
APACHEII D-2	46	1	22.07	8.77	21.50	49
APACHEII D-1	46	4	22.50	8.56	22.00	47
APACHEII D0	46	4	23.35	9.01	23.00	45
APACHEII D+1	42	3	23.45	9.45	23.50	50
APACHEII D+2	41	3	23.29	10.31	21.00	56
APACHEII D+3	39	3	23.03	9.71	21.00	48

Table 6:
Description of the SOFA score

	N	Minimum	Average	Deviation	Median	Maximum
SOFA D-3	34	4	6.50	2.12	6.00	11
SOFA D-2	46	3	6.50	2.14	6.00	11
SOFA D-1	46	2	6.96	2.21	6.00	12
SOFA D0	46	2	7.17	2.35	6.00	13
SOFA D+1	43	2	6.74	2.34	6.00	12
SOFA D+2	41	2	6.51	2.24	6.00	12
SOFA D+3	39	3	8.28	9.06	5.00	48

The results of the calculation of the area under the ROC curve for the APACHE II, SAPS II, SOFA and LOD scores – which were calculated from the third day before the diagnosis of the nosocomial event, and up to the third post diagnostic day – are described in Table 7 and Figure 1.

Table 7:
Confidence interval (95%) for the AUC ROC

Score	Day	Lower bound 95%	AUC	upper bound 95 %
	-3	0.321	0.536	0.750
	-2	0.257	0.458	0.660
	-1	0.313	0.509	0.705
SAPS II	0	0.361	0.560	0.758
	1	0.384	0.577	0.770
	2	0.449	0.634	0.818
	3	0.354	0.563	0.771
	-3	0.329	0.558	0.786
	-2	0.383	0.596	0.809
	-1	0.356	0.575	0.794
LODS	0	0.399	0.603	0.807
	1	0.491	0.674	0.858
	2	0.452	0.635	0.818
	3	0.386	0.586	0.786
	-3	0.419	0.632	0.846
	-2	0.443	0.630	0.817
	-1	0.489	0.674	0.859
APACHE II	0	0.489	0.679	0.869
	1	0.527	0.704	0.881
	2	0.546	0.726	0.906
	3	0.526	0.711	0.896
	-3	0.489	0.713	0.938
	-2	0.542	0.729	0.915
	-1	0.519	0.719	0.920
SOFA	0	0.613	0.766	0.919
	1	0.519	0.714	0.910
	2	0.455	0.661	0.866
	3	0.519	0.718	0.916

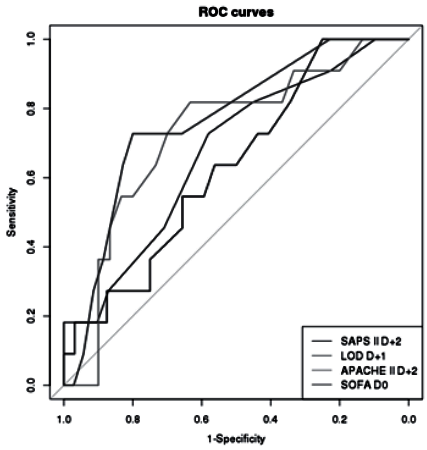

Figure 1: *ROC curve for APACHE II, SOFA, and SAPSII scores*

The multiple logistic regression analysis, which controlled for the predictive factors of a fatal issue (death), shows that the SOFA score on the day of diagnosis is the most predictive of mortality (OR: 12.3; 95% CI: 2.33–64.91), followed by the APACHE II score (OR: 8.29; 95% CI: 1.43–48.14). The next most predictive are the LOD score and the SAPAS II score, respectively (LOD OR: 4.06; 95% CI: 0.81–20.26; SAPS II OR: 2.26; 95% CI: 0.55–9.24).It was evident that the area under the ROC curve is higher for the SOFA score on the day of diagnosis. The area under the ROC curve was highest for the LODS score on the day after the diagnosis was made, and it was highest 2 days after the diagnosis was made for the SAPS II and APACHE II scores. Conversely, the results of the analysis show that the best value of the Youden index (0.527), the best specificity (80%), the best global prediction rate (78.3%), as well as the best negative and positive predictions (53.3% and 90.3%, respectively) were established by the SOFA score on the day of diagnosis. The APACHE II score yields the highest sensitivity (Table 8).

Table 8: Death prediction on the very best day as far as discriminating power is concerned.

Score	Daily scores with the best discriminating power	cut off point	Youden index	Sensitivity (in %)	Specificity (in %)	global prediction	positive prediction (in %)	negative prediction (in %)
SAPS II	+2	42.5	0.201	54.5	65.6	62.8	35.3	80.8
LODS	+1	5.5	0.308	72.7	58.1	61.9	38.1	85.7
APACHE II	+2	22	0.451	81.8	63.3	68.3	45	90.5
SOFA	0	7.5	0.527	72.7	80	78.3	53.3	90.3

The multiple logistic regression analysis, which controlled for the predictive factors of a fatal issue (death), shows that the SOFA score on the day of diagnosis is the most predictive of mortality (OR: 12.3; 95% CI: 2.33–64.91), followed by the APACHE II score (OR: 8.29; 95% CI: 1.43–48.14). The next most predictive are the LOD score and the SAPAS II score, respectively (LOD OR: 4.06; 95% CI: 0.81–20.26; SAPS II OR: 2.26; 95% CI: 0.55–9.24).

Discussion

Nosocomial infections in intensive care remain a major public health problem, and there are some fatal cases. To limit this problem, one needs to share resources and engage in multi-level actions (upstream and downstream) to continually assess the severity of the disease. Indeed, evaluating a complex clinical and physiological state such as multi-trauma and/or multi-deficient patients in intensive care in a nosocomial context, and with simplified evaluation tools, may help with developing a more proactive response and more suitable therapeutic actions.

The aim of the present study was to compare the predictive performances of four scores (SAPS II, SOFA, APACHE II, and LOD) when assessing the level of gravity in nosocomial patients during their ICU stay from the third day preceding the diagnosis of a nosocomial event to the third day after the diagnosis. However, it is important to remember that the aim and the calculation techniques used for the aforementioned scores are slightly different. Indeed, the SOFA score is used to describe the level of morbidity, whereas the LOD score was designed to be a tool that evaluates the mortality probability due to malfunctioning organ(s) on the day of admission.[13]

To our knowledge, no study has ever compared the capacity of the SAPS II, SOFA, APACHE II, and LOD scores to predict mortality in nosocomial patients that are infected during their stay in intensive care. It is thus difficult to compare our results to another study. However, Peres Bota et al's[21] results comparing SOFA scores to the Multiple Organ Dysfunction Score (MODS), which was calculated every 2 days using patients in intensive care who were not specifically nosocomial, showed that the SOFA score has very good discriminatory ability to determine a patient's outcomes. The authors indicated that the SOFA score truly sets itself apart from the other scores in terms of its better sensitivity. The results of Khwannimit's[22] study– which was conducted on a population comparable to that noted in Peres Bota et al's[21] study – reported the excellent discriminatory ability of SOFA and LOD scores with respect to the SOFA score's area under the curve(AUC) (initial: 0.879; maximum: 0.907)when compared to that of the LOD score (initial: 0.88; maximum: 0.92). The authors also indicated that the AUC of the different scores were much higher than the one calculated in Peres Bota et al's[21] study.

Also, even if the outcome considered does not specifically pertain to mortality in the ICU, but rather to the overall hospital's mortality rates, then the results of the following respective studies (Timsit et al[23] and Pettilä et al[24]) describe good predictive performance for both the SOFA score and the LOD score. For instance, in the study by Pettilä et al,[24] the AUC of the initial SOFA and LOD scoreswere as follows: 0.73 and 0.73, respectively. However, it should be noted that the discriminatory ability of the SOFA score tends to be weaker according to the findings from Zygun et al's study.[25]The AUC of the initial value of the SOFA score is 0.67 and the maximum value is 0.69.

According to Khwannimit,[22] the disparity of the results might be due to the different calculation methodologies used for the scores, and it may also be due to different treatment policies adopted in each ICU. On the other hand, Livingston et al's[26] study – which was conducted in 22 different ICUs in Scotland, and which was based on the evaluation of the

performance of the APACHE and SAPS scores –reported good to excellent discriminatory capacities of these measures. The AUC of the APACHE and SAPS scores are 0.78 and 0.85, respectively.

The results of other studies[27,28] also reported that the APACHE II score's discrimination capacity is better than the one established by the SOFA score calculated at admission. On the other hand, though the results of additional studies[26,27] objectify that the SAPS score and SOFA score have the same discrimination capacity; however, when it is calculated during admission, Janssens et al[29]reported the opposite result- indeed, the SOFA score's AUC during admission was 0.82 and the SAPS II score's AUC was 0.77.In our study, the multiple analyses, which controlled for other predictive factors associated with a fatal complication (death), revealed that on the very day of diagnosis, the SOFA score was the most predictive (OR: 12.3; 95% CI: 2.33–64.91), followed by the APACHE II score (OR: 8.29; 95% CI: 1.43–48.14).Moreover, the calculation of the ROC AUC of the APACHE II, SAPS II, SOFA, and LOD scores performed on days –3 –2, –1, 0, 1, 2, and 3 of the nosocomial event (Table 9) showed that the highest ROC AUC is the one used for the SOFA score on the day of diagnosis. On the day after diagnosis, the highest AUC are the ones of the LODS and SOFA scores. On the second day after diagnosis, the highest AUC were those associated with the SAPS II and APACHE II scores.

According to these results, it appears that only the SOFA score AUC calculated on days (–3,–2, –1, 0, 1, 2, and 3) count >0.5 values (reference line). The rate lies between (0.66 and –0.76). As the discrimination capacity of a score is considered as excellent with a AUC >0.9 and good with an AUC >0.8, it appears that (according to our study) only the SOFA score is distinct from the other scores in terms of predictive performance, as it was considered to be correct to good. The lack of predictive performance observed in the other scores could mostly be explained by a possible inadequacy of the gravity scores across the population we studied.

Indeed, it was reported[24] that the scores were often applied to a population of patients where most of them (over half) had stayed in the ICU no longer than 3 days; however, the median length of stay in the population we studied was 6 days. According to Timsit et al,[23]the discrimination capacity of these scores' abilities to predict patients' outcomes is affected as the length of stay grows longer; their predictive ability is also affected by the intricacy of the organ dysfunction and by the infectious process itself. Indeed, in the process, several intrinsic variables (underlying disease, age, and sex) are implied, but intervention variables such as antibiotic treatment (which is appropriate in the beginning[13]), the prompt removal of unnecessary lines responsible for the spread of infection,[14] and the optimizing of the hemodynamic condition by the provision of artificial hydratation or vasopressor drugs[15,16] could determine the evolution of the process or alter the scores' predictions.

In this study, several limits should be mentioned, including the retrospective and monocentric nature, as well as the size of our sample.

Conclusion

Among the documented scores in our study, the SOFA score was the only one that stood out as having good predictive performance in terms of the patients' outcomes. The contribution of these types of markers is very useful for a sequential estimation of each patient's state, and it could serve as a tool to assist in the decision of choosing among proposed therapeutic projects. In addition, our study could help other research teams in their approaches.

Acknowledgements

None.

Conflicts of interest

There are no conflicts of interest.

References :

1. Brown-Bush C, Bonmarchand G, Carlson J, et al. The Risk for and Approaches to Control of Nosocomial Infections in ICUs: Guidelines from the SRLF/SFAR Task Force on Nosocomial Infections in ICUs. Paris, France: French Society of Anesthesia and Intensive Care; 2010.
2. Vincent JL, Bihari DJ, Suter PM, et al. The prevalence of nosocomial infection in intensive care units in Europe. Results of the European Prevalence of Infection in Intensive Care (EPIC) Study. EPIC International Advisory Committee. JAMA 1995; 274(8):639-644.
3. Girou E, Stephan F, Novara A, Safar M, Fagon JY. Risk factors and outcome of nosocomial infections: results of a matched case-control study of ICU patients. Am J Respir Crit Care Med 1998; 157(4 Pt 1):1151-1158.
4. Garrouste-Orgeas M, Timsit JF, Tafflet M, et al. OUTCOMREA Study Group. Excess risk of death from intensive care unit-acquired nosocomial bloodstream infections: a reappraisal. Clin Infect Dis 2006; 42(8):1118-1126.
5. Cabré L, Mancebo J, Solsona JF, et al. Bioethics Working Group of the SEMICYUC. Multicenter study of the multiple organ dysfunction syndrome in intensive care units: the usefulness of Sequential Organ Failure Assessment scores in decision making. Intensive Care Med 2005; 31(7):927-933.
6. Le Gall JR. The use of severity scores in the intensive care unit. Intensive Care Med 2005; 31(12):1618-1623.
7. Marshall JC, Cook DJ, Christou NV, Bernard GR, Sprung CL, Sibbald WJ. Multiple organ dysfunction score: a reliable descriptor of a complex clinical outcome. Crit Care Med 1995; 23(10):1638-1652.
8. Vincent JL, Moreno R, Takala J, et al. The SOFA (Sepsis-related Organ Failure Assessment) score to describe organ dysfunction/failure. On behalf of the Working Group on Sepsis-Related Problems of the European Society of Intensive Care Medicine. Intensive Care Med 1996; 22(7):707-710.
9. Le Gall JR, Klar J, Lemeshow S, et al. The Logistic Organ Dysfunction system. A new way to assess organ dysfunction in the intensive care unit. ICU Scoring Group. JAMA 1996; 276(10):802-810.
10. Dupont H, Mentec H, Sollet JP, Bleichner G. Impact of appropriateness of initial antibiotic therapy on the outcome of ventilator-associated pneumonia. Intensive Care Med 2001; 27(2):355-362.
11. Rijnders BJ, Peetermans We, Verwaest C, Wilmer A, Van Wijngaerden E. Watchful waiting versus immediate catheter removal in ICU patients with suspected catheter-related infection: a randomized trial. Intensive Care Med 2004; 30(6):1073-1080.

12. Knaus WA, Draper EA, Wagner DP, Zimmerman JE. APACHE II: a severity of disease classification system. Crit Care Med 1985; 13(10):818-829.

13. Le Gall JR, Loirat P, Alperovitch A. Simplified acute physiological score for intensive care patients. Lancet 1983; 2(8352):741.

14. Khwannimit B. Validation of the LOD score compared with APACHE II score in prediction of the hospital outcome in critically ill patients. Southeast Asian J Trop Med Public Health 2008; 39(1):138-145.

15. Vincent JL, de Mendonça A, Cantraine F, et al. Use of the SOFA score to assess the incidence of organ dysfunction/failure in intensive care units: results of a multicenter, prospective study. Working group on "sepsis-related problems" of the European Society of Intensive Care Medicine. Crit Care Med 1998; 26(11):1793-1800.

16. Vincent JL, Moreno R, Takala J, et al. The SOFA (Sepsis-related Organ Failure Assessment) score to describe organ dysfunction/failure. On behalf of the Working Group on Sepsis-Related Problems of the European Society of Intensive Care Medicine. Intensive Care Med 1996; 22(7):707-710.

17. Ferreira FL, Bota DP, Bross A, Mélot C, Vincent JL. Serial evaluation of the SOFA score to predict outcome in critically ill patients. JAMA 2001; 286(14):1754-1758.

18. Peres Bota D, Melot C, Lopes Ferreira F, Nguyen Ba V, Vincent JL. The Multiple Organ Dysfunction Score (MODS) versus the Sequential Organ Failure Assessment (SOFA) score in outcome prediction. Intensive Care Med 2002; 28(11):1619-1624.

19. Buckley TA, Gomersall CD, Ramsay SJ. Validation of the multiple organ dysfunction (MOD) score in critically ill medical and surgical patients. Intensive Care Med 2003; 29(12):2216-2222.

20. Moreno R, Vincent JL, Matos R, et al. The use of maximum SOFA score to quantify organ dysfunction/failure in intensive care. Results of a prospective, multicentre study. Working Group on Sepsis related Problems of the ESICM. Intensive Care Med 1999; 25(7):686-696.

21. Peres Bota D, Melot C, Lopes Ferreira F, Nguyen Ba V, Vincent JL. The Multiple Organ Dysfunction Score (MODS) versus the Sequential Organ Failure Assessment (SOFA) score in outcome prediction. Intensive Care Med 2002; 28(11):1619-1624.

22. Khwannimit B. Serial evaluation of the MODS, SOFA and LOD scores to predict ICU mortality in mixed critically ill patients. J Med Assoc Thai 2008; 91(9):1336-1342.

23. Timsit JF, Fosse JP, Troché G, et al. Accuracy of a composite score using daily SAPS II and LOD scores for predicting hospital mortality in ICU patients hospitalized for more than 72 h. Intensive Care Med 2001; 27(6):1012-1021.

24. Pettilä V, Pettilä M, Sarna S, Voutilainen P, Takkunen O. Comparison of multiple organ dysfunction scores in the prediction of hospital mortality in the critically ill. Crit Care Med 2002; 30(8):1705-1711.

25. Zygun DA, Laupland KB, Fick GH, Sandham JD, Doig CJ. Limited ability of SOFA and MOD scores to discriminate outcome: a prospective evaluation in 1,436 patients. Can J Anaesth 2005; 52(3):302-308.

26. Livingston BM, MacKirdy FN, Howie JC, Jones R, Norrie JD. Assessment of the performance of five intensive care scoring models within a large Scottish database. Crit Care Med 2000; 28(6):1820-1827.

27. Ho KM, Lee KY, Williams T, Finn J, Knuiman M, Webb SA. Comparison of Acute Physiology and Chronic Health Evaluation (APACHE) II score with organ failure scores to predict hospital mortality. Anaesthesia 2007; 62(5):466-473.

28. Gosling P, Czyz J, Nightingale P, Manji M. Microalbuminuria in the intensive care unit: Clinical correlates and association with outcomes in 431 patients. Crit Care Med 2006; 34(8):2158-2166.

29. Janssens U, Graf C, Graf J, et al. Evaluation of the SOFA score: a single-center experience of a medical intensive care unit in 303 consecutive patients with predominantly cardiovascular disorders. Sequential Organ Failure Assessment. Intensive Care Med 2000; 26(8):1037-1045.

Bangladesh Crit Care J March 2014; 2 (1): 10-15

Original Article

Progression of severe sepsis to septic shock in under-five diarrheal children in an urban critical care ward in Bangladesh: Identifiable risks, blood isolates and outcome

Mohammod Jobayer Chisti[1], Monira Sarmin[2], Tahmeed Ahmed[3], Pradip Kumar Bardhan[4], Hasan Ashraf[5], Shafiqul Alam Sarker[6], Abu Sayeed Golam Faruque[7], Sumon Kumar Das[8], Mohammed Abdus Salam[9]

Abstract:

Background: *Both severe sepsis and septic shock are the terminal events of all infectious diseases including diarrhea and often associated with fatal outcome. However, death is highest in septic shock even in high resource centre in developed countries. Thus, identification of factors associated with septic shock from severe sepsis is critically important. Nevertheless, data are scarce on the clinical predictors of septic shock in under-five children presenting with severe sepsis especially in resource poor settings. We evaluated the factors associated with septic shock and their outcome in such population.*

Methods: *This study involved the analysis of retrospective data in diarrheal children which had been extracted from the hospital management system (SHEBA), an online data base of the Dhaka Hospital of icddr,b. All under-five diarrheal children, admitted to the Dhaka Hospital of the International Canter for Diarrhoeal Diseases Research, Bangladesh (icddr,b) having severe sepsis between October`2010 and September`2011 were studied. Severe sepsis defined as tachycardia plus hypo (≤35.0° C) or hyperthermia (≥38.5° C), or abnormal WBC count plus presence of infection with poor peripheral perfusion (age specific hypotension and/or absent peripheral pulses or delayed capillary refilling time (CRT) in absence of dehydration. Patient unresponsive to fluid (normal saline/cholera saline) boluses (20 ml/kg; maximum 60 ml/kg and 40 ml/kg in well nourished and malnourished children respectively) and required inotrop(s) categorized as septic shock. Children with (cases=88) and without septic shock (controls=116) wee compared.*

Results: *Median (inter-quartile range) age (months) was comparable among the cases and the controls [5.3 (3.2, 12.0) vs. 5.6 (2.7, 10.0); p = 0.515). Case-fatality-rate was significantly higher among the cases than the controls (67% vs. 14%; p<0.001). In logistic regression analysis after adjusting for potential confounders such as severe under-weight, nutritional edema, respiratory difficulty and pneumonia, cases more frequently had drowsiness on admission (OR = 4.2, 95% CI = 1.3-14.2, p = 0.017), received blood transfusion (OR = 5.8, 95% CI = 2.7-12.2, p <0.001), and required mechanical ventilation (OR = 13.7, 95% CI = 4.8-39.5, p <0.001). Bacterial isolates were equally distributed among the groups but more than three-fourths were gram negatives.*

Conclusion: *The results of our data suggest that darrheal children under five years of age with severe sepsis presenting with drowsiness on admission are vulnerable to develop septic shock and may often require blood transfusion and mechanical ventilation. Thus, clinicians may consider inotrop(s) in such children presenting with the co-morbidity of severe sepsis and drowsiness which may help to prevent mechanical ventilation and death.*

Key Words: *Bangladesh; children; diarrhea; severe sepsis; septic shock*

Introduction:

Progression of severe sepsis to septic shock is one of the major health care problems, not only in developing countries but also in developed countries, and often associated with high number of deaths.[1-3] This event in critically ill children with infectious diseases, including diarrhoea, is the terminal event.[4-7] Developing countries face the largest global sepsis burden.[8] Almost two third of the 7.6 million worldwide deaths in

1 Mohammod Jobayer Chisti, MBBS, MMed (Paed) , Scientist & Clinical Lead, ICU, Clinical Service (CS), International Centre for Diarrhoeal Disease Research, Bangladesh (icddr,b), & Centre for Nutrition & Food Security (CNFS), icddr,b, Dhaka, Bangladesh.

2 Monira Sarmin, MBBS, Senior Clinical Fellow, Dhaka Hospital, Centre for Nutrition & Food Security (CNFS), icddr,b, Dhaka, Bangladesh.

3 Tahmeed Ahmed, MBBS, PhD; Director, Clinical Service (CS), International Centre for Diarrhoeal Disease Research, Bangladesh (icddr,b), Dhaka, Bangladesh.

4 Pradip Kumar Bardhan MBBS, MD, Scientist & Chief Physician, Clinical Service (CS), International Centre for Diarrhoeal Disease Research, Bangladesh (icddr,b), & Centre for Nutrition & Food Security (CNFS), icddr,b, Dhaka, Bangladesh.

5 Hasan Ashraf, MBBS, MCPS, MD, Senior Scientist & Clinical Lead, ARI Ward, Clinical Service (CS), International Centre for Diarrhoeal Disease Research, Bangladesh (icddr,b), & Centre for Nutrition & Food Security (CNFS), icddr,b, Dhaka, Bangladesh.

6 Abu Shafiqul Alam Sarker, MBBS, MD, PhD, Senior Scientist, Clinical Service (CS), International Centre for Diarrhoeal Disease Research, Bangladesh (icddr,b), & Centre for Nutrition & Food Security (CNFS), icddr,b, Dhaka, Bangladesh.

7 Abu SG Faruque, MBBS, MPH, Consultant, Clinical Service (CS), International Centre for Diarrhoeal Disease Research, Bangladesh (icddr,b), Dhaka, Bangladesh.

8 Sumon Kumar Das, MBBS; Assistant Scientist, Clinical Service (CS), International Centre for Diarrhoeal Disease Research, Bangladesh (icddr,b), Dhaka, Bangladesh.

9 Mohammed Abdus Salam, MBBS, Director, Research & Clinical Administration and Strategy (RCAS), icddr,b, Dhaka, Bangladesh

Corresponding Author:
Dr. Mohammod Jobayer Chisti,
Scientist, CNFS & Clinical Lead, Intensive Care Unit & Consultant Physician, ARI ward; Dhaka Hospital, icddrb;
68 Shaheed Tajuddin Ahmed Sarani, Mohakhali, Dhaka 1212, Bangladesh, E-mail: chisti@icddrb.org

neonates and infants are due to sepsis and the bulk of cases occurring in Asia and Sub-Saharan Africa.[9,10] Judicious recognition of septic shock with early on administration of antibiotic therapy can reduce deaths in children.[11,12] Early fluid resuscitation in children with severe sepsis prevents irreversible septic shock, and reduces deaths.[5] Identification and treatment of severe sepsis and septic shock in diarrheal children is very really captivating. In diarrheal children shock may resulting from severe dehydration as well as severe sepsis, overlapping the clinical signs. However, identification of severe sepsis in diarrheal children becomes little bit easier in absence of dehydration or after correction of dehydration.[13,14] Additionally, diarrheal children with hypovolemic shock used to respond in fluid resuscitation whereas diarrheal children with septic shock might not respond to fluid resuscitation.[15] Nevertheless, both severe dehydration and sever sepsis may present in a same patient, other clinical signs of severe sepsis in diarrheal children such as thermo-instability, delayed CRT are very important for the diagnosis of severe sepsis in this population. On the other hand, clinical signs of severe sepsis in severely malnourished children are invariably absent[16] even in sick children and aggressive fluid management may have an undesirable effect.[17]

Fluid resuscitation in severely malnourished children is always very intriguing. World Health Organization (WHO) recommends blood transfusion for the management of severely malnourished children having septic shock in order to reduce mortality[18]. Inotrope support is needed for patient not responding to fluid resuscitation and several studies have shown improvement in hemodynamic and urine output in septic shock treated with dopamine[19,20]. Intensive Care Unit of the Dhaka Hospital of the International Centre for Diarrhoeal Diseases Research, Bangladesh (icddr,b) treats a number of diarrheal children with severe sepsis and septic shock following survival sepsis guideline[3] and still encounters high burden of mortality. However, data on the risks and outcome of the progression of severe sepsis to septic shock especially in diarrheal children are lack. Our aim was to evaluate the risks and outcome of the progression of severe sepsis to septic shock in diarrheal children.

Materials & methods:

Ethical statement:

In this chart review, data were analyzed anonymously, thus, no parental or ethical consent was required.

Study design:

This study involved the analysis of retrospective data in diarrheal children which had been extracted from the hospital management system (SHEBA), an online data base of the Dhaka Hospital of icddr,b. All under-five diarrheal children, admitted to the Dhaka Hospital of the International Canter for Diarrhoeal Diseases Research, Bangladesh (icddr,b) having severe sepsis between October`2010 and September`2011 were studied. Sepsis was defined as tachycardia plus hypo (≤ 35.0° C) or hyperthermia (≥38.5° C), or abnormal WBC count plus presence or presumed presence of infection. Severe sepsis was defined as the presence of sepsis plus poor peripheral perfusion (age specific hypotension and/ or absent peripheral pulses and/or delayed capillary refilling time (CRT) in absence of dehydration. Patient unresponsive to fluid (normal saline/cholera saline) boluses [20 ml/kg (maximum 40 ml/kg for severely malnourished children over 2 hours and 60 ml/kg over 10-15 minutes for the children without severe malnutrition)], and required support of inotrop(s) categorized as septic shock. Comparison of clinical characteristics of diarrheal children who progressed from severe sepsis to septic shock (cases) was made with those without septic shock (controls).

Study site:

Dhaka Hospital of icddr,b, Dhaka, Bangladesh was the study site which provides care and treatment to around 140,000 patients of all ages and both sexes with diarrhea, with or without associated complications and with or without other health problems each year. Diarrhea is the entry point for admission to the hospital. After admission, the hospital triage nurses obtain brief medical history and make a quick assessment of the patients, focusing on the severity and complication of diarrhea and dehydration status but also look for associated health problems. Following this, patients are referred either to the emergency physician for re-assessment or are admitted to an appropriate ward of the hospital. Patients with complications of diarrhea, or those with respiratory distress, cyanosis, apnea, hypothermia, sepsis, severe sepsis, septic shock, impaired consciousness, convulsion, severe pneumonia with hypoxemia or respiratory failure are admitted to the ICU. The vast majority of the patients at icddr,b have poor socio-economic backgrounds and live in urban and peri-urban Dhaka, the capital city of Bangladesh.

Patient management:

On arrival in the ICU, attending physicians re-evaluate the patients, commence required work up and prescribe a management plan according to standard management guidelines of the hospital. Arterial oxygen saturation (SpO2) was measured using a portable pulse oximeter (OxiMaxN-600, Nellcor, Boulder, Co) and blood glucose was estimated using a Gluco-check machine (STADA, Bad Vilbel, Germany). Children with hypoxemia received oxygen supplementation through nasal prongs (2L/min) or mask (5L/min). Antibiotic therapy was provided for children with pneumonia, sepsis, severe cholera, dysentery, severe malnutrition, and other bacterial infections following standard management guideline in our hospital.[21,22] Dehydration was corrected using oral (for those with some dehydration) or intravenous fluids (for those with severe dehydration and also those who were unable to drink due to any reason); appropriate feeding, micronutrients, vitamins and minerals as and when required.[23]After correction of dehydration (defined by "Dhaka methods" of assessment of dehydration that is almost similar to WHO method and approved by WHO),[24,25] patients were assessed for features of severe sepsis, and IV fluid was administered to patient with severe sepsis according to surviving sepsis guideline.[26] Patient with septic shock received blood transfusion.[23] In resource poor setting, like Bangladesh it is difficult to arrange safe blood promptly. So, inotrope(s) were started in patients not responding to fluid without waiting for blood transfusion. However, as soon as the blood was

arranged, transfusion was given immediately. Our treatment goal was to achieve good peripheral perfusion [mean arterial pressure (MAP) >50 mm Hg, and/or urine output (U/O) >1 ml/kg/hour, and capillary refilling time (CRT) <3 sec]. Mechanical ventilation was used for management of children admitted to ICU with respiratory failure.

Measurements and data collection:

Data acquisition was done after development of case report forms (CRF) which were pretested before finalization. Characteristics analyzed include demographic (age, gender,), clinical signs [nutritional status, drowsiness, abdominal distension and convulsion at admission, respiratory rate, temperature, lower chest wall in-drawing (inward movement of the bony structures of the lower chest wall with inspiration), crackles and rhonchi in lungs (by auscultation), dehydration, systolic and diastolic blood pressure, level of haemoglobin, blood transfusion, mechanical ventilation, hospital stay, clinical diagnosis (severe sepsis, septic shock) and outcome. Data were retrospectively collected from "SHEBA", a computer based system for keeping documents of patients management. After admission at Dhaka Hospital of icddr,b, every patient got a unique identifying number. All the data including history, clinical examination findings, laboratory reports, treatments provided, dietary management, daily follow up and clinical outcome (improved, or discharged or referred to other hospital for necessary management or fatal outcome) were recorded against this number. To avoid potential error these data were also re-checked manually.

Analysis:

Data of all the study children were entered into a personal computer and edited before analysis using SPSS for Windows (version15.0; SPSS Inc, Chicago) and Epi Info (version 6.0, USD, Stone Mountain, GA). Differences in proportions were compared by the Chi-square test. In normally distributed data differences of means were compared by Student's t-test and Mann-Whitney test was used for comparison of data that were not normally distributed. A probability of less than 0.05 was considered statistically significant. Strength of association was determined by calculating odds ratio (OR) and their 95% confidence intervals (CIs). In identifying predictors associated with septic shock, variables were initially analyzed in a uni-variate model, then after adjusting with potential confounders, multiple logistic regression models were used to identify the independent predictors of the progession.

Results:

We were able to identify 88 cases and 116 controls. The progression of severe sepsis to septic shock at Dhaka Hospital of icddr,b during the study period was estimated at 43% (88/204) . The case-fatality-rate was significantly higher among the cases compared to the controls (Table 1).

Table 1. Clinical and laboratory parameters of under-five diarrheal children who progressed septic shock (cases) from severe sepsis (controls) at the ICU of Dhaka Hospital of icddr,b.

Parameters	Cases n=88 n (%)	Controls n=116 n (%)	OR (95% CI)	p value
Age (median, IQR)	5.3 (3.2, 12.0)	5.6 (2.7, 10.0)	-	0.515
Nutritional edema	15 (17%)	8 (7%)	287 (1.03 - 7.9)	0.041
Abdominal distension	13 (15)	6 (5)	3.2 (1.1 - 10.6)	0.036
Poor Intake	7 (8)	2 (2)	4.9 (0.9 - 49.4)	0.071
Respiratory difficulty	53 (60)	50 (43)	1.9 (1. 1 -3.7)	0.022
Drowsiness	22 (25)	5 (4)	7.4 (2.6 - 25.9)	<0.001
Vomiting	25 (28)	21 (18)	1.79 (0.9 - 3.7)	0.115
Dehydration (some/severe)	26 (31)	34 (29)	0.4 (0.1 - 0.8)	0.014
Pneumonia	66 (75)	69 (57)	2.04 (1.1 - 3.9)	0.029
Respiratory rate(mean± SD)	48.4 ± 16.7	53.2 ± 16.9	-4.8 (-9.5 - 0.1)*	0.047
Temperature(mean± SD)	37.2 ± 1.4	37.6±1.5	-0.4(-0.8 - 0.01)*	0.052
Pulse (mean± SD)	130.8 ± 51.1	128±59.9	2.0 (-13.6 - 17.6)*	0.097
Systolic Blood Pressure (mean± SD)	41.6 ± 30.0	47.66±36.3	-6.1 (-20.3 - 8.2)*	0.398
Diastolic Blood Pressure(mean± SD)	19.6 ± 18.15	23.8±20.5	-4.1 (-12.5 - 4.2)*	0.323
Delayed CRT	20 (23)	39 (34)	0.58 (0.3-1.1)	0.123
Rales in lung	39 (44)	52 (45)	0.9 (0.5-1.8)	0.944
Rhonchi in lung	4 (5)	5 (4)	1.1 (0.2-5.1)	0.792
Supra-sternal resection	4 (5)	8 (7)	0.6 (0.1 - 2.5)	0.680
Lower chest wall in-drawing	25 (28)	40 (35)	0.8 (0.4 - 1.4)	0.441

Mechanical ventilation	36 (41)	6 (5.0)	12.7 (4.8 -38.7)	<0.001
Blood transfusion	50 (57)	21 (18)	5.9 (3.0 - 11.8)	<0.001
Haemoglobin (mean± SD)	10.0 ± 3.5	10.4±2.5	-0.4 (-1.3 - 0.4)*	0.340
Neutrophil (mean± SD)	55 ± 16.4	91.5±381.2	-36.5 (-7.7 - 44.6)*	0.367
Band (mean± SD)	4.2 ± 5.4	3.1 ± 5.8	1.1 (-0.5 - 2.7)*	0.166
Bacterial isolates from blood	22 (25)	28 (24)	1.1 (0.5 - 2.1)	0.982
Severe wasting	22 (36%)	25 (33)	1.2 (0.6 - 2.5)	0.680
Severe under-weight	59 (67)	60 (52)	1.9 (1.03-3.5)	0.040
Hospital stay in hours (median, IQR)	92.5 (34.3,184.0)	137.5 (74.8, 242.0)	-	0.011
Deaths	59 (67)	16 (14)	12.71 (6.07-27.64	<0.001

OR = Odds ratio; CI = Confidence interval; IQR = Inter-quartile range; SD = Standard deviation; *MD (95% confidence interval); Severe wasting = weight for length/height z score <-3; Severe under-weight = weight for age z score <-3

The cases more frequently presented with nutritional edema, abdominal distension, respiratory difficulty, pneumonia (Table 1), higher respiratory rate, and required lesser hospital stay (Table 2) compared to the controls.

Table 2: Results of logistic regression analysis by enter method to disclose the independent clinical predictors of progression of severe sepsis to septic shock

Characteristics	OR	95% CI	p value
Mechanical ventilation	13.7	4.8-39.5	<0.001
Blood transfusion	5.8	2.7-12.2	<0.001
Drowsiness	4.2	1.3-14.2	0.017
Pneumonia	1.7	0.7-4.0	0.210
Nutritional edema	1.5	0.5-4.7	0.468
Severe underweight	1.4	0.7-3.0	0.341
Respiratory difficulty	1.0	0.4-2.2	0.950

In logistic regression analysis, after adjusting for potential confounders such as pneumonia, nutritional edema, severe underweight, and respiratory difficulty, cases more often had drowsiness on admission, received blood transfusion and required mechanical ventilation (Table 3).

Table 3. Bacterial isolates from blood of the study children

Bacterial isolates	Cases n = 22 (%)	Controls n = 28 (%)
Acinetobacter	1 (4)	2 (7)
Aeromonas	0	1 (4)
Candida	1 (4)	1 (4)
Enterobacter Species	1 (4)	2 (7)
Escherichia Coli	5 (23)	6 (22)
Enterococcus Species	2 (9)	4 (14)
H inflenzae	0	1 (4)
Klebsiella Species	1 (5)	3 (10)
Pseudomonas Species	7 (33)	4 (14)
Salmonella typhi	1 (4)	0
Staphylococcus aureus	0	2 (7)
streptococcus Species	3 (14)	2 (7)

The distribution of other variables in table 1 and 2 were comparable among the cases and the controls. Among the isolated organisms from blood 41 (82%) were gram negatives which were equally distributed among the groups (Table 3).

Discussion:

Our study revealed a number of important observations for clinicians in developing countries: first- progression of septic was strongly associated with high case-fatality rate; two-severe sepsis and septic shock is similarly associated with gram negative bacteremia; third- strong association of drowsiness with progression to septic shock from severe sepsis. Our observation of very high case-fatality-rate from septic shock is understandable and consistent with earlier observation.[26, 27] The observation of predominant Gram negatives in blood isolates in children with severe sepsis with or without the progression of septic shock is an important observation for the clinicians as well as policy makers in developing countries. This observation indicates that diarrheal children with severe sepsis, with or without the progression to septic shock should receive extended spectrum antibiotics to provide adequate coverage against the wide range of gram negative bacteremia in order to evade potential deleterious effect of gram negative bacteremia.[28] Our observation of drowsiness as an independent predictor of the progression to septic shock from severe sepsis in under-five diarrheal children is also understandable and could be used as a startling sign for the potential early initiation of aggressive therapy. Our study children comprised of severe sepsis and/or septic shock and both the groups needed aggressive management. However, survival rate in under-five children with severe sepsis who did not develop septic shock was higher which accentuates the significance of timely recognition of these diarrheal children in order to initiate any potential additional therapy such as inotrope(s) simultaneously with fluid resuscitation. Aggressive fluid therapy in children with septic shock found to be associated with higher deaths in study from Kenya.[29] Nonetheless, our study population were comparatively more sick than the Kenyan study population and we were essentially not aware of any potential deleterious effect of rapid fluid therapy that contributed higher case fatality in our study population.

The observation of repeated requirement of blood transfusion

and mechanical ventilation in diarrheal children with septic shock is also comprehensible as nearly all diarrheal children who had progression to septic shock from severe sepsis received blood transfusion. A recent published data from Bangladesh also observed similar events.[16] The diarrheal children with progression to septic shock from severe sepsis having respiratory failure required respiratory support by mechanical ventilation.

Diarrheal children who had progression of septic shock from severe sepsis more often had nutritional edema, severe underweight, and pneumonia compared to their counterpart and co-morbidity of severe malnutrition and pneumonia is often associated with high mortality.[30-32]

These children more often presented with respiratory difficulty, higher respiratory rate, pneumonia, abdominal distension and severe underweight by uni-variate analysis, but logistic regression analysis revealed that these variables were no longer significant. This phenomenon designates the subsistence of solemn illness of the diarrheal children in both the groups and emphasizes the requirement of aggressive treatment in both the groups.

The overwhelming evidence from our data concludes that the case-fatality-rate was significantly higher among the under-five diarrheal children who had the progression to septic shock from severe sepsis. Diarrheal children under the age of five years presenting with severe sepsis having drowsiness on admission were at risk of developing septic shock and often entailed blood transfusion as well as mechanical ventilation. From this point of view, the intensivists in developing countries with less resource may consider early initiation of inotrope(s) in such children.

Acknowledgments:

This research was funded by icddr,b and its donors which provide unrestricted support to icddr,b for its operations and research. Current donors providing unrestricted support include: Australian Agency for International Development (AusAID), Government of the People's Republic of Bangladesh; Canadian International Development Agency (CIDA), Swedish International Development Cooperation Agency (Sida), and the Department for International Development, UK (DFID). We gratefully acknowledge these donors for their support and commitment to icddr,b's research efforts. We would like to express our sincere thanks to all physicians, clinical fellows, nurses, members of feeding team, cleaners, and specially SHEBA

References:

1. Linde-Zwirble W, Angus D. Severe sepsis epidemiology: sampling, selection, and society. *Crit Care* 2004;8(4):222.
2. Dombrovskiy VY MA, Sunder-, ram J PH. Rapid increase in hospitalization and mortality rates for severe sepsis in the United States: a trend analysis from 1993 to 2003. *Crit Care Med* 2007;35:1414-5.
3. Dellinger RP, Levy MM, Rhodes A, Annane D, Gerlach H, Opal SM, et al. Surviving sepsis campaign: international guidelines for management of severe sepsis and septic shock: 2012. *Crit Care Med*. 2013;41(2):580-637.
4. Angus DC L-ZW, Lidicker J CG, Carcillo J,, MR P. Epidemiology of severe sepsis in the United States: analysis of incidence, outcome, and associated costs of care. *Crit Care Med* 2001;29:1303-10.
5. Biban P, Gaffuri M, Spaggiari S, Zaglia F, Serra A, Santuz P. Early recognition and management of septic shock in children. *Pediatr Rep* 2012;4(1):e13.
6. Watson RS, Carcillo JA, Linde-Zwirble WT, Clermont G, Lidicker J, Angus DC. The epidemiology of severe sepsis in children in the United States. *Am J Respir Crit Care Med* 2003;167(5):695-701.
7. Odetola FO, Gebremariam A, Freed GL. Patient and hospital correlates of clinical outcomes and resource utilization in severe pediatric sepsis. *Pediatrics* 2007 Mar;119(3):487-94.
8. Cheng AC, West TE, Limmathurotsakul D, Peacock SJ. Strategies to reduce mortality from bacterial sepsis in adults in developing countries. *PLoS Med* 2008;5(8):e175.
9. Black RE, Cousens S, Johnson HL, Lawn JE, Rudan I, Bassani DG, et al. Global, regional, and national causes of child mortality in 2008: a systematic analysis. *Lancet*.375(9730):1969-87.
10. Dunser MW, Festic E, Dondorp A, Kissoon N, Ganbat T, Kwizera A, et al. Recommendations for sepsis management in resource-limited settings. *Intensive Care Med* 2012;38(4):557-74.
11. Han YY, Carcillo JA, Dragotta MA, Bills DM, Watson RS, Westerman ME, et al. Early reversal of pediatric-neonatal septic shock by community physicians is associated with improved outcome. *Pediatrics* 2003;112(4):793-9.
12. Inwald DP, Tasker RC, Peters MJ, Nadel S. Emergency management of children with severe sepsis in the United Kingdom: the results of the Paediatric Intensive Care Society sepsis audit. *Arch Dis Child* 2009;94(5):348-53.
13. Chisti MJ, Saha S, Roy CN, Salam MA. Predictors of bacteremia in infants with diarrhea and systemic inflammatory response syndrome attending an urban diarrheal treatment center in a developing country. *Pediatr Crit Care Med* 2010;11(1):92-7.
14. Chisti MJ, Duke T, Robertson CF, Ahmed T, Faruque AS, Bardhan PK, et al. Co-morbidity: exploring the clinical overlap between pneumonia and diarrhoea in a hospital in Dhaka, Bangladesh. *Ann Trop Paediatr* 2011;31(4):311-9.
15. Ashworth A. Guidelines for the inpatient treatment of severely malnourished children. WHO; 2003.
16. Chisti MJ, Ahmed T, Ashraf H, Faruque ASG, Bardhan PK, Dey SK, et al. Clinical predictors and outcome of metabolic acidosis in under-five children admitted to an urban hospital in Bangladesh with diarrhea and pneumonia. *PLoS One* 2012;7(6):e39164.
17. Khilnani P, Singhi S, Lodha R, Santhanam I, Sachdev A, Chugh K, et al. Pediatric Sepsis Guidelines: Summary for resource-limited countries. *Indian J Crit Care Med* 2010;14(1):41-52.
18. Rivers E, Nguyen B, Havstad S, Ressler J, Muzzin A, Knoblich B, et al. Early goal-directed therapy in the treatment of severe sepsis and septic shock. *N Engl J Med* 2001;345(19):1368-77.
19. Girbes AR, Patten MT, McCloskey BV, Groeneveld AB, Hoogenberg K. The renal and neurohumoral effects of the addition of low-dose dopamine in septic critically ill patients. *Intensive Care Med* 2000;26(11):1685-9.
20. Juste RN, Panikkar K, Soni N. The effects of low-dose dopamine infusions on haemodynamic and renal parameters in patients with septic shock requiring treatment with noradrenaline. *Intensive Care Med* 1998;24(6):564-8.
21. World Health O. Management of severe malnutrition: a manual for physicians and other senior health workers. Management of severe malnutrition: a manual for physicians and other senior health workers: World Health Organization; 1999.
22. Ahmed T, Ali M, Ullah MM, Choudhury IA, Haque ME, Salam MA, et al. Mortality in severely malnourished children with diarrhoea and use of a standardised management protocol. *Lancet* 1999;353(9168):1919-22.

23. WHO. Pocket book for hospital care of children: guidelines for the management of common childhood illness 2nd ed. Geneva: World Health Organization; 2013.

24. Alam NH, Ashraf H. Treatment of infectious diarrhea in children. *Paediatr Drugs* 2003;5(3):151-65.

25. Chisti MJ, Duke T, Robertson CF, Ahmed T, Faruque AS, Ashraf H, et al. Clinical predictors and outcome of hypoxaemia among under-five diarrhoeal children with or without pneumonia in an urban hospital, Dhaka, Bangladesh. *Trop Med Int Health* 2012;17(1):106-11.

26. Dellinger RP, Levy MM, Rhodes A, Annane D, Gerlach H, Opal SM, et al. Surviving sepsis campaign: international guidelines for management of severe sepsis and septic shock, 2012. *Intensive Care Med* 2013;39(2):165-228.

27. Levy MM, Dellinger RP, Townsend SR, Linde-Zwirble WT, Marshall JC, Bion J, et al. The Surviving Sepsis Campaign: results of an international guideline-based performance improvement program targeting severe sepsis. *Crit Care Med* 2010;38(2):367-74.

28. Chisti MJ, Saha S, Roy CN, Salam MA. Predictors of bacteremia in infants with diarrhea and systemic inflammatory response syndrome attending an urban diarrheal treatment center in a developing country. *Pediatr Crit Care Med* 2010;11(1):92-7.

29. Maitland K, Kiguli S, Opoka RO, Engoru C, Olupot-Olupot P, Akech SO, et al. Mortality after fluid bolus in African children with severe infection. *N Engl J Med* 2011;364(26):2483-95.

30. Chisti MJ, Ahmed T, Faruque AS, Abdus Salam M. Clinical and laboratory features of radiologic pneumonia in severely malnourished infants attending an urban diarrhea treatment center in Bangladesh. *Pediatr Infect Dis J* 2010;29(2):174-7.

31. Chisti MJ, Duke T, Robertson CF, Ahmed T, Faruque AS, Bardhan PK, et al. Co-morbidity: exploring the clinical overlap between pneumonia and diarrhoea in a hospital in Dhaka, Bangladesh. *Ann Trop Paediatr* 2011;31(4):311-9.

32. Chisti MJ, Tebruegge M, La Vincente S, Graham SM, Duke T. Pneumonia in severely malnourished children in developing countries - mortality risk, aetiology and validity of WHO clinical signs: a systematic review. *Trop Med Int Health* 2009;14(10):1173-89.

Bangladesh Crit Care J March 2014; 2 (1): 16-20

Original Article

Territorial location of cerebral infarcts on imaging in patients with first ever stroke with diabetes

Nirmalendu Bikash Bhowmik[1], Mohammad Saifuddin[2], Rajib Bhadra[3], Md. Rashedul Islam[4], Rumana Habib[5], Aminur Rahman[6], Md. Zahid Hassan[7], Md. Amirul Haque[8].

Abstract:

Aims: *The study was aimed to evaluate vascular territories of infarcts involved in patients with stroke for the first time with diabetes on CT and/ or MRI of brain.*

Methodology: *This cross sectional descriptive study was carried on a total of 100 adult patients with first ever stroke consecutively reported in the Department of Neurology, BIRDEM General Hospital, Dhaka, over a period of six months.*

Results: *The mean age was 61.45 years and majority (35%) belongs to age group of 50-59. Ten (10%) subjects had age above 80 years. Male were 68% and 32% were female. Majority (89%) of the subjects had hemiplegia following acute stroke. Aphasia (71%), headache (39%), convulsion (23%), vomiting (18%) and cranial nerve palsy (17%) were also found. Additional preexisting risk factors were hypertension (72%), dyslipidaemia (59%), smoking (56%) and alcohol abuse (2%). Among the study subjects the diabetic complications were peripheral vascular disease (4%), neuropathy (8%), nephropathy(9%)and retinopathy(25%). CT scan and/ or MRI brain showed parietal lobe lesion in 57% cases. Majority (76%) had infarcts in middle cerebral artery territory. Involvement of anterior and posterior cerebral artery territory was found in 7% and 5% subjects respectively. Vertebro-basilar arterial system involvement was observed in 6% cases. 4% subjects had involvement of both middle and posterior cerebral arteries. Both anterior and posterior arterial territory infarcts were found in 2% cases.*

Conclusions: *In conclusion most of the diabetic subjects with first ever ischemic stroke had involvement of middle cerebral artery.*

Key Words: *Stroke, Cerebral Infarcts, Diabetes mellitus.*

Introduction: A stroke is the rapid loss of brain function due to disturbance in the blood supply to the brain with symptoms lasting for more than 24 hours or resulting in death before 24 hours and in which after adequate investigations symptoms are presumed to be non-traumatic vascular in origin. This can be due to ischemia caused by blockage (thrombosis, arterial embolism), or a hemorrhage.[1] As a result, the affected area of the brain cannot function, which might result in an inability to move one or more limbs on one side of the body, inability to understand or formulate speech, or an inability to see one side of the visual field.[2]

Undoubtedly stroke is more preventable than to look for the cure. In this respect identification of the major risk factors especially modifiable risk factors and their control needs maximum concern.[3, 4] Risk factors for stroke include arterial hypertension, diabetes mellitus, obesity, cigarette smoking, hyperlipdaemia , oral contraceptives, alcohol intake, age, positive family history of stroke, hyperviscosity etc. Every type of cardiac disease is also associated with increased risk of stroke. Control of hypertension, atrial fibrillation appear to greatest chance of reducing risk of for stroke recurrence after an ischemic stroke.[5,6] In the management of stroke we can't cure the disease but we can to some extent prevent it by early detection and treatment of risk factors especially modifiable risk factors.

The clinical syndrome produced by a stroke is determined by the artery or arteries that are occluded. Blood is supplied to the brain by two major sets of arteries, the anterior and posterior circulations. The anterior circulation consists of the right and left internal carotid arteries (ICA) which bifurcate into the anterior cerebral artery (ACA) and middle cerebral artery (MCA) . The MCA supplies most of the temporal lobe, the anterolateral frontal lobe, and the lateral parietal lobe. Perforating branches supply the posterior limb of the internal capsule, part of the head and body of the caudate nucleus and the globus pallidus. The MCA supplies the largest proportion of the brain and its occlusion is the most common cause of

1. Dr. Nirmalendu Bikash Bhowmik, MD (Neurology); Associate Professor of Neurology, BIRDEM General Hospital & Ibrahim Medical College, Shahbag, Dhaka.
2. Dr. Mohammad Saifuddin; Assistant Registrar, Neurology, BIRDEM General Hospital & Ibrahim Medical College, Shahbag, Dhaka.
3. Dr. Rajib Bhadra, Resident Trainee doctor.Department of Neurology, BIRDEM General Hospital & Ibrahim Medical College, Shahbag, Dhaka
4. Dr. Md. Rashedul Islam, FCPS (Med), MRCP (UK); Registrar, Neurology, BIRDEM General Hospital & Ibrahim Medical College, Shahbag, Dhaka.
5. Dr. Rumana Habib, FCPS (Medicine); Registrar, Neurology, BIRDEM General Hospital & Ibrahim Medical College, Shahbag, Dhaka.
6. Dr. Aminur Rahman, MD (Neuology); Associate Professor of Neurology, BIRDEM General Hospital & Ibrahim Medical College, Shahbag, Dhaka.
7. Dr. Md. Zahid Hassan, PhD; Professor, Dept of Physiology & Molecular Biology, BUHS, Mirpur-1, Dhaka-1216
8. Dr. Md. Amirul Haque FCPS (BD), FRCP (Glasgow), FACP (USA), DCN (London); Professor of Neurology, BIRDEM General Hospital & Ibrahim Medical College, Shahbag, Dhaka.

Corresponding Author :
Dr Nirmalendu Bikash Bhowmik
Associate Professor;Department of Neurology
Room # 1422, BIRDEM General Hospital
Shahabag, 122 Kazi Nazrul Islam Avenue, Dhaka-1000
E-mail: bhowmiknbb24@gmail.com

severe stroke.The ACA supplies most of the medial surface of the frontal lobe, the frontal pole, medial parietal and anterior portions of the corpus callosum. Perforating branches supply the anterior limb of the internal capsule, the inferior portions of the head of the caudate and the anterior globus pallidus. The anterior choroidal artery arises at the distal ICA and supplies the medial anterior temporal lobe and the genu of the internal capsule.

The posterior circulation consists of the vertebral and basilar arteries and their branches. Typically, two vertebral arteries join and form the basilar artery. The vertebrobasilar system supplies the brainstem and has branches to the cerebellum. The basilar artery typically bifurcates into two posterior cerebral arteries (PCA) . The PCAs supply the occipital lobes and portions of the temporal lobes. Proximally, these arteries give rise to perforators that supply the thalami . The left and right anterior circulations are joined to each other by the anterior communicating artery which connects the ACAs. The anterior and posterior circulations are connected by two posterior communicating arteries. This circle of communicating arteries, known as the Circle of Willis, provides collateral cerebral circulation that may be extremely important in maintaining tissue viability during acute stroke. Collateral circulations occur via leptomeningeal (pial) branches between ACA and MCA territories, as well as between the MCA and PCA territories. There is substantial variability in the cerebral circulation in individual patients; this is readily appreciated with modern angiographic neuroimaging.[7]

Cerebral infarction (85% of stroke patients) is mostly due to thromboembolic disease, secondary to atherosclerosis in the major extra cranial arteries eg. carotid and aortic arch.[1] Cerebral infarction is a process which takes some hours to completes, even enough through the patient's deficit may be maximal close to the onset of the causative vascular occlusion, when homeostatic mechanisms fail, the process of ischemia starts and ultimately leads to infarction once blood flow falls below the thresholds for maintenance of electrical activity, neurological deficit appears.[4] The incidence of ischemic stroke in anterior circulation is about 70% where as in posterior circulation it is about 5-10%. [8] Among the anterior circulation the incidence of ischemic strokes is significantly related to middle cerebral artery and it is less than 3% due to occlusion of the anterior cerebral artery.[9]

Many strong evidences support that Diabetes Mellitus is a major health problem among the adult population worldwide and almost half the ischemic stroke population suffer from Diabetes. Diabetes patients had higher rates of stroke as compared to non diabetic patients. Although there has been a decline in mortality and morbidity from stroke in the past 30 years, preventive measures and improvement of treatment modalities should be undertaken in diabetic stroke patients since the prevalence of Diabetes Mellitus is estimated to increase and will become a global burden.[3]

It is well known fact that most of the life threatening clinical features of stroke occur within few minutes to few days of initial attack depending the territory involvement. However the incidence of these features may vary with age, gender, control blood glucose, lipidaemic status of patients etc.[10] Some of these complications are benign and requires no treatment. While some are life-threatening depending upon the territory of brain involvement. So knowledge of territory involvement is always helpful for the neurologist. Better approach for the selection of appropriate treatment like the explanation of prognosis, speech therapy, occupational therapy, physical therapy and social rehabilitation can be planned.

Several studies regarding stroke in diabetic carried out but very few studies regarding the territory involvement had been conducted in recent years. Though this study was not in such a larger scale to enrich modern medicine, nevertheless this obviously would give some information regarding our own patients and would add to the work done in past in this era.

Materials and methods: This cross sectional observational study was conducted in the Dept of Neurology, BIRDEM Hospital. Patients with ischemic stroke with type 2 diabetes, consecutively admitted in the department were recruited in the study for the period of March 2012 to August 2012. Strict recruitment criteria were followed. Inclusion criteria were type 2 diabetes patient presented with first ever stroke irrespective of age and confirmed by imaging (CT-Scan). Demographic information was prospectively recorded and substantiated by means of inspection of medical record. Information included was the subject's age, gender, medical history, clinical history of acute stroke with diabetes, followed by conduction of the study. All the relevant collected data were compiled on a master chart first. Then organized by using scientific calculated and standard statistical formulas, percentage was calculated to find out the proportion of the findings. Further statistical analyses of the results were done by computer software device as statistical packages for social scientist (SPSS). The results were presented in tables, figures, diagrams etc.

Results :

A total of 100 cases were included in the study. The mean age was 61.45 years with standard deviation of mean (SD) ±11.65 years and their age ranged from 35 to 84 years. Majority (35%) of the respondents was found in the age group of 50-59. About 8% subjects were found in 30-39 years age group. Twenty four (24%) subjects had age between 60-69 years. Ten (10%) subjects belonged to 80 years and above age groups(Table I). Out of 100 subjects 68% were male and rest 32% were femal(Table II).

The mean duration of diabetes, was 9.64 (±6) years (Table III). The respondents suffered from diabetes for 3 to 25 years. Majority (27%) of the subjects had diabetes for more than 5 years. Beside Diabetes, the study subjects had hypertension (72%), Dyslipidaemia (59%), history of smoking (56%) and alcoholism (2%). Other risk factors were positive family history of IHD and stroke which prevailed as 12% and 13% respectively (Table IV).

Majority (89%) of the subjects presented with hemiplagia after acute stroke (Figure I). Other common clinical

presentation were aphasia (71%), headache (39%), convulsion (23%), vomiting (18%) and cranial nerve palsy (17%)

Brain imaging was done in all cases. CT scan was performed in 85% subjects and MRI scan of brain was done in 38% cases (Table V).

In most of the cases, parietal lobe of brain (57%) was mostly affected. Basal ganglia (45%), internal capsule (56%), brain stem (6%), thalamus (6%) and cerebellum (8%) were the other common sites of involvement. Ischemic infarcts were also found in paraventricular location (18%), in frontal (6%) and temporal (7%) lobes (Table VI).

In majority of the subjects (76%) middle cerebral arterial territory was affected. Involvements of anterior and posterior cerebral arteries were found in 7% and 5% subjects respectively. In 6% cases, involvement of vertibro-basilar arterial system was observed. Four percent subjects had involvement of both middle and posterior arteries. Both anterior and posterior arterial territory infarcts were found in 2% cases (Table VII).

Table I: Age distribution of the study (n=100)

Age group (Years)	Number	Percentage
30-39	08	08
40-49	10	10
50-59	35	35
60-69	24	24
70-79	13	13
80 and above	10	10
Mean ± SD	61.45	±11.65
Maximum- Minimum	35-84	

Table II: Gender distribution of the study subjects (n=100)

Gender	Number	Percentage
Male	68	68
Female	32	32

Table III: Duration of disease in the study subjects (n=100).

Duration of Diabetes (years)	Number	Percentage
≤5	27	27
6-10	20	20
11-15	23	23
16-20	11	11
21 and above	19	19
Mean ± SD	09.64	±6.00
Range (Minimum-maximum)	03	-25

Table IV: Pre-existing risk factors of the study subjects (n=100)

Co-morbid conditions	Number	Percentage
Hypertension	72	72
Dyslipidaemia	59	59
Smoking	56	56
Alcoholism	02	02
Positive family history of IHD	12	12
Positive family history of stroke	13	13

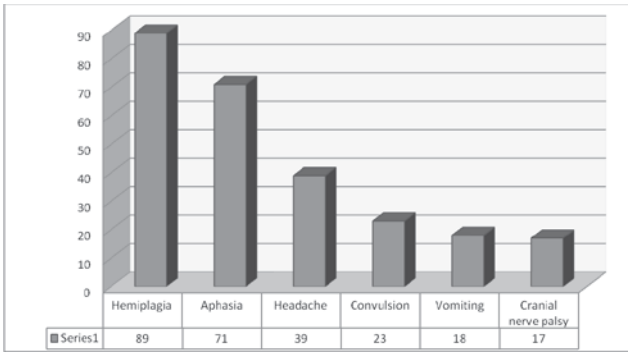

Figure 1: *Bar diagram showing common clinical presentations of the study subjects (n=100)*

Table V: Modality of investigation for detection of stroke (n=100)

Arterial territory	Number	Percentage
CT scan	85	85
MRI	38	38

Table VI: Location of involvement of ischemic lesion (n=100)

Arterial territory	Number	Percentage
Parietal	57	57
Frontal	06	06
Temporal	07	07
Occipital	05	05
Internal capsule	56	56
Thalamus	06	06
Basal ganglia	45	45
Brain stem	06	06
Paraventricular location	18	18
Cerebellum	08	08

Table VII: Involvement of arterial territory in the study subjects (n=100)

Arterial territory	Number	Percentage
Anterior cerebral artery	07	07
Middle cerebral artery	76	76
Posterior cerebral artery	05	05
Vertibro-basilar artery	06	06
Both anterior and posterior arteries	02	02
Both middle and posterior arteries	04	04

Discussion: The traditional definition of stroke, devised by the World Health Organization in the 1970s, is a "neurological deficit of cerebrovascular cause that persists beyond 24 hours or is interrupted by death within 24 hours"[2]. There were several study regarding stroke in diabetic subjects but a very few studies were conducted to see which arterial territory was mostly affected during first ischemic attack. This present cross sectional descriptive study was conducted to evaluate the cerebral vascular territories involvement in diabetic patients with first ever ischemic stroke on 100 subjects. The study result findings were discussed concerning the general objective of the study on basis of related previous study.

The mean age was 61.45 years with standard deviation of mean of ±11.65 years. Majority (35%) of the respondents was found in the age group of 50-59. About 24% subjects were found in 60-69 years age group. The respondents suffered from diabetes for 3 to 25 years. There was an interesting finding in this present study that highest age of occurrence first ischemic stroke was 84 years. It could be thought that strict control of diabetes with control of other diabetic related complications could halt the early onset of stroke.

Among preexisting risk factors, the study subjects had hypertension (72%), dyslipidaemia (59%), history of smoking (56%) and alcoholism (2%). Other risk factor was positive family history of IHD & CVD which prevailed as 12% & 13% respectively. [11] Among the complications of diabetes, about 4% were suffering from peripheral vascular disease, 8% from diabetic Neuropathy, 9% from diabetic nephropathy and 25% from diabetic retinopathy, 7% from peripheral neuropathy in association with diabetes. Previous studies reveal the same risk factors of stroke.[12]

Among the study subjects, majority (89%) of the subjects presented with hemiplagia after an attack of acute stroke. Other common clinical presentation were aphasia (71%), headache (39%), convulsion (23%), vomiting (18%) and cranial nerve palsy (17%). Majority of the present study subjects had motor deficits. Similar result where was found in another study where majority of the subjects were presented with motor deficits[13].

CT scan was performed in 85% subjects and MRI scan of brain was done in 38% cases. In most of the cases, parietal lobe of brain (57%) was mostly affected. Basal ganglia (45%), internal capsule (56%), brain stem (6%), thalamus (6%) and cerebellum (8%) were the other common sites of involvement. Ischemic infarcts were also found in paraventricular location (18%), in frontal (6%) and temporal (7%). Previous study revealed the same site of involvement in stroke patients. [14]

Scans revealed that in majority (76%) of the subjects middle cerebral arterial territory was affected. Kertesz et al (1985) [15] observed that about 88% subjects had single MCA territory involvement and 7% subjects had both middle and posterior cerebral arteries involvement. Stolz et al. (2008)[16] reported similar result where it was seen that about 82% of all stroke patients had involvement of MCA territory. Involvements of anterior and posterior cerebral arteries were found in 7% and 5% subjects respectively. Kang et al (2008)[17] found that ischemic stroke affected mostly ACA territory in their study population (consisting diabetic and non- diabetic). In present study 6% had involvement of vertibo-basilar arterial system. Arboix et al (2011)[18] reported that Posterior cerebral artery (PCA) stroke was less common than stroke involving the anterior circulation which was consistent with the present study findings. Vertibro-basilar arterial territory was affected in 6% subjects in the present study. In a study conducted by Biller et al. (1988)[19] revealed that 8% subjects had vertebro-basilar system. In present study four percent subjects had involvement of both middle and posterior arteries. Both anterior and posterior arterial territory infarcts were found in 2% cases.

Conclusion: Most of the diabetic subjects with first ever ischemic stroke had involvement of middle cerebral artery and further study with large sample size involving multiple centers may be undertaken to conclusively identify cause of involvement of specific territory in ischemic stroke in diabetic subjects.

References:

1. Wades.S. Smith, Joey D. English,S. Claiborne Johnston. Neuorological disorder. In: Kasper DL, editors, Harrison's principles of internal medicine. 15th ed. New York: Mc Graw Hill; 2008. p.2513-35
2. Kidwell CS, Warach S. Acute ischemic cerebrovascular syndrome: diagnostic criteria. Stroke 2003; 34(vol): 2995–98.
3. Goldsein LB, Adams R, Alberts MJ,Appel LJ,Brass LM,Bushell CD, Culebras A, Degraba TJ, Gorelick PB, Gyton JR, Hart RG, Howard G, Kelly-Hayes M, Nixon JV,Saacco RL. Primary prevention of ischemic stroke: A guideline from the American Heart Association/American Stroke Association Stroke Council: Cosponsored by the Atherosclerotic Peripheral Vascular Disease Interdisciplinary Working Group:Cardiovascular Nursing Council: Clinical Cardiology council: Nutrittion, Physical Activity, and Metabolism Council; and the Quality of Care and Outcomes Resarch Interdisciplinary Working Group.Stroke 2006; 37:1583-1633.
4. Allen CMC, Lueck C.J, Neurological disease. In: Nicholas AB, editors, Davidson's principles and practice of medicine. 19th ed. Edinburgh: Churchill Livingstone, Elsevier; 2010; p. 1103-1209.
5. Adams HP , del Zoppo G, Alberts MJ, Bhatt DL, Brass L, Furlan A, Grubb RL, Higashida RT, Jauch EC,Kidwell C, Lyden PD, Morgenstern LB, Qureshi AI, Rosenwasser RH, Scott PA, Wijdicks EF. Guidelines for the early management of adults with ischemic stroke: a guideline from the American Heart Association/American Stroke Association Council, Clinical cardiology council, Cardiovascular radiology and intervention Council, and the

atherosclerotic Peripheral Vascular Disease and Quality of Care Outcomes in Research in Interdisciplinary Working Groups: The American Academy of Neurology affirms the value of this guideline as an educational tool for neurologists. Stroke 2007; 38: 1654-1711.

6. O'Regan C, Wu P, Arora P, Perri D, Mills EJ. Statin therapy in stroke prevention: a meta-analysis involving 121,000 patients. Am J Med 2008; 121(vol): 24–33.

7. Lev MH, Farkas J, Rodriguez VR *et al.* CT angiography in the rapid triage of patients with hyper acute stroke to intra arterial thrombolysis: accuracy in the detection of large vessel thrombus. J. Comput. Assist. Tomogr. 2001; 25(4): 520-28

8. Donnan GA, Fisher M, Macleod M, Davis SM. Stroke. Lancet 2008; 371 (9624): 1612–23.

9. CRA Clarke. Neurological disease. In: Kumar P, Clark ML, editors, Kumar and Clark clinical medicine. 6th Ed. London: Elsevier Saunders, 2005; p. 1122-1135

10. Hebert PR, Gaziano JM, Hennekens CH . An overview of trials of cholesterol lowering and risk of stroke. Arch Intern Med 1995; 1559 (vol): 50–5.

11. Seok J, Sa-Yoon KangL. Family History and risk factor for ischemic stroke: Sibling history is more strongly correlated with the disease than parental history. Journal of Neurological Sciences 2009; 284(1):29-34.

12. Janghorbani M, Hu FB, Willett WC, Li TY, Manson JE, Logroscino G, Rexrode KM. Prospective study of type 1 and type 2 diabetes and risk of stroke subtype: the Nurses' Health Study. Diabetes Care. 2007; 30: 1730–35.

13. Nor AM, Davis J, Sen B . The Recognition of Stroke in the Emergency Room (ROSIER) scale: development and validation of a stroke recognition instrument. Lancet Neurology 2005; 4: 727–34.

14. Dauzat MMT, Laroche TP, Bray TM, Deklunder G and Woodcock TP. Vascular Ultrasound- Head and neck. In: Dewbury K, Miere H, Cosgrove D, editors, Grainger & Allison's Diagnostic Radiology. 6th ed. London: Churchill livingstone; 1993. p. 833-54.

15. Kertesz A, Nicholson I, Cancelliere A, Kassa K, Black SE. Motor impersistence: a right-hemisphere syndrome. Neurology 1985; 35(5): 662-66.

16. Stolz E, Cioli F, Allendoerfer J, Gerriets T, Del Sette M, Kaps M. Can early neurosonology predict outcome in acute stroke: a metaanalysis of prognostic clinical effect sizes related to the vascular status. Stroke 2008; 39(12):3255-61.

17. Kang SY, Kim JS. Anterior cerebral artery infarction: stroke mechanism and clinical-imaging study in 100 patients. Neurology 2008; 70(2): 2386-93.

18. Arboix A, Arbe G, GarcÃ□ a-Eroles L, Oliveres M, Parra O, Massons J. Infarctions in the vascular territory of the posterior cerebral artery: clinical features in 232 patients. BMC Res Notes 2011; 4: 329-30.

19. Biller J, Yuh WT, Mitchell GW . Early diagnosis of basilar artery occlusion using magnetic resonance imaging. Stroke 1988; 19(3): 297-306.

Original Article

Antibiotic sensitivity pattern of urinary tract infection at a tertiary care hospital

Rama Biswas[1], Raihan Rabbani[2], Hasan Shahrear Ahmed[3], Mohammed Abdus Satter Sarker[4], Nahida Zafrin[5], Md. Motlabur Rahman[6]

Abstract:

Background: *Urinary tract infections (UTIs) remain the common infections in outpatients as well as hospitalized patients. Current knowledge on antimicrobial sensitivity pattern is essential for appropriate therapy. The aim of the study is to determine the changing pattern of antibiotic sensitivity among uropathogens causing UTI.*

Methods: *Urinary isolates from symptomatic UTI cases attending in Square hospital were processed in the Microbiology lab. Antimicrobial susceptibility testing was performed by Kirby Bauer's disc diffusion method. Extended spectrum beta lactamase (ESBL) production was determined by double disk synergy test method.*

Results: *Of the 200 tested sample 110 samples showed growth of pathogens among which the most prevalent were E.coli (58.18%) followed by Enterococci (13.6%). The majority (68.18%) of the isolates were from female. ESBL production was observed in 46.87% o E.coli strains and 25% of Klebsiella strains. More than 98% of the isolates are sensitive to Imipenem, Meropenem , while 86.36% are sensitive to Amikacin , 73.63% to Nitrofurantoin and 74.54% to Gentamicin. Very high rate of resistance is seen against amoxicillin (88.19%), cefixime (65.46%), cotrimoxazole (68.19%) and ceftriaxone (63.63%). E. coli showed high sensitivity to meropenem, imipenem and amikacin (100%) followed by Gentamicin (94.1%).*

Conclusion: *The study revealed that E.coli was the predominant bacterial pathogens of UTIs. An increasing trend in the production ESBLs among UTI pathogens in the community was noted. Nitrofurantoin should be used as empirical therapy for primary, uncomplicated UTIs.*

Key Words: *Urinary Tract Infection, Antibiotic Sensitivity.*

Introduction:

Urinary tract infections (UTIs) are a major public health problem in terms of morbidity and financial cost, and incur the highest total health care cost among urological diseases, exceeding that of chronic renal failure even when renal dialysis and renal transplantation are included.[1] UTI represents one of the most common diseases encountered in medical practice today with an estimated 150 million UTIs per annum worldwide.[2]

Although UTIs occur in both men and women, clinical studies suggest that the overall prevalence of UTI is higher in women. Uncomplicated UTIs in healthy women have an incidence of 50/1000/year.[3]An estimated 50% of women experience at least one episode of UTI at some point in their lifetime and between 20% and 40% of women have recurrent episodes.[4,5] Approximately 20% of all UTIs occur in men.[6]

UTI is said to exist when pathogenic organisms are detected in the urine, urethra, bladder, kidney or prostate. In most instances, growth of more than 10^5 organisms per milliliter from a proper collected midstream clean-catch urine sample indicates infection. However significant bacteriuria is lacking in some cases of true UTI. Especially in symptomatic patients, a smaller number of bacteria (10^2 to 10^4/ml) may signify infection. In urine specimens obtained by suprapubic aspiration or in-and-out catheterization and in samples from a patient with an indwelling catheter, colony counts of 10^2 to 10^4/ml generally indicate infection. Conversely colony counts>10^5/ml of midstream urine are occasionally due to specimen contamination, which is specially likely when multiple species are found.[7] The vast majority of uncomplicated UTIs are caused by Escherichia coli, with other pathogens including enterococci, Staphylcoccus saprophyticus, Klebsiella spp. And Proteus mirabilis.[8] The extensive and inappropriate use of antimicrobial agents has invariably resulted in the development of antibiotic resistance which, in recent years, has become a major problem worldwide.[9] To ensure appropriate treatment, knowledge of the organisms that cause UTI and their antibiotic susceptibility is mandatory.[10]The aim of the study was to

1. Dr. Rama Biswas, MBBS, FCPS. Specialist, Medicine, Square Hospital Ltd, Dhaka.
2. Dr. Raihan Rabbani, MBBS, FCPS, MD (USA), Associate Consultant, Square Hospital Ltd, Dhaka.
3. Dr. Hasan Shahrear Ahmed, MBBS, Medical Officer, Surgery, BSMMU.
4. Dr. Mohammed Abdus Satter Sarker, MBBS, MCPS, FCPS, Assistant Professor, SSMC and Mitford Hospital, Dhaka.
5. Dr. Nahida Zafrin, MBBS, FCPS, Medical Officer, Pathology, Sylhet Medical College, Sylhet.
6. Dr. Md. Motlabur Rahman, MBBS, MCPS, FCPS, Assistant Professor, DMC.

Corresponding Author:
Dr. Rama Biswas
Specialist, Medicine, Square Hospital Ltd,
18/F, Bir Uttam Qazi Nuruzzaman Sarak (West Panthapath)
Dhaka – 1205. E- mail: drramabiswas@gmail.com

assess the changing susceptibility of urinary pathogens to antimicrobial agents in UTIs.

Materials and methods:

This study was conducted on patients admitting in Square hospital, Dhaka between November 2011 and February 2013. Clean–catch midstream urine specimens from patients diagnosed clinically to be having UTI on the basis of symptoms were inoculated on Blood agar and McConkey Agar plates, which were incubated aerobically at 37°C

overnight. Plates showing growth suggestive of significant bacteriuria, with colony count exceeding 10^5cfu/ml were subjected to standard biochemical tests for identification. Antimicrobial sensitivity testing was performed using Kirby Bauer disc diffusion method as described by the National Committee for Clinical Laboratory Standard (presently called Clinical Laboratory Standard Institute).[11] Interpretation as Sensitive or Resistant was done on the basis of the diameters of zone of inhibition of bacterial growth as recommended by disc manufacturer. The ESBL phenotypic confirmatory test was performed by disk diffusion method on Muller-Hinton agar plates. The antibiotics used for susceptibility testing were Amoxycillin, Ciprofloxacin, Cefixime, Ceftriaxone, Cefepime, Gentamicin, Amikacin, Nitrofurantoin, Cotrimoxazole, Imipenem and Meropenem.

Results:

Of the 200 urine samples processed 110 (55%) gave significant growth of pathogens

Table 1 outlines the demographic profile of UTI. The patients were between 18 and 90 years of age. The prevalence of UTI is high among females (68.18%) than males (31.82%). Females of the reproductive age group (18-49years) constituted 56.37% of the total patients with UTI. However, elderly (50-90years) males had a higher incidence of UTI (23.64%) compared to the elderly females (11.81%).

Table 1: Age and sex distribution of patients with urinary tract infections

Age group (in years)	Females No (%)	Males No (%)
18-29	23(20.91%)	2(1.82%)
30-49	39(35.46%)	7(6.36%)
50-90	13(11.81%)	26(23.64%)

The commonest isolates were Escherichia coli, Enterococci, Pseudomonas, Proteus, Staphylococcus aureus and Klebsiella pneumoniae. (These represented 58.18%, 13.63%, 9.09%, 8.18%, 4,54% and 3.63% of isolate respectively). Pie chart showed the distribution of organisms.

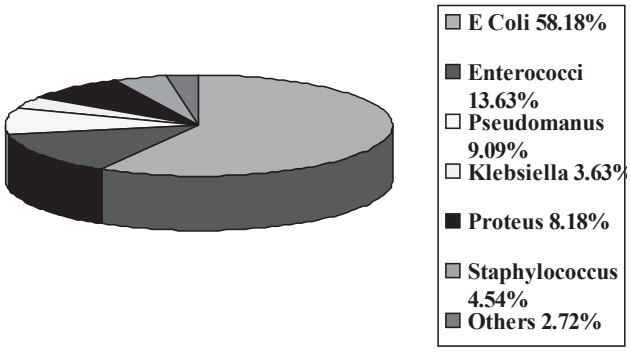

Figure 1: *The pie chart showing organisms isolated*

Table 2 depicts the frequency of isolation of ESBL producing organisms over the study period. Extended spectrum beta lactamase production was observed in 46.87% of E. coli strains and 25% of Klebsiella strains.

Table 2: Percentage distribution of extended spectrum beta lactamase producing uropathogens

Total no. of E. coli isolated	ESBL producing E.coli No.(%)	Total no. of Klebsiella spp.	ESBLproducing Klebsiella spp. No(%)
64	30 (46.87%)	04	1 (25%)

The antimicrobial potency and spectrum for 11selected antimicrobial agents of different classes against the five most frequent UTI pathogens are summarized in table 3. Sensitivity to Nitrofurantoin to pseudomonas were not tested as they have intrinsic resistance to that drug. E. coli showed high sensitivity to meropenem, imipenem and amikacin (100%) followed by Gentamicin (94.1%) , Cephalosporin group (82.35%) with good susceptibility to Ciprofloxacin (88.23%). But ESBL E. coli showed highest sensitivity to Imipenem (100%) with Nitrofurantoin (90%) and Amikacin (83.3%). Enterococci is highly sensitive to Imipenem, Meropenem (100%), Nitrofurantoin (86.6%) and Gentamicin (53.33%). Pseudomonas showed highest sensitivity to Meropenem (90%) followed by Amikacin , Cefepime (60%) and Ciprofloxacin (50%). Imipenem, Gentamicin, cephalosporin group and Cotrimoxazole showed highest percent susceptibility (100%) against Proteus. Staphylococcus aureus showed highest sensitivity to Nitrofurantoin, Imipenem, Meropenem, Amikacin (100%) followed by Cotrimoxazole (80%). Gentamicin and Imipenem are 100% sensitive against Klebsiella followed by Amikacin (75%) and Cotrimoxazole(50%). The isolates show low degree of susceptibility to Amoxycillin (11.81%), Cefixime (34.54%), Cefepime (44.54%), Ceftriaxone (36.37%) and cotrimoxazole (31.81%).

Table 3: Antibiotic sensitivity and Resistance pattern of isolated organisms in UTI

	E.coli (n=34)		ESBL E.coli (n=30)		Enterococci (n=15)		Pseudomonas (n=10)		Proteus (n=9)		Staph.aureus (n=5)		Klebsilla (n=4)	
S	R	S	R	S	R	S	R	S	R	S	R	S	R	
Amoxycillin	8.33%	91.67%	0%	100%	53.33%	46.67%	0%	100%	0%	100%	20%	80%	0%	100%
Cefixime	82.35%	17.65%	0%	100%	0%	100%	0%	100%	88.9%	11.1%	20%	80%	25%	75%
Ceftriaxone	82.35%	17.65%	0%	100%	0%	100%	0%	100%	100%	0%	20%	80%	25%	75%
Cefepime	82.35%	17.65%	0%	100%	0%	100%	60%	40%	100%	0%	80%	20%	25%	75%
Ciprofxacin	88.23%	11.77%	3.33%	96.67%	15.38%	84.62%	50%	50%	70%	30%	20%	80%	25%	75%
Gentamicin	94.11%	5.99%	73.33%	26.67%	53.33%	46.67%	60%	40%	100%	0%	20%	80%	100%	0%
Amikacin	100%	0%	83.33%	16.67%	33.3%	66.7%	60%	40%	80%	20%	100%	0%	75%	25%
Imipenem	100%	0%	100%	0%	93.3%	6.7%	90%	10%	100%	0%	100%	0%	100%	0%
Meropenem	100%	0%	100%	0%	93.3%	6.7%	90%	10%	100%	0%	100%	0%	100%	0%
Nitrofurantoin	100%	0%	90%	10%	86.66%	13.34%	ND		0%	100%	100%	0%	0%	100%
Cotrimoxazole	23.52%	76.48%	16.67%	83.33%	0%	100%	10%	90%	100%	0%	80%	20%	50%	50%

S= Sensitive, R= Resistant,ND= Not done

Table 4 depicts the overall percentage of uropathogens sensitivity to antibiotics. More than 98% of the isolates are sensitive to Imipenem, Meropenem , while 86.36% are sensitive to Amikacin , 73.63% to Nitrofurantoin and 74.54% to Gentamicin.

Table 4: Overall percentage of uropathogens sensitivity to Antibiotics

Antibiotic	Sensitivity (%)	Resistance (%)
Amoxycillin	11.81%	88.19%
Cefixime	34.54%	65.46%
Ceftriaxone	36.37%	63.63%
Cefepime	44.54%	55.46%
Ciprofloxacin	40%	60%
Gentamicin	74.54%	25.46%
Amikacin	86.36%	13.64%
Imipenem	98.18%	1.82%
Meropenem	98.18%	1.82%
Nitrofurantoin	73.63%	26.37%
Cotrimoxazole	31.81%	68.19%

Discussion:

The study observes that the prevalence of UTI is high among females (68.18%) than males (31.82%). Females of the reproductive age group (18-49years) constituted 56.37% of the total patients with UTI. It has been reported that adult women have a higher prevalence of UTI than men, principally due to anatomical and physical factors.[12]Among males an increased prevalence of UTI was recorded in elderly age group 50-90 (23.64%) than young (8.18%).This is probably because with advancing age, the incidence of UTI increases in men due to prostate enlargement and neurogenic bladder.[13]

The study demonstrates that E.coli remain the leading uropathogen being responsible for 58.18% of UTI. This is in consistence with findings of other studies in which E. coli was the most frequently reported isolate from patients with UTIs.[14] Following E.coli , our study shows Enterococcus species (13.6%) and Pseudomonas (9.09%) as the other common uropathogens. Our findings are in accordance with a study by Dias Neto et al.[15]Enterobacteriaceae have several factors responsible for their attachment to the urothelium. These gram negative aerobic bacteria colonize the urogenital mucosa with adhesion, pilli, fimbriae and P1-blood group phenotype receptor.[13]

Our study reveals that 46.87% of E.coli isolates and 25% of Klebsialla species to be ESBL producers. Aggarwal et al.reported 40% of E.coli and 54.54% of Klebsialla species to be ESBL producers from Rohtak, Haryana.[16] In another study in Nagpur, 18.5% of E.coli isolates and 25.6%Klebsiella isolates were found to be ESBL producers.[17] This geographical difference may be due to different patterns of antibiotic usage. Our study confirms the global trend towards increased resistance to beta lactum antibiotics. ESBL producing bacteria may not be detectable by routine disk diffusion susceptibility test, leading to inappropriate use of antibiotics and treatment failure. It is emphasized that institutions should employ appropriate tests for their detection and avoid indiscriminate use of third generation cephalosporins.

From this study, it can be seen that cotrimoxazole and amoxicillin are virtually useless against uropathogens as they were effective against 31.81%and 11.81%of all isolated organisms respectively. Nitrofurantoin showed strong activity against 73.63% of all isolated organisms and was very active E.coli and Staph aureus particularly. However it has a very weak activity against Proteus spp and Pseudomonas spp. It has also been shown to be very safe in pregnancy[18] and also a recent study in India showed that Nitrofurantoin had the best in-vitro susceptibility profile against E.coli.[19] The consistent and high level susceptibility of E.coli to Nitrofurantoin may be influencd by nitrofurantoin's narrow spectrum of activity, limited indication, narrow tissue distribution and limited contact with bacteria outside the urinary tract.[20] The isolates shows low degree of susceptibility (40%) to Fluoroquinolone which indicates that they can no more be opted for treating UTI. From our study, it can be seen that more than 98% of the isolates are sensitive to Imipenem, Meropenem, while 86.36% are sensitive to Amikacin, 73.63% to Nitrofurantoin and 74.54% to Amikacin.

Conclusion

In our study , culture positive rate for uropathogens was high, with the majority coming from adult female patients. E.coli was the most common etiological agent and remains susceptible to nitrofurantoin. This drug should be the ideal antibiotic to use for uncomplicated UTI. Our findings suggest the presence of ESBL-producing strains; therefore, monitoring of antibiotic susceptibility of bacterial isolates should be mandatory.To tackle the upcoming problems of ESBL producing E.coli, Imipenem and Amikacin are good choice along with nitrofurantin.

References:

1. Gales AC, Sader HS, Jones RN. The SENTRY Participants Group (Latin America). Urinary tract infection trends in Latin American hospitals: Report from the SENTRY antimicrobial surveillance program (1997-2000). Diagn Microbiol Infect Dis 2002; 44:289–99
2. Karlowsky JA, Kelly LJ, Thornsberry C, Jones ME, Sahm D. Trends in antimicrobial resistance among urinary tract infection isolates of *Escherichia coli* from female outpatients in the United States. Antimicrob Agents Chemother 2002;46: 2540–5.
3. De Backer D, Christiaens T, Heytens S, de Sutter A, Stobberingh EE, Verschraegen G. Evolution of bacterial susceptibility pattern of *Escherichia coli* in uncomplicated urinary tract infections in a country with high antibiotic consumption: A comparison of two surveys with a 10 year interval. J Antimicrob Chemother 2008; 62:364–8.
4. Rock W, Colodner R, Chazan B, Elias M, Raz R. Ten years surveillance of antimicrobial susceptibility of community acquired *Escherichia coli* and other uropathogens in Northern Israel.(1995-2005) Israel Med Assoc J 2007;9:803–5
5. Vasquez Y, Hand WL. Antibiotic susceptibility patterns of community acquired urinary tract infection isolates from female patients on the US (Texas)-Mexico Border. J Appl Res 2004; 4:321–6.
6. Griebling TL. Urinary tract infection in men. In: Litwin MS, Saigal CS, editors. Urologic Diseases in America. DHHS, PHS, NIH, NIDDK. Washington, DC: GPO; 2007. pp. 621–45. NIH publication 07-5512.
7. Stamm WE, schaeffer AJ. The state of the Art in the management of Urinary tract infections, Am J Med 2002; (supp 1A): 113.
8. Blondeau JM. Current issues in the management of urinary tract infections; extended- release ciprofloxacin as a novel treatment option. Drugs 2004;54(6): 611-28.
9. Goldstein FW. Antibiotic susceptibility of bacterial strains isolated from patients with community acquired urinary tract infections in France. Multicentre Study Group. Eur J Clin Microbial Infect Dis 2000;19:112-7.
10. Ashkenazi S, Eventov S, Samra Z, et al. Uropathogens of various populations and their antibiotic susceptibility. Pediatr Infect Dis J 1991; 10: 742-6.
11. National Committee for Clinical Laboratory Standards: Methods for Disk Susceptibility Tests for Bacteria That Grow Aerobically. NCCLS Document M2-A7. Wayne, National Committee for Clinical Laboratory Standards 7th edition. 2000.
12. Akram M, Shahid M, Khan AU. Etiology and antibiotic resistance patterns of community acquired urinary tract infections in JNMC Hospital, Aligarh, India. Ann Clin Microbiol Antimicrob 2007;6:6.
13. Das R, Chandrasekhar TS, Joshi HS, Gurung M, Shreshtha N, Shivananda PG. Frequency and susceptibility profile of pathogens causing urinary tract infections at a tertiary care hospital in western Nepal. Singapore Med J 2006;474:281–5.
14. Dimitrov TS, Udo EE, Emara M, Awni F, Passadilla R. Etiology and antibiotic susceptibility patterns of community acquired urinary tract infections in a Kuwait Hospital. Med Princ Pract 2004;13:334–9.
15. Dias Neto JA, Martins AC, Tiraboschi RB, Domingos AL, Cologna AJ, Paschoalin EL, et al. Community acquired urinary tract infection: Etiology and bacterial susceptibility. Acta Cir Bras 2003;18(Suppl5):33–6.
16. Aggarwal R, Chaudhary U, Sikka R. Detection of extended spectrum β-lactamase production among uropathogens. J Lab Physicians 2009;1:7–10.
17. Tankhiwale SS, Jalgaonkar SV, Ahamad S, Hassani U. Evaluation of extended spectrum beta lactamase in urinary isolates. Indian J Med 2004;120:553–6.
18. Delzell JE Jr et al. Urinary tract infections during pregnancy. Am Fam Physician 2000; 61:713.
19. Biswas D, Gupta P, Prasad R, Singh V, Arya M, Kumar A. Choice of antibiotic for empirical therapy of acute cystitis in a setting of high antimicrobial resistance. Indian J Med Sci 2006; 60:53-58
20. James AK, Laurie J, Clyde T, Mark EJ, Daniel FS. Trends in Antimicrobial Resistance among Urinary Tract Infection Isolates of Escherichia coli from Female Outpatients in the United States. Antimicrob Agents Chemother 2002; 46(8): 2540-2545.

Original Article

Childhood Deaths with a Co-Morbidity of Diarrhea and Severe Malnutrition: A Brief Insight in an Urban Critical Care Ward in Dhaka, Bangladesh

Md Shakil Hossain[1], Sufia Islam[2], Mohammod Jobayer Chisti[3]

Abstract

Background and aim: *Although co-morbidity of childhood diarrhea and severe malnutrition is very common with high mortality, data on predicting factors for deaths in diarrheal under-five children also having severe malnutrition are very limited in medical literature. The aim of this study was to evaluate the clinical predicting factors for death in diarrheal under-five children with severe malnutrition.*

Methods: *The study was designed as a prospective analysis from retrospective data of diarrheal children (case control design) which were collected from electronic database of the hospital of the International Center for Diarrheal Disease Research, Bangladesh (icddr,b) from mid-September 2011 to mid-September 2012. The cases were severely malnourished diarrheal children under the age of five years who died in the intensive care unit and the controls were those who survived. Comparison of clinical characteristics among the cases and the controls were made.*

Results: *There were 32 cases from the ICU and 1790 controls including 253 from the ICU. The median (inter-quartile range) age (months) of the cases compared to the controls was significantly lower [8.0 (4.1, 14.1) vs. 10.0 (6.1, 17.2); p=0.050]. The cases more often had pneumonia (OR 3.40, 95% CI 1.48-7.66, p<0.001) with respiratory distress (OR 30.06, 95% CI 11.47-77.67, p<0.001), frequently presented with the features of clinical sepsis (OR 52.22, 95% CI 24.02-127.68; p<0.001), less often received Oral Rehydration Salt (ORS) at home (OR 0.07, 95% CI 0.03-0.14; p<0.001), and more often had lower Z-score for weight for age [(mean -5.42 ± standard deviation 1.35) vs. (mean -4.14 ± standard deviation 1.28); p<0.001] compared the controls.*

Conclusion: *The brief results of the data suggest that severely malnourished diarrheal children presenting with younger age with a history of lack of intake of ORS at home, extreme under-weight, pneumonia with respiratory distress or clinical sepsis are at higher risk of death. This re-emphasizes the importance of identification of these simple clinical parameters which may help in early aggressive management of these children and underscores the importance of the requirement of extensive mass media education in encouraging the adequate intake of ORS during diarrhea in order to reduce their morbidity and deaths.*

Key Words: *Childhood Death, Diarrhea, Malnutrition.*

Introduction

Severe Malnutrition is one of the most common causes of morbidity and mortality among children in developing countries including Bangladesh[1,2]. Among the global deaths in children under five years of age, about 48 % occurred in different forms of malnutrition (19% were due to underweight, 14.5% to stunting, and 14.6% to wasting)[3]. Although the prevalence rates of childhood malnutrition are slowly regressing in Asia, the highest prevalence can still be found in South Asia[1]. Malnutrition has been responsible, directly or indirectly, for 54% of the global annual deaths among children under five[4]. The immediate causes of malnutrition and child death are mutually reinforcing conditions of inadequate dietary intake and infectious disease; the underlying causes are household food insecurity, inadequate health service and absence of healthy environment[1]. According to national guidelines, 2008; the death rate among children hospitalized for severe acute malnutrition in Bangladesh was as high as 15 percent[5]. The Dhaka hospital of International Centre for Diarrheal Disease and Research, Bangladesh (icddr,b) runs the Clinical Research and Service Centre (CRSC) in Dhaka, Bangladesh, which treats more than 120 000 patients for diarrheal disease each year[6]. The overall mortality rate in the CRSC is only 0·45%, but the mean mortality rate among severely malnourished children with diarrhea is about 15%, and most of these deaths occur within the 48 hours of admission[7]. Death is even higher at intensive care unit (ICU) of this setting with this co-morbidity of diarrhea and severe malnutrition[8]. These two contributes each other and associated with a number of risks for death. However, data are limited on the predicting factors of deaths in such children at critical care set ups. It is thus important to identify the simple predicting factors for death to initiate

1. Md Shakil Hossain, M. Pharm, Research Fellow, Clinical Service (CS), International Centre for Diarrhoeal Disease Research, Bangladesh (icddr,b), Dhaka, Bangladesh and Department of Pharmacy, East West University, Dhaka, Bangladesh.
2. Sufia Islam, M. Pharm, Ph.D, Associate Professor and Head, Department of Pharmacy, East West University, Dhaka, Bangladesh.
3. Mohammod Jobayer Chisti, MBBS, MMed (Paed) , Scientist, Centre for Nutrition and Food Security & Clinical Lead, ICU, Centre for Nutrition and Food Security (CNFS), icddr,b, Dhaka, Bangladesh.

Corresponding Author:
Dr. Mohammod Jobayer Chisti, MBBS, MMed (Paed)
Scientist, Centre for Nutrition and Food Security &
Clinical Lead, ICU, Dhaka Hospital
International Centre for Diarrhoeal Disease Research, Bangladesh (icddr,b).
68 Shaheed Tajuddin Ahmed Sarani, Mohakhali, Dhaka 1212, Bangladesh
E-mail: chisti@icddrb.org

prompt management in order to reduce deaths in such children. The purpose of our analysis, using a case-control design, was to evaluate the predicting factors for death in severely malnourished children below 5 years of age attending the ICU of the Dhaka Hospital of icddr,b with diarrheal diseases.

Methods

Study population & Site

The study was conducted at the Dhaka hospital of icddr,b. This hospital provides care and treatment to over 120000 diarrheal patients, with or without associated health problems, each year. It also conducts research on enteric and other common infectious diseases and malnutrition, and provides training on case management and research methodology. Under-five children constitute over 60% of the total patients, and vast majority of the patients come from the poor socio-economic background of urban and peri-urban Dhaka, the capital of Bangladesh.

Study Design

The study was designed as a prospective analysis from retrospective data of patients collected from the `SHEBA', an online database from icddr,b. For the collection of data a questionnaire was prepared which was given to the programmed analyst of the hospital for assembling the data. All under-five pediatric patient suffering from diarrhea having severe malnutrition and admitted in the ICU of the Dhaka Hospital of icddr,b from September 2011 to September 2012 were enrolled in the study. Comparison of simple clinical features was made among the children who died & survived. Severe malnutrition was defined following WHO anthropometry[9].

Patient management

Treatment received by the study children in the ICU/HDU/ARI ward have been described elsewhere[9].

Measurements

Case report forms (CRF) were developed, pretested, and finalized for data acquisition. Death was the primary outcome and characteristics analyzed include age, clinical sepsis[10], pneumonia[11], respiratory distress, ORS intake at home, and Z score for weight for age.

Analysis

All data were entered into SPSS for Windows (version 15.0; SPSS Inc, Chicago) and Epi-Info (version 6.0, USD, Stone Mountain, GA). Differences in the proportions were compared by the Chi-square test. For normally distributed data, the differences of means were compared by Student's t-test and Mann-Whitney test was used for comparison of data that were not normally distributed. A probability of less than 0.05 was considered statistically significant. Strength of association was determined by calculating odds ratio (OR) and their 95% confidence intervals (CIs).

Results

A total of 1822 children enrolled during the study period and among them 32 (2%) died in the ICU and 1790 survived including 253 in the ICU. The median (inter-quartile range) age (months) of the children who died compared to the survivors was significantly lower [8.0 (4.1, 14.1) vs. 10.0 (6.1, 17.2); p = 0.05]. The children who died frequently presented with pneumonia (31% vs. 12%; OR 3.40, 95% CI 1.48-7.66, p<0.001) with respiratory distress (28%. 1%; OR 30.06, 95% CI 11.47-77.67, p<0.001), often had the features of clinical sepsis (53%. 2%; OR 52.22, 95% CI 24.02-127.68; p<0.001), seldom received ORS at home (50% vs. 94%; OR 0.07, 95% CI 0.03-0.14; p<0.001), and more often had lower Z score for weight for age [(mean -5.42 ± standard deviation 1.35) vs. (mean -4.14 ± standard deviation 1.28); p<0.001] compared the controls.

Discussion

This study observed a number of simple clinical predicting factors for death in diarrheal children having severe malnutrition: younger age, pneumonia with respiratory distress, clinical sepsis, less intake of ORS at home, and extreme under-weight. These observations are not surprising at all, however, in spite of decreasing trend of worldwide malnutrition, for the last few decades severe malnutrition remained as one of the greatest contributors of deaths in south Asia, including Bangladesh due to inadequate social and political commitment[1]. Thus, these simple clinical predicting factors for deaths in diarrheal children having severe malnutrition is critically important for the clinicians as well as policy makers to take adequate preventive as well as curative measures.

The observation of clinical sepsis as one of the predicting factors in diarrheal children with severe malnutrition is understandable. Clinical sepsis in severely malnourished children often associated with vasodilatation and capillary leakage[12,13,14] and leads to poor peripheral microcirculation[10] with fatal outcome[9]. The observation of association of less intake of ORS at home with deaths in these children is also understandable. Lack of replacement of purging by taking ORS is often associated with a number of ramifications such as dehydration, shock, hypoglycemia, electrolyte imbalance especially hyponatremia and hypokalemia following convulsion[7,11] which are highly associated with deaths in such children[7,15,16]. Observation of association of pneumonia with respiratory distress with deaths in such children has also been reported earlier[17]. The higher the severity of malnutrition, the higher the rates of deaths, especially in diarrheal children[18] and this explains our observation of higher deaths in diarrheal children with extreme malnutrition. Observation of younger age as one of the predicting factors of death in diarrheal children with severe malnutrition has also been reported earlier[7].

The main limitation of the analyses is the fewer number of variables which impeded the exploration of potentially more predicting factors associated with deaths in diarrheal children having severe malnutrition.

In conclusion, severely malnourished diarrheal children who present with a history of lack of adequate intake of ORS at home, young age (8 months), extreme under-weight, pneumonia with respiratory distress, and clinical sepsis are prone to deaths. Identification of these simple clinical

predicting factors may help in early aggressive management of these children and re-emphasizes the importance of further requirement for extensive mass media education in encouraging the adequate intake of ORS during diarrhea in order to reduce their morbidity and deaths.

Acknowledgements

This research was funded by icddr,b and its donors which provide unrestricted support to icddr,b for its operations and research. Current donors providing unrestricted support include: Australian Agency for International Development (AusAID), Government of the People's Republic of Bangladesh; Canadian International Development Agency (CIDA), Swedish International Development Cooperation Agency (Sida), and the Department for International Development, UK (DFID). We gratefully acknowledge these donors for their support and commitment to icddr,b's research efforts. We also like to express our sincere thanks to SHEBA personnel for their invaluable support during data collection.

References :

1. Ahmed T, Hossain M, I. SK (2012) Global Burden of Maternal and Child Undernutrition and Micronutrient Deficiencies. Ann Nutr Metab 61 (supplement): 8–17.
2. Chisti MJ, Hossain MI, Malek MA, Faruque AS, Ahmed T, et al. (2007) Characteristics of severely malnourished under-five children hospitalized with diarrhoea, and their policy implications. Acta Paediatr 96: 693-696.
3. Black RE, Allen LH, Bhutta ZA, Caulfield LE, de Onis M, et al. (2008) Maternal and child undernutrition: global and regional exposures and health consequences. Lancet 371: 243-260.
4. Schaible UE, Kaufmann SH (2007) Malnutrition and infection: complex mechanisms and global impacts. PLoS Med 4: e115.
5. National Guidelines for the Management of Severely Malnourished Children in Bangladesh (2008).
6. Chisti MJ, Salam MA, Ashraf H, Faruque AS, Bardhan PK, et al. (2013) Predictors and outcome of hypoxemia in severely malnourished children under five with pneumonia: a case control design. PLoS One 8: e51376.
7. Ahmed T, Ali M, Ullah MM, Choudhury IA, Haque ME, et al. (1999) Mortality in severely malnourished children with diarrhoea and use of a standardised management protocol. Lancet 353: 1919-1922.
8. Chisti MJ, Pietroni MA, Smith JH, Bardhan PK, Salam MA (2011) Predictors of death in under-five children with diarrhoea admitted to a critical care ward in an urban hospital in Bangladesh. Acta Paediatr 100: e275-279.
9. Chisti MJ, Salam MA, Ashraf H, Faruque AS, Bardhan PK, et al. (2013) Clinical risk factors of death from pneumonia in children with severe acute malnutrition in an urban critical care ward of bangladesh. PLoS One 8: e73728.
10. Chisti MJ, Duke T, Robertson CF, Ahmed T, Faruque AS, et al. (2012) Clinical predictors and outcome of hypoxaemia among under-five diarrhoeal children with or without pneumonia in an urban hospital, Dhaka, Bangladesh. Trop Med Int Health 17: 106-111.
11. WHO (2006) Pocket book for hospital care of children: guidelines for the management of common illness with limited resources Geneva: World Health Organization. pp. 173-195.
12. Annane D, Bellissant E, Cavaillon JM (2005) Septic shock. Lancet 365: 63-78.
13. Ebrahim GJ (2011) Sepsis, septic shock and the systemic inflammatory response syndrome. J Trop Pediatr 57: 77-79.
14. Chisti MJ, Ahmed T, Faruque AS, Abdus Salam M (2010) Clinical and laboratory features of radiologic pneumonia in severely malnourished infants attending an urban diarrhea treatment center in Bangladesh. Pediatr Infect Dis J 29: 174-177.
15. Samadi AR, Wahed MA, Islam MR, Ahmed SM (1983) Consequences of hyponatraemia and hypernatraemia in children with acute diarrhoea in Bangladesh. Br Med J (Clin Res Ed) 286: 671-673.
16. Chisti MJ, Ahmed T, Bardhan PK, Salam MA (2010) Evaluation of simple laboratory investigations to predict fatal outcome in infants with severe malnutrition presenting in an urban diarrhoea treatment centre in Bangladesh. Trop Med Int Health 15: 1322-1325.
17. Chisti MJ, Salam MA, Hossain MI, Ashraf H, Faruque ASG, et al. (2013) Fatal outcome related risks in severely malnourished children with pneumonia in an urban critical care ward of Bangladesh. . Bangladesh Critical Care Journal 1: 80-85.
18. Roy SK, Buis M, Weersma R, Khatun W, Chowdhury S, et al. (2011) Risk factors of mortality in severely-malnourished children hospitalized with diarrhoea. J Health Popul Nutr 29: 229-235.

Bangladesh Crit Care J March 2014; 2 (1): 28-34

Review Article

EEG in ICU: A monitoring tool for critically ill patient

Selina Husna Banu[1]

Abstract:

Electroencephalographic monitoring provides dynamic information about the brain function that permits early detection of changes in neurologic status, which is especially useful when the clinical examination is limited. Identification of ongoing electrographic seizures, non-convulsive status epilepticus (NCSE), periodic epileptogenic discharges (PED), irreversible cerebral dysfunction i.e., isoelectric tracing would help the care providers in appropriate decision making regarding the management. Non-convulsive seizures (NCSz) are more common than previously recognized and are associated with worse outcome if not treated in time. Majority of seizures at the ICU are not clinically identified because of the disease phenomena or as the patient may remain under sedation. Studies revealed the first NCSz within 1 to 24 hours of EEG monitoring; longer period of monitoring is required in comatose patient and those with PED. Factors associated with an increased risk of NCSz and NCSE include coma, prior clinical seizures, CNS infection, trauma, stroke, hypoxic ischemic encephalopathy, brain tumor, recent neurosurgery, and PED.

In resource-poor situation, EEG is frequently requested to confirm brain death, particularly where there is limited information on neurological examination or inconclusive apnea test; or when the patient is in prolonged state of coma. Presence of isoelectric tracing for at least 30 minutes in the EEG along with other clinical evidences is helpful in such situations.

Extreme care should be taken for recording and reviewing continuous EEG (cEEG) monitoring at the ICU where sources of electrical noise are present. Patients identified with electrographic seizures and mild to moderate degree encephalopathy, with presence of normal background activities had better outcome compared to those with PED, monorrhythmic alpha beta coma and severe generalized encephalopathy.

Real-time detection of ischemia at a reversible state is technologically feasible with cEEG and should be developed into a practical form for prevention of in-hospital infarction.

Brain function monitoring with EEG is useful and this is in great demand at the ICU of present time. Such monitoring can help to improve neurological outcome in a variety of ICU settings.

Key Words: *EEG, Electroencephalogram, Subclinical Seizure, Intensive Care.*

Introduction:

Critical care unit (**CCU**) or **intensive care unit** (**ICU**), is a special department of a health care facility. Common conditions treated at the ICUs include those in the state of coma with or without an immediate history of overt seizure, acute stroke, head injury, multiple organ failure, post operative slow or non recovery, cardio-respiratory failure, cardiac arrest and sepsis[1]. Patients are transferred from an emergency department, or from a ward if they rapidly deteriorate; or immediately after surgery if the surgery is majorly invasive and the patient is at high risk of complications[2]. First ICU was established in Copenhagen (1953) in response to a polio epidemic where many patients required constant ventilation [3]. The first application in the United States was in 1955 [4].

There was limited facility to assess the brain function at the ICU until recently. Electro-cencephalographic (EEG) monitoring is introduced recently that explored the fact that non-convulsive seizure attacks are common, that remain unrecognized on physical examination [5,6]. The use of electroencephalography (EEG) in the ICU is not widely discussed or evaluated even in advanced countries.

Why it is important to identify the electrographic seizures or non-convulsive seizures?

Delayed recovery or deteriorated clinical condition in a critically ill patient is the major consequence of unidentified electrographic seizure. In addition, later negative effect on the speech-communication, attention and -behavior can be presumed through extrapolated information. Studies have suggested that these are affected by continuous spike wave of slow sleep (CSWSS), a specific EEG findings that had been identified long ago[7,8].

Technical aspect of EEG:

Electro-encephalography is the recording of the difference in voltage between at least 2 electrode sites on the scalp to detect brain activity, in a conscious or an unconscious patient. It involves multiple electrode placement on the scalp, connection of the electrode wires to an amplifier (head box), which is then connected to the monitor to display the wave pattern. Routine test (rEEG) is performed for a minimum period of 30 minutes. Emergency EEG (emEEG) is required in acutely ill patients, with an objective to prognostic evaluation, to assess the level of sedation, identify ongoing

1. Selina Husna Banu, MBBS, DCH, PhD, specialist Fellow in clinical Neurophysiology, ICH and GOSH, University College London, UK. Presbyterian Hospital, NY, USA. Dept of Clinical Neurophysiology and Sleep Clinic in Oxford University College Hospital, UK, Clinical Neurophysiologist and Child Neurologist. Associate professor Neurosciences dept. Institute of Child Health and Shishu Sasthya Foundation Hospital, Mirpur, Dhaka.

Corresponding Author:
Selina Husna Banu
Associate professor, Neurosciences Department
ICH and SSF Hospital, Neurosciences center
6/2 Barabag, Mirpur, Dhaka.
Email: selinabanu17@gmail.com

neuronal discharges or electrographic seizures and would assist in medical treatment. In some situation, EEG can assist the confirmation of brain death. Most of the critically ill patients would need a continuous EEG monitoring (cEEG), i.e., continuous digital EEG recorded for hours, days or weeks[9]. Duration of cEEG varied from hours to several days depending on the problem and clinical suspicion in different studies[5,6,10]. To address the question, "how long is enough time for monitoring in cEEG and whether a routine EEG is adequate", Pandian et al[10] performed a rEEG for 30-minuted before their prolonged, digital VIDEO EEGs in 105 patients; seizures were detected in 11% and 27% with rEEG , and cEEG (median duration 2.9 days, *p=0.01*) respectively. Therefore, rEEG may detect less than half of seizures eventually identified by longer cEEG recording. One study[5] identified the first seizure on cEEG in the first hour of recording in 50% among total 110 patients (56 non-comatose and 54 comatose). Studies in both adults[5] and children[11] have reported that 80–95% of seizures are detected within 24 hours, slightly longer durations are needed in comatose patients. Longer recording period is suggested to detect NCSzs in comatose patient or if periodic epileptiform discharges are seen[12].

EEG findings in a critically ill patient: The EEG could reveal any-thing between normal cerebral activities for the patient's age and state (Fig 1 & 2) to severe dysfunctions. It

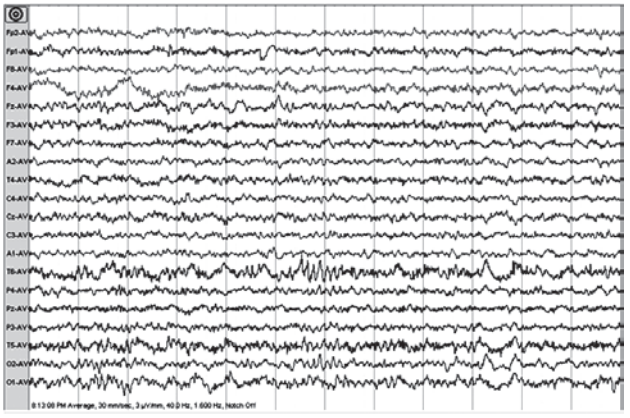

Fig-1

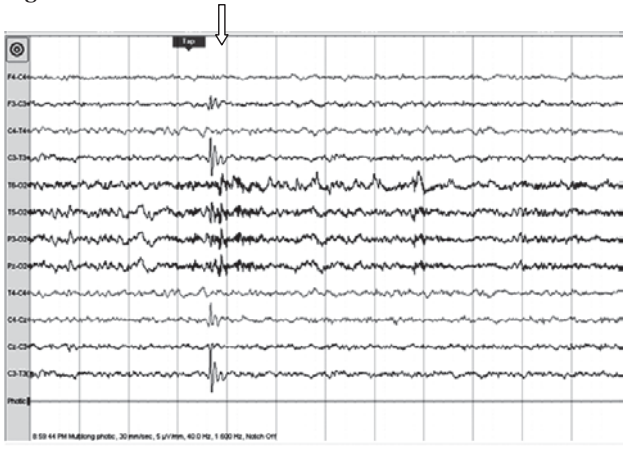

Fig-2

may show distortion of normal background activities or abnormal pattern without any normal background activities in between e.g., burst suppression pattern, periodic complexes.Figure 1,2: A 25 year male, in unexplained non-improving coma state for 16 days, emEEG was called to find any supportive evidence of brain death. Note cerebral activity and reactivity to tactile stimulation. Occasional epileptogenic activities were noted over the temporal parietal area predominantly over the left side of the brain. The EEG excluded cerebral death at this stage. The patient was discharged with partial recovery, farther recovery later.

The immediately treatable electrical condition is "continuous or frequent spike –wave discharges or electrographic seizures (Fig- 3) without any overt seizure in a comatose patient.

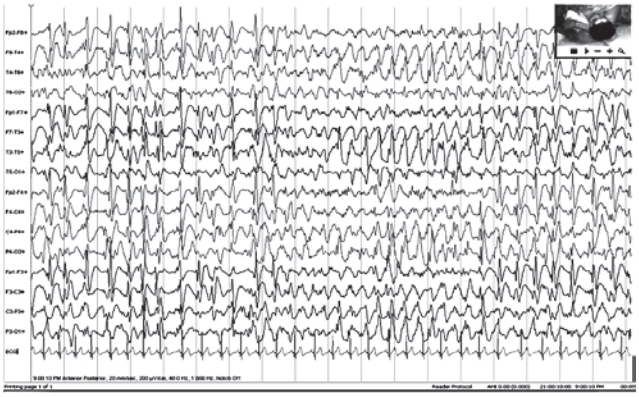

Figure – 3: *NCSE, Post ictal non-recovery, 5 year boy, unconscious for 5 days, no recognizable seizure for 5 days. Note continuous, high amplitude,2 c/s spike-wave complexes involving all the channels. sensitivity – 20µV/mm.*

Other dysfunctions include non -reactive- monorhythmic activities (e.g., alpha-beta coma) (Fig 4); localized or generalized delta wave activities; or iso-electric tracing (Fig 5).

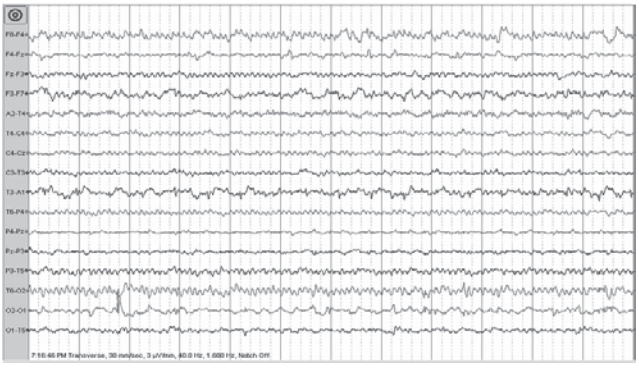

Figure 4: *A 22 yr male, on artificial Ventilator for 2 wks. Note, the EEG showing non-reactive, very low amplitude 9-11c/s, monorrhythmic activities in the background (alpha coma state). The patient expired on the next day.*

Correlating with other evidence this may indicates brain death. The EEG findings have diagnostic and prognostic value and may help in the treatment plan of a critically ill patient.

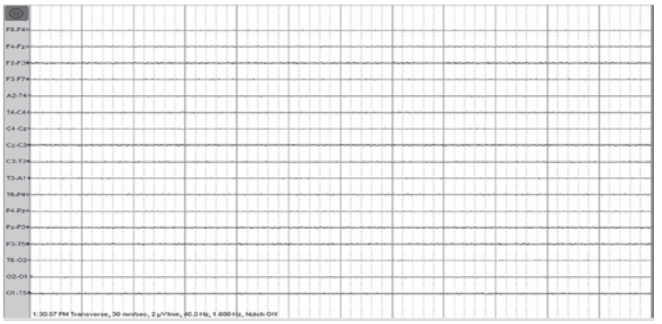

Figure 5: *Isoelectric, non-reactive EEG tracing in all the channels in a 3 ½ month boy, post-operative non-recovery, unconscious for 4 days (sensitivity= 2 µV/mm) .*

Electro-clinical correlation involves appropriate timing and duration of the EEG recording and is important for brain function monitoring. During data analysis the neurophysiologist should consider the previous history of seizure, primary etiology of the present illness, present medication with dose and recent clinical change[6].

Pitfalls and challenges:

The EEG is a non-invasive way to assess the brain functions with certain limitations and challenge. On the first instance, patient selection, optimum time for the brain function monitoring is important. High quality cEEG recording in the ICU is a significant challenge. It is necessary to have adequately trained technologist to connect patients with the monitoring equipment and maintain those connections for many hours. Critically ill patients are frequently repositioned, and often undergo multiple procedure and diagnostic tests, including MRI ordered simultaneously. Choice of electrode (MRI compatible electrodes), paste to keep the electrodes in position (collodion, a durable nitrocellulose-based paste to secure disk electrodes) and checking the electrodes are suggested. Newer electrodes, such as subdural wires, which may be more secure and lead to less skin breakdown, may be appropriate for comatose patients [13,14,15]. The next challenge is the labor intensive EEG data collection and interpretation.

There are numerous sources of artifacts make EEG interpretation difficult, some are easy to identify, such as 60 Hz (50Hz in Europe) line noise from nearby electrical equipment. Artifacts from dialysis machine, cooling blankets, pacemakers, chest percussion, vibrating beds and IV drips may be difficult to avoid and sometimes mimic seizure-like phenomena or PEDs. cEEG with VIDEO recording is strongly recommended , that helps to recognize subtle seizures and clinical events that mimic seizures, also useful for artifact recognition.

Challenge for the countries with limited resources also includes the cost and time management for the cEEG. This problem could be managed through some modification i.e., emergency EEG with repeated brief period (30 – 60 minutes) of VIDEO- EEG recording and judicial patient selection. A research group has reported a study result on emergency EEG (25 EEGs) on 20 critically ill patients of mean age 14 years ranging from 1 month to 68 year (st deviation 20.2) performed in different ICUs of Dhaka city[16]. Clinical conditions categorized as "patients in unexplained coma" for over 2 to 4 wks period in 40% ; "post-convulsive non-recovery" in 35%, "post operative complication" in 20%, neonatal "hypoxic ischemic encephalopathy" (HIE) 5%. None had recognizable seizures during EEG recording. The EEG recording was performed for 30 to 60 minutes. EEG features were categorized as "severe generalized encephalopathy with non-reactive delta waves" (40%), "isoelectric tracing" (27%); "epileptogenic discharges" in 20%; "alpha-beta coma" (13%). For correlation analysis with the clinical outcome, the EEG findings were re-categorized as 1.*"irreversible cerebral dysfunction(ICD)"* (isoelectric tracing and alpha-beta coma); 2. Severe *generalized encephalopathy (SGE)* and 3. *Localized and/ or generalized epileptiform discharges with other dysfunction (LGEOD)*. Clinical outcome revealed significant correlation (p-<0.05) with 100% mortality in those with ICD and 9% with SGE. Recovery 'partial' and 'total' was reported in 67% and 33% in those showing LGEOD; and 55% and 10% of those with SGE respectively. The researchers concluded that emEEG is useful to take appropriate decision at the ICU, particularly regarding continuation of ventilator support in a resource poor situation [16].

Detection of non-convulsive seizures (NCSz) and non-convulsive status epilepticus (NCSE):

NCSz are electrographic seizures with little or no overt clinical manifestations commonly found in neonates, may occur in apparently well functioning children or adults, increasingly detected in comatose patients. NCSE is a condition with continuous or near continuous electrographic seizures of at least 30 minutes duration. Presence of NCsz or NCSE would delay the recovery process or may deteriorate the condition even when the primary cause of coma is treated well. Diagnosis of NCSz and NCSE are possible by the EEG test and are increasingly recognized as common occurrences in the critically ill patients. Over 8% - 48% of the comatose patients may have NCSz, depending on which patients are studied [5,6,9,10,11,12,17,18, 19,20,21,48].

Clinical feature: Common manifestation of NCSE or NCSz in critically ill patients is a depressed level of consciousness or non-improving, static condition [21]. Most patients with NCSz have purely electrographic seizures (figure 3),[5] , but subtle signs such as face and limb myoclonous, stereotyped movement, nystagmus, eye deviation, pupilary abnormalities (including hippus), and autonomic instability can be identified[23,-30]. None of these clinical signs are highly specific of NCSz, and they are often noted under other circumstances in the critically ill patients; thus, EEG is necessary to diagnose NCSz and NCSE.

Patients with NCSzs are not exclusively in the neurology ICUs; studies on comatose patients from any ICU [12], pediatric ICU [18], or patient having unexplained altered mental status anywhere in the hospital have identified ongoing NCSz in 8%-37%, suggesting that at-risk patients can be found in any critical care setting [8,21,22,23,24,25,26]. It is important to note that many of the studies are retrospective and included some

patient for whom there was a high suspicion for NCSz based on previous history of seizures, rhythmic movements or a possibly epileptogenic injury potentially contributing to the high rate of NCSz observed in some studies.

In a prevalence study [12], EEG evaluation of 236 comatose patients of all ages has concluded that NCSE is an under-recognized cause of coma, occurring in 8% of all comatose patients without clinical manifestation. Therefore, EEG should be included in the routine evaluation of comatose patients even if clinical seizure activity is not apparent.

The underlying cause or etiologies for the NCSz and NCSE in ICU patients are not exactly identified, they have some common associations. These include acute structural lesions, intracranial hemorrhage, head injury, infections, infarctions, stroke, metabolic derangements, toxins, withdrawal and epilepsy.

NCSzs following convulsive status epilepticus (SE)

Presence of continuous electrographic seizures has been identified in many cases after control of convulsive SE [21,27,28,29,32,33,61]. In most of the patients coma was the only clinical manifestation. The mortality rate was also more than two fold higher among those patients identified with NCSE compared to those who recovered with cessation of convulsion [32]. Therefore, cEEG monitoring should be performed on any patient who does not quickly regain consciousness after a convulsive seizure to detect ongoing seizure activity.

Cerebral hemorrhage

Cerebral hemorrhage, including intra-cerebral, subarachnoid, subdural hematoma, from any underlying cause, e.g., stroke, ruptured aneurysm, tumor, trauma, etc. can be irritating to the surrounding neurons. If the neurons become very irritated and/or hyperactive, seizures can occur. In such case seizure may remain clinically undetectable because of the fact that the patient may remain under deep sedation or in deep coma. NCSzs were identified in 18% - 21% of patients with intracerebral hemorrhage (ICH) [19, 20]. cEEG findings may also predict outcome after ICH. Vespa et al[34] and Claassen et al[19] found that NCSz were associated with increased mid-line shift and with expansion of hemorrhage volume that led to worse outcomes. Periodic epileptiform discharges (PEDs) in cEEG was found to be an independent predictor of poor outcome (death, vegetative state, minimally conscious on discharge)[22].

Traumatic Brain injury (TBI):

Early post traumatic seizures (EPTS) is a common occurrence found in previous studies[20, 35,36], however, because of the widespread use of seizure prophylaxis after TBI, acute clinical seizures have become less common, occurring in <1% in one large study[37]. In 96 consecutive patients with moderate to severe TBI underwent cEEG, 22% of the patients had seizures, half of them had only NCsz[38]. Some studies have shown that EPTS is an independent risk factor for adults[39] and children[40] with severe TBI.

Post-operative complications:

Postoperative clinical seizures are common association with neuro-surgical procedures, especially those involving the supratentorial lesions (in 4%-17% cases)[41- 44] and in patients, with history of presurgical epilepsy (34%)[44]. Incidence of NCSz and NCSE in post operative patients has not been studied, however, should be considered as contributing factor in post-operative unusual behavior, movement or delayed recovery.

Table 1. Indication for Emergency-EEG (Americal College of Emergency Physicians 2004)

1. Refractory SE
2. Persistent altered consciousness
3. Suspected NCSE after generalized convulsive SE (failing to return to the normal behavior or cognitive state after convulsive SE)
4. Pharmachological paralysis - deep sedation
5. Coma
6. Suspected Brain death

Hypoxic Ischemic Injury (HIE):

A series of comatose patient, 42% identified with NCSE had hypoxic/anoxic injury[12], and 20% of the patient with hypoxic ischemic injury monitored by cEEG in Columbia series had seizures, most of which were NCSz[5]. Presence of clinical seizure or decreased mental status after cardiac arrest is suggested to be the indication for EEG monitoring[45]. In addition, with recent use of hypothermia after cardiac arrest for neuroprotection cEEG might be a help to distinguish shivering from seizures especially during rewarming period[46]

Toxic-metabolic encephalopathy:

Overt and subclinical seizures or change of mental status are not unusual consequences of hypo-, or hyperglycemia, hyponatremia, hypocalcemia, drug intoxication or withdrawal, hepatic failure, uremia, sepsis[31]. In the Columbia cEEG study 20% of the primary diagnosed cases of toxic-metabolic encephalopathy had NCSz[5]. In other series, 5%-25% of patients with NCSz had metabolic derangements as the likely etiology[12,47].

A study on 201 medical ICU patients revealed PED or seizures in 22%; sepsis and acute renal failure were significantly associated with electrographic seizures[48].

Patients in Pediatric ICU

Incidence of NCSz and NCSE are probably more frequent, however, less reported in younger age and infants[5,49]. NCSz and NCSE was identified among 23%, 33% and 44% in critically ill children studied[11,50, 52]. The most common associations and etiology identified were previous history of epilepsy, hypoxic ischemic injury and stroke[11,51,52]. Out of 183 infants having cardiopulmonary operation for congenital heart defect 11.5% were identified with NCSE as post surgery complication[53].

Acute brain ischemia or acute stroke:

Patients with primary diagnosis of stroke may show the first supportive evidence in their EEG, where changes could be detected within seconds of reduction in cerebral blood flow (CBF)[54,55]. This is the basis for intra-operative EEG monitoring for patients undergoing surgeries with a high risk for cerebral ischemia, such as carotid endarterectomy[56,57,58]. As the CBF decreases below 25-30 $mL \cdot 100g^{-1} \cdot min^{-1}$ there is a progressive loss of higher frequency and prominent slowing of background EEG activity noted. When CBF is below 8-10 $mL \cdot 100g^{-1} \cdot min^{-1}$, low enough to cause cell death, all EEG frequencies are suppressed[59,60]. EEG monitoring can detect ischemia at the early stage and provides a window of opportunity to prevent permanent brain injury. This is important as thrombolytic and endovascular therapies have been shown to be effective in acute stroke and vasospasm, especially when treatment is provided very early[61, 62].

Table 2. Indication for continuous EEG monitoring (cEEG)

1. Detection of subclinical seizures (NCSz) and Characterization of spells in patients with **altered** mental status/ or conscious level
    a. Particularly in patients with previous history of epilepsy/seizures
    b. Recent convulsive status epilepticus
    c. Acute brain injury with altered mental status
    d. Fluctuating mental status
    e. Unexplained alteration of mental status
    f. Stereotyped, paroxysmal or repetitive movements or episodic posturing,
    g. Subtle twitching, jerking, nystagmus, eye deviation, chewing
    h. Paroxysmal automatic spells including tachycardia
2. Monitoring ongoing therapy
    a. Assessment of level of sedation
    b. Induced coma for elevated intracranial pressure or refractory status epilepticus
3. Management of burst-suppressions in anesthetic coma
4. Detection of Ischemia
    a. After subarachnoid hemorrhage
    b. During and After vascular neurosurgical or interventional neurocardiology procedures
    c. In patients with hemodynamic lesions and borderline flow
    d. In other patients at risk for in-hospital acute ischemia
5. Prognostication
    a. Following cardiac arrest
    b. Following acute brain injury
    c. Encephalopathy of infective or other origin

Recent advances in EEG technique with real-time application of quantitative algorithms (qEEG) have allowed for extracting time-frequency data to measure change in the background EEG rhythms. Visual review of simple values produced by cEEG recording is useful to detect cerebral hypoperfusion, especially in comatose and sedated patients when clinical examination is limited. qEEG is used for the detection of ischemic stroke and delayed cerebral ischemia (DCI) due to vasospasm after subarachnoid hemorrhage (SAH). However, its value in timely detection of vasospasm and cerebral ischemia is well analyzed and reviewed in different retrospective studies[63, 64, 65] with sensitivity 100% and specificity from 50% - 84%. cEEG with the specific algorithm (qEEG) is proved to be useful for ischemia detection and prognostification [66,67].

Efficacy of therapy

Treatment of refractory status epilepticus (SE) with IV infusions i.e., midazolam, propofol, or pentobarbital under EEG monitoring is useful technique[68]. qEEG based tools, such as Bispectral index[69], patient state index[70], and narcotrend[71] have been in use in operating room and ICU for more than a decade to monitor depth of sedation.

Confirmation of brain death:

Brain death is referred to the complete, irreversible, permanent loss of all brain and brainstem functions. EEG might serve as an auxiliary and useful tool in the confirmatory tests for adults and children[72,73,74]. Typically, isoelectric EEG recording is required at least for 30 min[75]. Confirmation of brain death is urgent in certain ICU situation, particularly in resource poor condition where maintenance of artificial ventilation costs high. In addition, there is a need to diagnose brain death with utmost accuracy and urgency because of an increased awareness amongst the masses for an early diagnosis of brain death and the requirements of organ retrieval for transplantation.

The diagnosis of brain death is primarily clinical. Ancillary testing is ordered only if clinical neurological examination cannot be fully performed due to patient factors, or if apnea testing is inconclusive and aborted, or is not performed due to patient factors. Only one ancillary test among the five (cerebral angiogram included CT or MR angiogram, Nuclear brain scan HMPAO SPECT, EEG, cerebral perfusion scientigraphy (CPS) needs to be performed (step 5 of the guideline)[76]. Considering the availability, time and cost effectiveness, EEG monitoring at least for 30 minutes is suitable in our situation. Visual evoked potentials (EP), somatosensory EPs, and brain stem auditory EPs (BAEPs) can also be used.

Conclusion:

On arrival of a critically ill or a comatose patient at the ICU, it is mandatory to monitor cardiopulmonary physiology, however, an equipment to monitor the brain physiology, a vital organ that is obviously dysfunctional in this case, is unavailable to the ICU staff in most of situation. In a comatose patient, there is hardly a few examinations that can be reliably followed to assess worsening brain injury. The

situation is worst in patients who are sedated and possibly paralyzed. Neuroimaging provides information about structural brain injury often after it is irreversible and cannot reveal functional changes, such as seizures and level of sedation. “Time is brain”, therefore cerebral function monitoring through a non-invasive technique is necessary for patients at risk for neuroprotection. Recent advances in computer technology, networking and data storage have made cEEG monitoring practical and its use is common in many non-neuroscience ICUs. Methods of analyzing and compressing the vast amounts of data generated by cEEG have allowed neurophysiologists to more efficiently review recording from many patients monitored simultaneously and provide timely information for guiding treatment. This article reviewed the use of EEG at the ICU with limitations and pitfalls, discussed different study findings, current indications and potential uses for emEEG and cEEGs (table 1,2). We believe that EEG monitoring should be included in the ICU management protocol.

References:

1. "What is Intensive Care?". London: Intensive Care Society, 2011. Retrieved 2013-05-25.
2. Smith, S. E. (2013-03-24). "What is an ICU". *wiseGEEK*. Bronwyn Harris, ed. Sparks, Nevada: Conjecture Corporation. Retrieved 2012-06-15.
3. Takrouri, M.S.M. (2004). "Intensive Care Unit". *Internet Journal of Health* (Sugar Land, Texas: Internet Scientific Publications) **3** (2). doi:10.5580/1c97. ISSN 1528-8315. OCLC 43535892. Retrieved 2007-08-25.
4. Grossman, D.C. (Spring 2004). "Vital Signs: Remembering Dr. William Mosenthal: A simple idea from a special surgeon". *Dartmouth Medicine* (Dartmouth College, Geisel School of Medicine) **28** (3). Retrieved 2007-04-10.
5. Claassen J, Mayer SA, Kowalski RG, Emerson RG, Hirsch LJ. Detection of electrographic seizures with continuous EEG monitoring in critically ill patients. Neurology. 2004;62:1743–8.
6. Abend NS, Dlugos DJ, Hahn CD, Hirsch LJ, Herman ST. Use of EEG monitoring and management of non-convulsive seizures in critically ill patients: a survey of neurologists. Neurocrit Care 2010 Jun;12 (3):382-9.
7. Paquier P.F, Van Dongen H.R.. Loonen C.B, The Landau-Kleffner syndrome or ‘acquired aphasia with convulsive disorder’ Long-term follow-up of six children and a review of the recent literature. Arc. Neurol, 1992, 49: 354-359
8. Roulet Perez E., Davidoff V., Despland P.A., Deonna T. Mental and behavioural deterioration of children with epilepsy and CSWS: Acquired epileptic frontal syndrome. Dev. Med Child Neurol 1993, 35: 661-674
9. Hirsch LJ, Continuous EEG monitoring in the intensive care unit, an over view. Journal of C. Neurophysiology, 2004; 21(5): 332-39)
10. Pandian JD, Cascino GD, So EL, Manno E, Fulgham JR. Digital video-electroencephalographic monitoring in the neurological-neurosurgical intensive care unit: clinical features and outcome. Arch Neurol. 2004;61:1090–4.
11. Saengpattrachai M, Sharma R, Hunjan A, Shroff M, Ochi A, Otsubo H, Cortez M,Snead Carter. Nonconvulsive seizures in the pediatric intensive care unit: etiology, EEG, and brain imaging findings. Epilepsia. 2006;47:1510–18.
12. Towne AR, Waterhouse EJ, Boggs JG, et al. Prevalence of nonconvulsive status epilepticus in comatose patients. Neurology. 2000;54:340–5.
13. Kull LL, Emerson RG. Continuous EEG monitoring in the intensive care unit: technical and staffing considerations. J Clin Neurophysiol 2005;22:107–18
14. Mirsattari SM, Lee DH, Jones D, Bihari F, Ives JR. MRI compatible EEG electrode system for routine use in the epilepsy monitoring unit and intensive care unit. Clin Neurophysiol 2004;115:2175–80
15. Young GB, Campbell VC. EEG monitoring in the intensive care unit: pitfalls and caveats. J Clin Neurophysiol 1999;16:40–5
16. Report on em EEGs on 20 ICU patients. Reported at the national conference BCNEPS, November 2013.
17. Jordan KG. Neurophysiologic monitoring in the neuroscience intensive care unit. Neurol Clin. 1995;13:579–626.]
18. Jette N, Claassen J, Emerson RG, Hirsch LJ. Frequency and predictors of nonconvulsive seizures during continuous electroencephalographic monitoring in critically ill children. Arch Neurol. 2006;63:1750–5.
19. Claassen J, Jette N, Chum F, et al. Electrographic seizures and periodic discharges after intracerebral hemorrhage. Neurology. 2007;69:1356–65.
20. Vespa PM, Nuwer MR, Nenov V, Ronne-Englstrom E, Hovda DA, Bergsneider M, Kelly DE, Martin NA, Beker DP, Increasing incidence of and impact of Nonconvulsive and convulsive seizures after traumatic brain injury as detected by continuous electroencepgalographic. J. Neurosurg. 1999;91:750–60.
21. DeLorenzo RJ, Waterhouse EJ, Towne AR, et al. Persistent nonconvulsive status epilepticus after the control of convulsive status epilepticus. Epilepsia. 1998;39:833–40.
22. Claassen J, Hirsch LJ, Frontera JA, Fernandez A, Schmidt M, Kapinos G, Wittman J, Connolly ES, Emerson RG, Mayer SA. Prognostic significance of continuous EEG monitoring in patients with poor-grade subarachnoid hemorrhage. Neurocrit Care 2006;4:103–12
23. Abend NS, Topjian A, Herman ST, et al. Electroencephalographic monitoring during hypothermia after pediatric cardiac arrest. Neurology. 2009;72:1931–40.
24. Jirsch J, Hirsch LJ, Nonconvulsive seizures: developing a rational approach to the diagnosis and management in the critically ill population. Clin Neurophysiol 2007; 118: 1660-70
25. Lowrenstein DH, Aminoff MJ, Clinical and EEG feature of status epilepticus in comatose patients, Neurology 1992; 42: 100-4
26. Kaplan PW, Behavioral manifestation of nonconvulsive status epilepticus. Epilepsy Behav 2002;3: 122-39
27. Hussain AM, Horn GJ, Jacobson MP, Non-convulsive status epilepticus: usefulness of clinical features in selecting patients for urgent EEG. J Nurol Neurosurg Psychiatry 2003; 74:189-91
28. Banu SH, Hussain M, Khan NZ. Non-convulsive Status Epilepticus Presenting as Deterioration in School Performance - A Case Report. Bangladesh J Child Health. 1998;22(3/4):75 - 77.
29. Banu SH, Mostafa Mahbub, AZM Moshiul Azam, Shipra Rani, Naila Z Khan (2009), Non-convulsive status epilepticus in children, electro-clinical profile and response to a specific treatment protocol, Bangladesh J. Child Health, 2009;33(3): 90- 99.
30. Privitera M, Hoffman M, Moore JL, Jester D. EEG detection of nontonic-clonic status epilepticus in patients with altered consciousness. Epilepsy Res. 1994;18:155–66.
31. Abou Khaled KJ, Hirsch LJ, Advances in management of seizures and status epilepticus in critically ill patients. Crit Care Clin, 2006;22:637-59
32. Bauer G, Aichner F, Mayr U, Nonconvulsive status epilepticus following generalized tonic clonic seizures. Eyr Neurol. 1982;21:411-19
33. Treiman DM, Meyers PB, Walten NY, Collins JF, Colling C, Rowan AL, Handforth A, Fought E, Calabrese VP, Uthman BM, Ramsay RE, Mamdani MB. A comparison of four treatments for generalized convulsive status epilepticus. Veterans affairs status epilepticus cooperative study group. N Eng J Med, 1998;339:792-8
34. Vespa PM, O’Phelan K, Shah M, Mirabelli J, Starkman S, Kidwell C, Saver J, Nuwer MR, Frazee JG, McArther DA, Martin NA, Acute seizures after intracerebral haemorrhage: a factor in progressive mid-line shift and outcome. Neurology, 2003; 60:1441-6

35. Annegers JF, Grabow JD, Groover RV, Laws ER Jr, Elveback LR, Kurland LT. Seizures after head trauma: a population study. Neurology 1980; 30:683–939.
36. Temkin NR, Dikmen SS, Wilensky AJ, Keihm J, Chabal S,Winn HR. A randomized, double-blind study of phenytoin for the prevention of post-traumatic seizures. N Engl J Med 1990;323:497–502
37. Temkin NR, Anderson GD, Winn HR, Ellenbogen RG, Britz GW, Schuster J, Lucas T, Newell DW, Mansfield PN, Machamer JE, Barber J, Dikmen SS. Magnesium sulfate for neuroprotection after traumatic brain injury: a randomised controlled trial. Lancet Neurol 2007; 6:29–38
38. Vespa PM, Continuous EEG monitoring for the detection of seizure in traumatic brain injury, inferction, and intracerebral hemorrhage; "to detect and protect". J Clin Neurophysiol, 2005; 22: 99-105
39. Wang HC, Chang WN, Chang HW, Ho JT, Yang TM, Lin WC, Chuang YC, Lu CH. Factors predictive of outcome in post traumatic seizures. J Trauma, 2008; 64:883-8
40. Chiareth A, Piastra M, Pulitano S, Pietrini D, De Rosa G, Barbaro R, Di Rocco C. Prognostic factors and outcome of children with severe head injury, an 8 year experience , Child Nerv Syst, 2002; 18:129-36
41. Foy PM, Copeland GP, Shaw MD. The incidence of postoperative seizures. Acta Neurochir (Wien) 1981; 55:253–64
42. Baker CJ, Prestigiacomo CJ, Solomon RA. Short-term perioperative anticonvulsant prophylaxis for the surgical treatment of low-risk patients with intracranial aneurysms. Neurosurgery 1995;37:863–70; discussion 870–1
43. Kvam DA, Loftus CM, Copeland B, Quest DO. Seizures during the immediate postoperative period. Neurosurgery 1983; 12:14–17
44. Matthew E, Sherwin AL, Welner SA, Odusote K, Stratford JG. Seizures following intracranial surgery: incidence in the first post-operative week. Can J Neurol Sci 1980; 7:285–90
45. Rossetti AO, Logroscino G, Liaudet L, Ruffieux C, Ribordy V, Schaller MD, Despland PA, Oddo M. Status epilepticus: an independent outcome predictor after cerebral anoxia. Neurology 2007; 69:255–60
46. Hovland A, Nielsen EW, Klu¨ ver J, Salvesen R. EEG should be performed during induced hypothermia. Resuscitation 2006; 68:143–6
47. Young GB, Jordan KG, Doig GS. An assessment of nonconvulsive seizures in the intensive care unit using continuous EEG monitoring: an investigation of variables associated with mortality. Neurology 1996; 47:83–9
48. Oddo M, Carrera E, Claassen J, Mayer SA, Hirsch LJ. Continuous Electroencephalography in the medical intensive care unit. Crit Care Med 2009; 37:2051–6
49. Clancy RR, Legido A, Lewis D. Occult neonatal seizures. Epilepsia 1988; 29:256–61
50. Hosain SA, Solomon GE, Kobylarz EJ. Electroencephalographic patterns in unresponsive pediatric patients. Pediatr Neurol 2005; 32:162–5
51. Tay SK, Hirsch LJ, Leary L, Jette N, Wittman J, Akman CI. Nonconvulsive status epilepticus in children: clinical and EEG characteristics. Epilepsia 2006; 47:1504–9
52. Abend NS, Dlugos DJ. Nonconvulsive status epilepticus in a pediatric intensive care unit. Pediatr Neurol 2007; 37:165–70
53. Clancy RR, Sharif U, Ichord R, Spray TL, Nicolson S, Tabbutt S, Wernovsky G, Gaynor JW. Electrographic neonatal seizures after infant heart surgery. Epilepsia 2005; 46:84–90
54. Sundt TM Jr, Sharbrough FW, Anderson RE, Michenfelder JD. Cerebral blood flow measurements and electroencephalograms during carotid endarterectomy. J Neurosurg 1974;41:310–20
55. Sundt TM Jr, Sharbrough FW, Piepgras DG, Kearns TP, Messick JM Jr, O'Fallon WM. Correlation of cerebral blood flow and electroencephalographic changes during carotid endarterectomy: with results of surgery and hemodynamics of cerebral ischemia. Mayo Clin Proc 1981; 56:533–43
56. Sharbrough FW, Messick JM Jr, Sundt TM Jr. Correlation of continuous electroencephalograms with cerebral blood flow measurements during carotid endarterectomy. Stroke 1973; 4:674–83
57. Zampella E, Morawetz RB, McDowell HA, Zeiger HE, Varner PD, McKay RD, Halsey JH Jr. The importance of cerebral ischemia during carotid endarterectomy. Neurosurgery 1991; 29:727–30; discussion 730–1
58. Arnold M, Sturzenegger M, Schaffler L, Seiler RW. Continuous intraoperative monitoring of middle cerebral artery blood flow velocities and electroencephalography during carotid endarterectomy. A comparison of the two methods to detect cerebral ischemia. Stroke 1997; 28:1345–50
59. Astrup J, Siesjo BK, Symon L. Thresholds in cerebral ischemia—the ischemic penumbra. Stroke 1981; 12:723–5
60. Jordan KG. Emergency EEG and continuous EEG monitoring in acute ischemic stroke. J Clin Neurophysiol 2004; 21:341–52
61. Dorsch NWC. Therapeutic approaches to vasospasm in subarachnoid hemorrhage. Curr Opin Crit Care 2002; 8:128–33
62. Wardlaw J, Berge E, del Zoppo G, Yamaguchi T. Thrombolysis for acute ischemic stroke. Stroke 2004; 35:2914–15
63. Labar DR, Fisch BJ, Pedley TA, Fink ME, Solomon RA. Quantitative EEG monitoring for patients with subarachnoid hemorrhage. Electroencephalogr Clin Neurophysiol 1991; 78:325–32
64. Vespa PM, Nuwer MR, Juha´sz C, Alexander M, Nenov V, Martin N, Becker DP. Early detection of vasospasm after acute subarachnoid hemorrhage using continuous EEG ICU monitoring. Electroencephalogr Clin Neurophysiol 1997; 103:607–15
65. Claassen J, Hirsch LJ, Emerson RG, Mayer SA. Treatment of refractory status epilepticus with pentobarbital, propofol, or midazolam: a systematic review. Epilepsia 2002; 43:146–53
66. Van Putten MJ, Tavy DL. Continuous quantitative EEG monitoring in hemispheric stroke patients using the brain symmetry index. Stroke 2004; 35:2489–92
67. de Vos CC, van Maarseveen SM, Brouwers PJ, van Putten MJ. Continuous EEG monitoring during thrombolysis in acute hemispheric stroke patients using the brain symmetry index. J Clin Neurophysiol 2008; 25:77–82
68. Abou Khaled KJ, Hirsch LJ. Updates in the management of seizures and status epilepticus in critically ill patients. Neurol Clin 2008; 26:385–408
69. Simmons LE, Riker RR, Prato BS, Fraser GL. Assessing sedation during intensive care unit mechanical ventilation with the Bispectral Index and the Sedation-Agitation Scale. Crit Care Med 1999; 27:1499–504
70. Prichep LS, Gugino LD, John ER, Chabot RJ, Howard B, Merkin H, Tom ML, Wolter S, Rausch L, Kox WJ. The Patient State Index as an indicator of the level of hypnosis under general anaesthesia. Br J Anaesth 2004; 92:393–9
71. Bauerle K, Greim CA, Schroth M, Geisselbrecht M, Kobler A, Roewer N. Prediction of depth of sedation and anaesthesia by the Narcotrend EEG monitor. Br J Anaesth 2004; 92:841–5123.
72. Wijdicks EFM (1995) Determining brain death in adults. Neurology 45:1003–1011.
73. Taylor RM (1997) Reexamining the definition and criteria of death. Semin Neurol 17:265–270.
74. Schneider S (1989) Usefulness of EEG in the evaluation of brain death in children: the cons. Electroencephalogr Clin Neurophysiol 73(4):276–278.
75. Wijdicks EFM (2002) Brain death worldwide: accepted fact but no global consensus in diagnostic criteria. Neurology 58:20–25.
76. Guidelines for Determining Brain Death. New York State Department of Health and New York State Task Force on Life and the Law, November 2011

Clinical Practice

"Airway Pressure Release Ventilation" a step up care in ARDS

M. Motiul Islam[1], Raihan Rabbani[2], M. Mufizul Islam Polash[3], Ahmad Mursel Anam[4]

Abstract:

APRV is a mode of mechanical ventilator which uses the principal of open lung approach. It is thought to be an effective & safe alternative for difficult to oxygenate patients like ARDS. It is inverse ratio, pressure controlled, intermittent mandatory ventilation with unrestricted spontaneous breathing. APRV has many purported advantages over conventional ventilation including alveolar recruitment, improved oxygenation, preservation of spontaneous breathing, improved hemodynamics and potential lung-protective effects. It has many claimed disadvantages related to risks of volumtrauma and increased energy expenditure related to spontaneous breathing. Though it was first described more than 20 years ago still it has not gained popularity till date as it is yet to prove its mortality benefits over other conventional modes. Currently there is a lot of ongoing trial globally on it.

Key Words: *APRV, ARDS, Ventilator Mode.*

Introduction:

The primary goal of this mode is to combat hypoxia but it is thought that it is a better mode in terms of alveolar recruitment, improved oxygenation, preservation of spontaneous breathing, improved haemodynamics & potential lung protective effect. This mode uses different terminology & approach. In APRV alveolus remain distended in most of the time in respiratory cycle with small intermittent release. In this mode patient breaths spontaneously in any part of the respiratory cycle & thus can maintain the physiology of normal breath. It causes physiological movement of the diaphragm & change of pleural pressure causing less V/Q mismatch. Generally it needs less sedation & is free from the adverse effects of them.

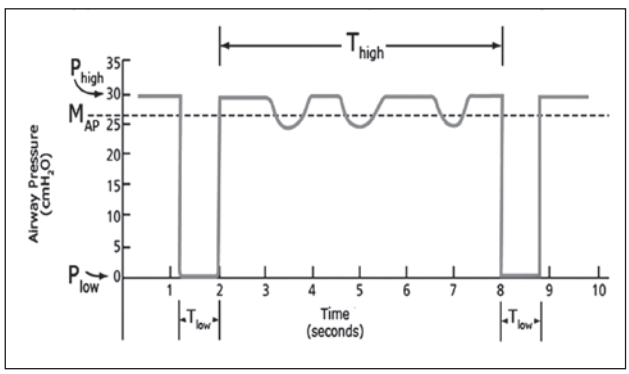

Figure 1: *This is a pressure-time graph of typical airway pressure release ventilation (APRV) mode.*

1. M Motiul Islam, MBBS, Clinical Staff
2. Raihan Rabbani, FCPS (Medicine), MD(USA), Associate Consultant, ICU & Internal Medicine.
3. M Mufizul Islam Polash, MBBS, Clinical Staff.
4. Ahmad Mursel Anam, MBBS, Chief Resident, ICU

All authors work in Intensive Care Unit.

SQUARE Hospital Limited
18/F BU Kazi Nuruzzaman Sarani (West Panthapath); Dhaka 1205.

Corresponding Author:
M Motiul Islam, MBBS
Clinical Staff, ICU
SQUARE Hospital Limited
18/F BU Kazi Nuruzzaman Sarani (West Panthapath); Dhaka 1205.
E mail: motiulccr16@yahoo.com

What is APRV:

APRV is actually a CPAP mode with intermittent release phase. It applies CPAP (P high) for a prolonged time (T high) to maintain adequate lung volume and alveolar recruitment. It has a time-cycled release phase to a lower set of pressure (P low) for a short period of time (T low) or (release time) where most of ventilation and CO_2 removal occurs. In acute respiratory distress syndrome (ARDS), the functional residual capacity (FRC) and lung compliance are reduced. The combination of those causes elevation of the elastic work of breathing (WOB). By applying CPAP, the FRC is restored and inspiration starts from a more favorable pressure-volume relationship, facilitating spontaneous ventilation, and improves oxygenation.[1] Applying 'P high' for a 'T high' (80–95%) of the cycle time, the mean airway pressure is increased insuring almost constant lung recruitment (open-lung approach). In contrast to the other conventional ventilatory methods APRV dose not cause repetitive inflation and deflation of the lung, which could result in ventilator-induced lung injury (VILI);[2,3]. Spontaneous breathing plays a very important role in APRV, allowing the patient to control his/ her respiratory frequency without being confined to an arbitrary preset inspiratory:expiratory ratio (I:E). Thus improving patient comfort and patient-ventilator synchrony with reduction of the amount of sedation necessity. Additionally, spontaneous breathing helps to drive the inspired gas to the nondependent lung regions by using the patient's own respiratory muscles and through pleural pressure changes producing more physiological gas distribution to the nondependent lung regions and improving ventilation/ perfusion (V/ Q) matching.[4–7]

When to use APRV:

Indication:

- Primarily used as an alternative ventilation technique in patients with ARDS.
- Used to help protect against ventilator induced lung injury.

Possible Contraindications

- Unmanaged increases in intracranial pressure.
- Large bronchopleural fistulas

- Possibly obstructive lung disease.
- Technically, it may be possible to ventilate nearly any disorder.

Terminology:

P High – the upper CPAP level. Analogous to MAP (mean airway pressure) and thus affects oxygenation

P Low - is the lower pressure setting.

T High- is the inspiratory time IT(s) phase for the high CPAP level (P High).

T low- is the release time allowing CO2 elimination

APRV setting:

As in any ventilation strategy in ARDS, the goal should be to ventilate the lung on the steep portion of the pressure-volume curve. Where the tidal volume should be between the upper & lower inflection point[12] [Fig 2] which has proven to reduce the ventilator induced lung injury [VILI] [9-11].

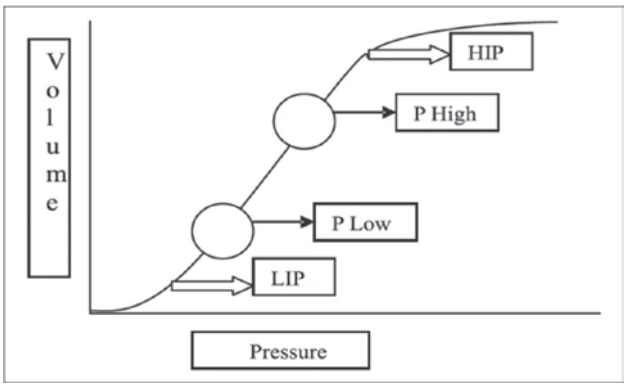

Figure 2: *Static pressure-volume curve during volume-controlled mechanical ventilation. High pressure ('P high') is set below the high inflection point (HIP) and low pressure is set above the low inflection point (LIP)* [14].

In case of APRV setting there are two excepted methods of practice till date. In one method there is short T low with a P low of zero cm H_2O with prolonged I: E ratio. This causes air trapping creating auto PEEP. This deliberate auto PEEP prevents lung collapse causing constant alveolar recruitment. In another method there is longer T low to eliminate auto PEEP with higher P low (generally above the lower inflection point) to avoid alveolar collapse. There are a very few data to support any of the two methods[12, 13]. But the fore mentioned method is better to most of the author, as it does not need to analyze the pressure volume curve & in many times it may be difficult to get a clear curve. The following method may be followed easily.

Initial Settings – P High

- P High – Set a plateau pressure (adult)
- Typically about 20-25 cm H_2O.
- In patients with plateau at or above 30 cm H_2O, set at 30 cm H_2O
- Over-distention of the lung must be avoided. Maximum P high of 35 cm H_2O. (controversial)
- Exceptions for higher settings – morbid obesity, decreased thoracic or abdominal compliance (ascites).

Setting Thigh/T low

- The inspiratory time (T high) is set at a minimum of about 4.0 seconds.
- Usually the T high should be 80-95% of the respiratory cycle.
- The more the T high ratio, the more favorable for oxygenation.
- Progress slowly for example start with T high: T low = 4.2 sec: 0.8 sec and then change as ABG.
- Target is oxygenation.

P low

- With short T low it is generally 0 cm of H_2O.

Troubleshooting:

Making Changes in APRV Settings Based on ABGs. The basic changes may be done by the following ways.

CO_2 Elimination (To Decrease $PaCO_2$):

- Decrease T High.
  - Shorter T High means more release/min.
  - No shorter than 3 seconds
  - Example: if initial T High: T Low is 4.2: 0.8 sec it may be changed to 4: 1 sec.
- Increase P High to increase volume exchange. (2-3 cm H_2O/change)
  - Monitor tidal volume.
  - PIP (best below 30 cm H_2O)
- Check T low. If possible increase T low to allow more time for "exhalation."

To Increase $PaCO_2$

- Increase T high. (fewer releases/min)
- Slowly! In increments of 0.5 to 2.0 sec.
- Decrease P High.
  - Monitor oxygenation and
  - Avoid derecruitment.
- It may be better to accept hypercapnia than to reduce P high so much that oxygenation decreases.

Management of PaO_2

To Increase PaO_2

1. Increase FIO_2
2. Increase MAP by increasing P High in 2 cm H_2O increments.
3. Increase T high slowly (0.5 sec/change)
4. Recruitment Maneuvers
5. Maybe shorten T low to increase T High in 0.1 sec. increments (This may reduce VT and affect $PaCO_2$)

Weaning From APRV

Some authors[15,16] have described a "drop and stretch method" of weaning APRV; they gradually reduced the level of P high ("drop") and reduced the number of releases by increasing the T high ("stretch") until the mode is converted to CPAP as a method of spontaneous breathing trial before extubation.

1. FiO_2 should be weaned first. (Target < 50% with SpO_2 appropriate.)
2. Reducing P High, by 2 cm H_20 increments until the P High is below 20 cm H_2O.
3. Increasing T High to change vent set rate by 5 releases/minute
4. The patient essentially transitions to CPAP with very few releases.
5. Patients should be increasing their spontaneous rate to compensate.

A study by Rathgeber and colleagues[17] compared duration of weaning between BIPAP, VC-IMV, and volume controlled continuous mandatory ventilation (VC-CMV) in postoperative cardiac patients, and reported a small yet significant reduction in time on mechanical ventilation. So the weaning may be done by using other mode also where we can use the conventional methods of weaning like pressure support ventilation (PSV) or T-tube.

During Weaning

Add Pressure Support judiciously.

Add Pressure Support to P High in order to decrease WOB while avoiding over-distention,

P High + PS $\leq$ 30 cm H_2O.

Conclusion:

Airway pressure release ventilation is a simple, safe and effective ventilatory method for patients with ARDS. Currently there is some but no strong evidence to suggest its superiority above other conventional ventilatory methods in regard to oxygenation, hemodynamics, regional blood flow, patient comfort and length of mechanical ventilation. There is no evidence of improved mortality outcome by using APRV as compared to other modes of mechanical ventilation. There is a need for large human trials to compare APRV to conventional mechanical ventilation using lung-protective strategies before drawing final conclusions about this interesting mode of ventilation. Currently APRV is not recommend for every patient with ARDS; but for carefully selected patients, consultation with specialist and respiratory therapist with expertise in using APRV may be necessary.

References :

1. Katz JA, Marks JD. Inspiratory work with and without continuous positive airway pressure in patients with acute respiratory failure. Anesthesiology. 1985;63:598–607.
2. Dreyfuss D, Saumon G. Ventilator-induced lung injury. Lessons from experimental studies. Am J Respir Crit Care Med. 1998;157:294–323.
3. Hotchkiss JR, Jr, Blanch L, Murias G, Adams AB, Olson DA, Wangensteen OD, et al. Effects of decreased respiratory frequency on ventilator-induced lung injury. Am J Respir Crit Care Med. 2000;161:463–8.
4. Putensen C, Zech C, Wrigge H, Zinserling J, Stüber F, Von Spiegel T, et al. Long term effects of spontaneous breathing during ventilatory support in patients with acute lung injury. Am J Respir Crit Care Med. 2001;164:43–9.
5. Wrigge H, Zinserling J, Neumann P, Defosse J, Magnusson A, Putensen C, et al. Spontaneous breathing improves lung aeration in oleic acid-induced lung injury. Anesthesiology. 2003;99:376–84.
6. Putensen C, Mutz N, Putensen-Himmer G, Zinserling J. Spontaneous breathing during ventilatory support improves ventilation/perfusion distribution in patients with ARDS. Am J Respir Crit Care Med. 1999;159:1241–8.
7. Sydow M, Burchardi H, Ephraim E, Zielmann S, Crozier TA. Long term effects of two different ventilatory modes on oxygenation in acute lung injury. Comparison of airway pressure release ventilation and volume-controlled inverse ratio ventilation. Am J Respir Crit Care Med. 1994;149:1550–6.
8. Amato MB, Barbas CS, Medeiros DM, Schettino Gde P, Lorenzi Filho G, Kairalla RA,

   et al*Beneficial effects of the "open lung approach" with low destending pressures in acute respiratory distress syndrome: a prospective randomized study on mechanical ventilation. Am J Respir Crit Care Med 1995;152(6):1835–1846.*
9. *International consensus conferences in intensive care medicine: ventilator–associated lung injury in ARDS. Am J Respir Crit Care Med 1999;160(6):2118–2124.*
10. Dreyfuss D, Saumon G *Ventilator-induced lung injury-lessons from experimental studies. Am J Respir Crit Care Med 1998;157(1):294–323*
11. Terragni PP, Rosboch GL, Lisi A, Viale AG, Ranier VM*How respiratory system mechanics may help in minimising ventilator-induced lung injury in ARDS patients. Eur Respir J 2003;22(Suppl 42):15S–21S.*
12. Dries DJ, Marini JJ *Airway pressure release ventilation. J Burn Care Res 2009;30(6):929–93*
13. Myers TR, MacIntyre NR*Does airway pressure release ventilation offer important new advantages in mechanical ventilator support? Respir Care 2007;52(4):452–460.*
14. Daoud EG (2007). "Airway pressure release ventilation.". *Ann Thorac Med* 2 (4): 176-9.
15. Habashi NM *Other approaches to open-lung ventilation: airway pressure release ventilation. Crit Care 2005;Med 33(Suppl 3):S228–S240.*
16. Frawley PM, Habashi NM *Airway pressure release ventilation: theory and practice. AACN 2001;12(2):234–246.*
17. Rathgeber J, Schorn B, Falk V, Kazmaier S, Spiegel T, Burchardi H *The influence of controlled mandatory ventilation (CMV), intermittent mandatory ventilation (IMV) and biphasic intermittent positive airway pressure (BIPAP) on duration of intubation and consumption of analgesics and sedatives. A prospective analysis in 596 patients following adult cardiac surgery. Eur J Anaesthesiol 1997;14(6):576–582.*

Bangladesh Crit Care J March 2014; 2 (1): 38-39

Case Report

Acute Shock in an Ambiguous Child

Chanchal Das [1], Pranab Kumar Sahana[2], Nilanjan Sengupta[3], Mukut Roy [4], Deshmukh Ashish[5], Ranen Dasgupta[6]

Abstract

Patients with congenital adrenal hyperplasia (CAH) usually presents with varied manifestations. In female, it can manifest as ambiguous genitalia, salt wasting crisis or androgen excess in puberty depending on the severity of enzyme deficiency. Here, we report a four and half year old girl who developed salt wasting crisis in the neonatal period. Prompt diagnosis and immediate glucocorticoid and fludrocortisone replacement saved her life. High index of suspicion is needed to diagnose CAH and continued replacement of glucocorticoid and mineralocorticoid is needed to suppress virilization of the female child and prevent further crises.

Key Words: *Congenital adrenal hyperplasia, Ambiguous genitalia, Salt wasting crisis, Glucocorticoid, Fludrocortisone.*

Introduction

Congenital Adrenal Hyperplasia (CAH) comprises a group of autosomal recessive disorders caused by deficient adrenal corticosteroid biosynthesis. It results from defects in one of the steroidogenic enzymes involved in cortisol biosynthesis. Between 90% and 95% of cases of CAH are caused by 21 α-hydroxylase deficiency.[1] Among several distinct clinical varieties of CAH, non-classic form is the most common. In female, salt-wasting form (1 in 20,000 live births) usually presents with sexual ambiguity at birth and develop salt wasting crisis later part in the neonatal period. We report an interesting case of acute adrenal crisis in the neonatal period.

Case Report

A four-and-half-year-old girl attended our endocrine department for the evaluation of sexual ambiguity. Past medical history revealed that the girl was born in a non consanguineous family with an average birth weight without any significant antenatal history. It was a full term, normal vaginal home delivery. Immediate post-natal period was uneventful. Though she had sexual ambiguity at birth, the parents did not seek any medical advice. After third week of age, the baby had developed lethargy, poor feeding, vomiting, decreased cry and activity. On the 31st day of her life, she was admitted in neonatal intensive care unit in a gasping condition. On examination, the baby had features of shock with hypothermia, and altered mental status. Examination of external genitalia revealed enlarged clitoris (clitoral Index-150 mm²), complete labial fusion (Prader stage 3), hyperpigmentation of labio-scrotal folds and urethral meatus just beneath the clitorophalus (Figure 1).

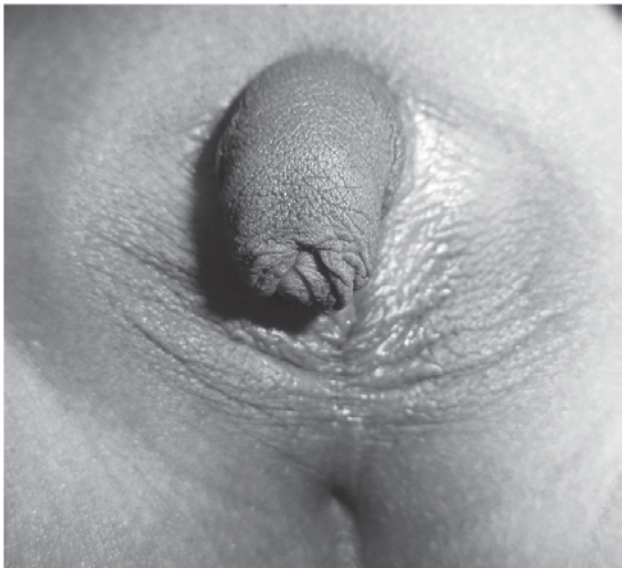

Figure 1: *Showing clitoromegally, fusion of labia causing ambuity in a female child*

There were no signs of sepsis clinically or biochemically. All biochemical reports were normal except hyponatremia [121 meq/L (135-145)], hypokalemia [3.1 meq/L (3.5-4.5)] and hypoglycaemia (62 mg/dl). Serum 17-Hydroxy-Progesterone (17 OH-P) and Dehydroepiandrostenedion - Sulphate (DHEA-S) were high [> 2000 ng/dL (3-8) and 3.9 µg/mL (0.9-1.8) respectively] and undetectable cortisol (<1.0 µg/dl) and elevated adrenocorticotropin hormone (ACTH) [109 pg/mL (9-52)]. Ultrasonography of abdomen showed bilateral enlarged adrenal glands (Figure 2, 3).

1 Chanchal, Das, M.B.B.S (Cal), DCH (Cal), MD (Medicine), Post Doctoral Trainee (Endocrinology)

2 Pranab Kumar Sahana, MD (Medicine), DM (Endocrinology), Associate Professor

3 Nilanjan Sengupta, MD (Medicine), DM (Endocrinology), Associate Professor & Head

4 Mukut Roy, M.B.B.S, MD (Medicine), Post Doctoral Trainee (Endocrinology)

5 Ashish Deshmukh, M.B.B.S, MD (Medicine), Post Doctoral Trainee (Endocrinology)

6 Ranen Dasgupta, MD (Medicine), DM (Endocrinology), Professor & Ex-Head Department of Endocrinology, N.R.S. Medical College & Hospital, Kolkata-700014, West Bengal, India.

Corresponding Author:
Dr. Chanchal Das,
Department of Endocrinology, N.R.S. Medical College & Hospital,
138, A.J.C.Bose Road,
Kolkata-700014, West Bengal, India
Email: drchanchal.das@gmail.com

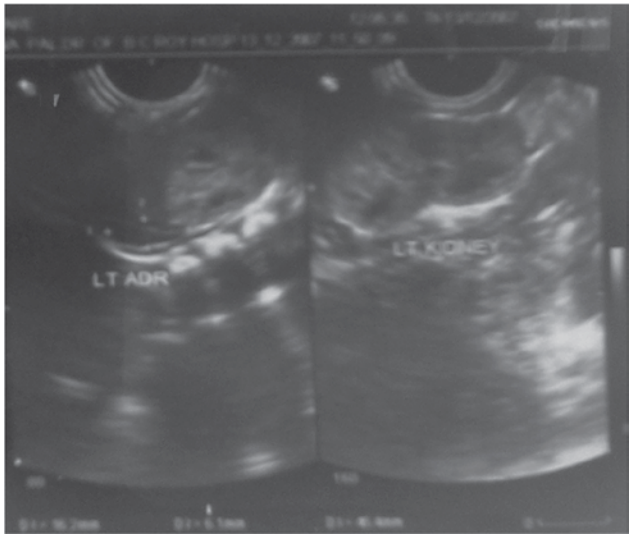

Figure 2: *Ultrasonography of pelvis showing enlarged left adrenal gland (16 mm x 6 mm, age 7 month)*

Presence of Mullerian duct and absence of any Wolfian duct structures (Figure 4). With the classical features of salt wasting, absence of sepsis, female sex and sexual ambiguity at birth, the baby was diagnosed as a case of salt wasting form of CAH (SW-CAH). Sample was sent for Karyotyping which later showed 46, XX.

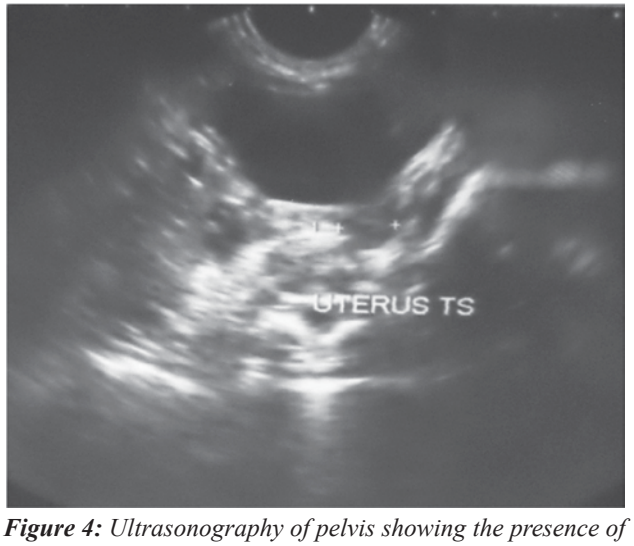

Figure 4: *Ultrasonography of pelvis showing the presence of uterus (age 7 month)*

The girl was resuscitated and given intravenous hydrocortisone and fludrocortisone. Her electrolytes became normal on the 7th day. At present she is being followed up with oral hydrocortisone and fludrocortisone. Her height and weight are 94 cm (<3rd percentile; Ht-SDS: -2.02) and 15 kilograms (>25th but < 50th percentile) respectively. Her blood pressure is normal (72/44 mmHg). She is still having features of virilization in the form of enlarged clitorophalus. Therefore, paediatric surgeon has been consulted for consideration of clitoroplasty and vaginoplasty which would be done very soon.

Discussion

The incidence of CAH due 21-α-hydroxylase deficiency varies from 1 in 10,000 to 1 in 15,000 live births[2], but in isolated communities due to consanguinity it may be much higher (1: 300 in Alaskan Inuit populations). In our case there is no history of consanguinity and negative family history of similar disorder. The condition arises because of defective conversion of 17-α-OHP to 11-deoxycortisol. Reduced cortisol biosynthesis results in reduced negative feedback drive and increased ACTH secretion.[3] Seventy-five percent of patients have clinically manifest mineralocorticoid deficiency because of failure to convert sufficient progesterone to deoxycorticosterone (DOC). We found hyponatremia in our case due to deficiency of mineralocorticoids. Hypokalemia is probably due to vomiting otherwise hyperkalemia would have been present. The enhanced ACTH drive to adrenal androgen secretion in utero leads to virilization of an affected female fetus. Depending on the severity, clitoral enlargement, labial fusion, and development of a urogenital sinus may occur, leading to sexual ambiguity at birth and even inappropriate sex assignment.[4] Neonates commonly present after the first 2 weeks of life with a salt-wasting crisis and hypotension due to exhaustion of serum cortisol derived from mother as the activity of the affected enzyme is zero no cortisol is being synthesized in the baby. Our case also had typical features of virilisation described above and presented in the later part of neonatal period, consistent with the literature.[5] The clinical signs and symptoms of salt wasting include poor feeding, vomiting, failure to thrive, lethargy, and sepsis-like symptoms. This baby also presented with similar types of features. These features may alert the clinician to the diagnosis in a male baby, but the diagnosis is still delayed in many cases, and the condition carries a significant neonatal mortality rate. The overall treatment goal is to replace glucocorticoid and mineralocorticoid, thereby preventing further salt-wasting crises, but also to normalize adrenal androgen secretion so that normal growth and skeletal maturation can proceed[6] and virilisation is prevented.[7]

Conclusion

Salt wasting form of Congenital Adrenal Hyperplasia is an uncommon clinical entity. High index of suspicion is needed to diagnose this condition. Early recognition and prompt treatment with glucocorticoid and mineralocorticoid is essential to save the newborn.

References :

1. White PC, Speiser PW. Congenital adrenal hyperplasia due to 21-hydroxylase deficiency. *Endocr Rev*. 2000; 21:245-291.
2. Paul MS, Nils PK. Adrenal cortex. Williums text book of endocrinology 12th Ed. S. Melmed et. al., (Saunders 2011): 482-580.
3. Merke DP, Bornstein SR. Congenital adrenal hyperplasia. *Lancet*. 2005; 365:2125-2136.
4. Rocha RO, Billerbeck AE, Pinto EM, et al. The degree of external genitalia virilization in girls with 21-hydroxylase deficiency appears to be influenced by the CAG repeats in the androgen receptor gene. *Clin Endocrinol (Oxf)*. 2008; 68:226-232.
5. Joint LWPES/ESPE CAH Working Group. Consensus statement on 21-hydroxylase deficiency from the Lawson Wilkins Pediatric Endocrine Society and the European Society for Paediatric Endocrinology. *J Clin Endocrinol Metab*. 2002; 87:4048-4053.
6. Eugster EA, Dimeglio LA, Wright JC, et al. Height outcome in congenital adrenal hyperplasia caused by 21-hydroxylase deficiency: a metaanalysis. *J Pediatr*. 2001; 138:26-32.
7. Hindmarsh PC. Management of the child with congenital adrenal hyperplasia. *Best Pract Res Clin Endocrinol Metab*. 2009; 23: 193-208.

Bangladesh Crit Care J March 2014; 2 (1): 40-41

Case Report

Star Fruit Intoxication in Chronic Kidney Disease: Our Experience

Farzana Shumy[1], Mohiuddin Ahmed[2], Ahmad Mursel Anam[3], M Mufizul Islam Polash[4], M Motiul Islam[5], Shahazadi Sayeeda Tun Nessa[6]

Summary

We report a case, where a patient of chronic kidney disease developed hiccups and alteration of consciousness after consuming star fruit. Prompt recognition of his features lead to commencement of hemodialysis, and that saved his life.

Key Words: *Star fruit, Uremia, Renal replacement therapy*

Case Report

A 46-year-old man with diabetes, hypertension and chronic kidney disease (CKD) without need of dialysis therapy presented to the emergency department of a hospital with persistent hiccups and vomiting for 3 days and disorientation since the morning of the day of admission. On that day, he was drowsy (Glasgow Coma Scale $E_4V_4M_5$) His blood pressure was high (180/100 mmHg) with a heart rate 102beats/min and he was afebrile. His physical examination revealed no neck stiffness, normal tendon reflexes and bilateral withdrawal plantar response. Other system examination was unremarkable. His consciousness state was deteriorated to $E_3V_2M_5$ on GCS and he was shifted to ICU of another hospital for better management. At that time his pupil was constricted but reacting to light. His spo_2 was 100% on room air, Blood sugar 15 mmol/L without detectable urinary ketone bodies. His blood urea and creatinine was 35 and 4.6 mg/dl respectively. There was no major electrolyte disturbance. His total white cell count including platelet and haemoglobin was within normal limit. cardiac enzyme level, liver function test and blood ammonia level was also normal. Brain MRI revealed multiple T_1 hypo, T_2 and FLAIR hyperintense foci are seen in subcortical and periventricular white matter of both cerebral hemispheres (Fig 1), more remarkable at left. No restricted diffusion is noted in DW_1. A small focal area of restricted diffusion is noted in left posterior parietal lobe which is mild hyperintense in T_2 and FLAIR image.

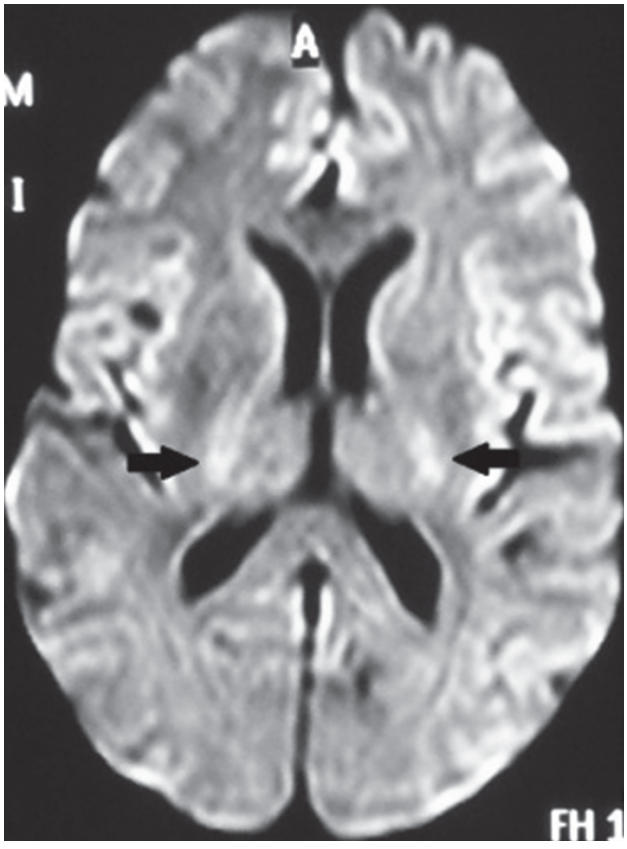

Fig 1: *MRI brain FLAIR showing hyperintense foci in subcortical and periventricular (arrows) white matter of both cerebral hemispheres.*

Reviewing his history, his spouse sated that he had ingested 17 star fruits 6 hours before his symptom started. On the first day in ICU he underwent for haemodialysis with the suspicion of star fruit intoxication and after two 4 hour session of dialysis he regained his consciousness and discharged smoothly without need of maintenance haemodialysis.

1. Farzana Shumy, MBBS, FCPS (Medicine), Medical Officer, Department of Internal Medicine, BSMMU, Dhaka, Bangladesh.
2. Mohiuddin Ahmed, MBBS, FCPS (Medicine), Assistant Professor, Department of Medicine, Enam Medical College, Savar, Bangladesh.
3. Ahmad Mursel Anam, MBBS, Chief Resident, ICU, Square Hospitals Ltd, Dhaka, Bangladesh.
4. M Mufizul Islam Polash, MBBS, Clinical Staff, ICU, Square Hospitals Ltd, Dhaka, Bangladesh.
5. M Motiul Islam, MBBS, Clinical Staff, ICU, Square Hospitals Ltd, Dhaka, Bangladesh.
6. Shahazadi Sayeeda Tun Nessa, Clinical Staff, ICU, Square Hospitals Ltd, Dhaka, Bangladesh.

Corresponding Author:

Dr. Farzana Shumy, MBBS, FCPS (Medicine), Medical Officer, Department of Internal Medicine, BSMMU, Dhaka, Bangladesh. Email: farzanashumy@hotmail.com

Discussion

Star fruit, which is very popular in tropical countries, belongs to Oxalidaceae family.[1] Although the exact neurotoxin remains unknown, oxalate, which is abundant in this fruit, is a possible cause of neurotoxicity.[2]

The neurotoxic effect of star fruit ranges from mild to severe, include hiccups, vomiting, insomnia, psychomotor agitation, numbness, paraesthesia, mental confusion, coma, seizure, and hemodynamic instability resulting in mortality.[2,3] The velocity of progression of symptom varies in different patient. Some manifest only with hiccups and others may develop seizure. These variations depend on individual biological response, the amount of toxin content in each fruit and the detoxification, excretion, or both, of this toxin from bloodstream and also on various star fruit subspecies. Some patient with mild intoxication may recover spontaneously. But others without proper treatment mild intoxication may become more severe.[2] This condition is uncommon in patient with normal renal function. Only two cases of oxalate nephropathy were reported in patient with normal renal function. [3,4]

Initially it is observed that only haemodialysis improves this symptom by removing Unknown neurotoxin. Patient presenting with severe intoxication who are not treated, that are treated by peritoneal method, or by late haemodialysis, will die with most of them in status epilepticus.[1] In several studies and case reports, it is found that haemoperfusion is superior to haemodialysis in removing star fruit toxin. Although chemical nature of neurotoxin largely unknown, it is believed that it has moderate volume of distribution and is not firmly bound to tissue. This neurotoxin can be redistributed in different body compartment after dialytic therapy, causing recurrence of symptom shortly after cessation of dialysis. These properties explain the superiority of haemoperfusion over haemodialysis and haemoperfusion also remove middle molecules from blood more efficientlyshould keep in mind about star fruit intoxication if patient of chronic kidney disease developed hiccups, unexplained change in consciousness or seizure after excluding other important causes. Because, this condition is fatal and patient may lose his valuable life.

References

1. Chang CT, Chen YC, Fang JT, Huang CC. Star Fruit (*Averrhoa carambola*) Intoxication: An Important Cause of Consciousness Disturbance in Patient with Renal Failure. *Ren Fail* 2002;24:379-382.
2. Chen LL, Fang JT, Lin JL. Chronic Renal Disease Patients with Severe Star Fruit Poisoning: Hemoperfusion May be an Effective Alternative Therapy. *Clin toxicol (Phila)* 2005;43:197-1
3. Chan CK, Li R, Shum HP, Lo SH, Chan KK, Wong KS, Tsoi TH, Yan WW. Star fruit intoxication successfully treated by charcoal haemoperfusion and intensive haemofiltration. *Hong Kong Med J* 2009;15:149-152.
4. Wu MY, Wu IW, Wu SS, Lin JL. Hemoperfusion as an effective alternative therapy for star fruit intoxication: a report of 2 cases. *Am J Kidney Dis* 2007;49:e1-e5.

Bangladesh Crit Care J March 2014; 2 (1): 42-43

Case Report

Sclerosing Encapsulating Peritonitis

Sharmistha Roy[1], Tapash Kumar Maitra[2], Samiron Kumar Mondal[3]

Abstract:

Sclerosing Encapsulating Peritonotis (SEP) or Abdominal Cocoon is a rare condition characterized by total or partial encasement of the small bowel by a fibrocollagenous cocoon like sac. It was first described and named by Foo et al[1] in 1978. Here we present a case of SEP or cocoon in a young girl with typical radiological and per operative finding.

Key Words: *Sclerosing Encapsulating Peritonitis, Peritoneal Cocoon, Peritonitis.*

Introduction: SEP has been classified as primary and secondary, based on whether it is idiopathic or has a definite cause. According to some Only the Idiopathic form is called Abdominal cocoon[2]. The condition may present as acute intestinal obstruction or a sub acute intestinal obstruction[3]. In our case she had features of sub acute intestinal obstruction, like- episodes of colicky abdominal pain over a period of 2 years associated with visible peristalsis, which became evident during the episodes of pain.

Our Case: Miss Parul a 16 year girl presented with complains of Occasional right lower abdominal pain for last 2 years, and appearance of a vague lump in right lower abdomen for same duration. Her pain was colicky in nature, appearing at right iliac fossa, then spread to the whole abdomen. Pain was precipitated by heavy meal. During the episodes of pain she noticed a swelling in the lower abdomen, which did not increase in size in last 2 years.

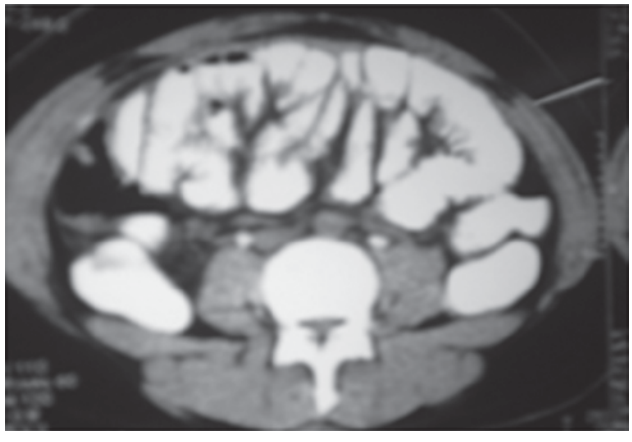

Figure 1: *CT scan of Abdomen showing small gut loops closely packed in a capsule.*

1. Sharmithsa Roy, Assistant Professor, Department Of Surgery, BIRDEM Hospital, Dhaka
2. Tapash Kumar Maitra, Associate Professor, Department of Surgery, BIRDEM.
3. Samiron Kumar Mondal, Associate Professor, Department of Surgery, BIRDEM.

Corresponding Author:
Sharmistha Roy
Assistant Professor of Surgery
BIRDEM General Hospital
E-mail: sprmista@yahoo.com

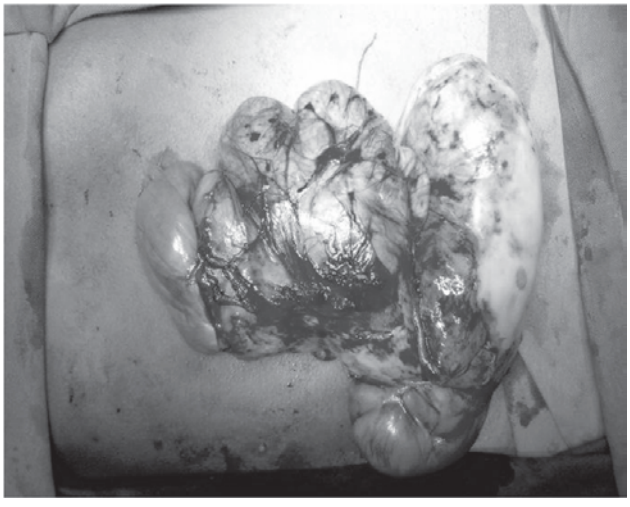

Figure 2: *Encapsulated small gut loops at Laparotomy.*

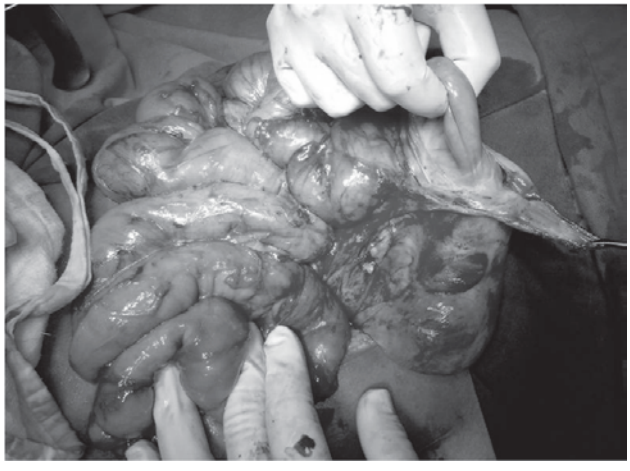

Figure 3: *Adhesiolysis in progress.*

She also complained of diahorrea during her pain. Pain was relieved by taking intravenous antispasmodic. There is no history of vomiting, fever, burning micturition, cough, altered bowel habit, malena, or significant weight loss. Her menarche occurred 3 years back, and her menstruation was regular. With these complains she took consultation from multiple physicians and was diagnosed as a case of acute appendicitis. She underwent Laparotomy but operating surgeons saw a large whitish mass in the abdomen, so they postponed the surgery and referred her to Dhaka. In our hospital on general

examination her vitals were stable and other findings were normal. On abdominal examination she had no palpable lump, no organomegally, no tenderness except at the site of scar of previous surgery one month back.

Investigations: CBC showed TC-9000/cumm, and no evidence of nutrophilia, Serum Creatinine, liver enzymes, electrolytes, pancreatic enzymes were normal. ECG and CXR were normal. Several ultrasonogram was done showing bulky Uterus but otherwise normal finding. There were no adenexal mass, or any other abdominal lump. Contrast CT of whole abdomen was done showing closely packed small gut loops within a thick fibrous capsule, and increased transit time of the dye.

Treatment: Initially we did diagnostic laparoscopy. A large whitish encapsulated mass was seen, so we opened the abdomen with midline incision. The major portion of jejunum(except 20 cm from DJ) and whole of the ileum was found encased within a fibrous sheath, which was calcified at places. Careful stripping of the gut from the fibrous capsule was done. Appendisectomy was done. Part of capsule, mesenteric lymphnode and appendix sent for Histopathology.

Histopathology: No granuloma or malignancy was seen in the lymph node and fibrous capsule, there was only hyalinized fibrocollagenous tissue. Appendix showed lymphoid hyperplasia, that is normal considering her age.

Her post operative period was uneventful. She was discharged on 10th post operative day, with an advice to follow up. She is doing fine now after 11 months.

Discussion: Although several hypotheses have been proposed, the etiology of the primary form remains uncertain. The abdominal cocoon has been classically described in young adolescent females from the tropical and subtropical countries[1]. To explain the etiology, a number of hypotheses have been proposed. These include retrograde menstruation with a superimposed viral infection, retrograde peritonitis and cell-mediated immunological tissue damage incited by gynecological infection[4]. However, since this condition has also been seen to affect males[5], premenopausal females and children, there seems to be little support for these theories.

Secondary causes have included placement of Le veen shunts, continuous ambulatory peritoneal dialysis, systemic lupus erythematosus, tuberculosis, use of povidone iodine washout and beta adrenergic blockers[1].

Clinical fetures: Patients usually present with acute intestinal obstruction in surgical emergency. Abdominal pain, distention, vomiting are common features. Perforation of gut may also occur and patient may have features of peritonitis. In our case patient did not develop acute intestinal obstruction, instead she was quite symptomless in between episodes of lower abdominal colicky pain when she noticed a vague swelling arising in her lower abdomen.

Diagnosis: Diagnosis of abdominal cocoon is most commonly done at laparotomy[6], as patient presents as a surgical emergency. But typical radiological features can help preoperative diagnosis if they are looked for properly, along with a high index of clinical suspicion. Barium follow through X ray may show small gut loops packed closely in a concertina like fashion, and a increased passage time of contrast[7]. CT scan of abdomen also shows tightly packed small gut loops, and a whitish fibrous sheath may also be seen in many cases as in ours, around the closely arranged small gut loops. Diagnosis is often done at laparotomy and per operative findings is pretty obvious. A fibrous sheath is seen packing the whole or part of small gut loops. Less commonly stomach , large gut may also be involved[8].

Treatment: There are two main surgical options, one is adhesiolysis by striping the fibrous capsule off the gut, and another is resection of affected portion of gut followed by anastomosis[6]. The success of surgery in this disease is determined by the technique used. The correct technique consists of freeing the adhesions and extirpating of the capsule as far as possible. Perforation, as well as resection and intestinal anastomosis, significantly increase mortality.

Prognosis: In case of secondary SEP with adequate surgery and alleviation of underlying cause, prognosis is good[1]. In case of primary SEP recurrence may occur, so follow up is necessary.

Conclusion: Though abdominal cocoon is a rare cause of intestinal obstruction, but more and more cases are being reported . This will help to improve knowledge about the condition and its clinical and radiological features, and thus more cases will be diagnosed preoperatively. As the idiopathic variety more commonly affects young adolescent girls[4], and chance of recurrence is more in Idiopathic form so there should be a protocol as to for how long this cases should be followed up.

Reference :

1. Foo KT, Ng KC, Rauff A, Foong WC, Sinmah R. Unusual small intestinal obstruction in adolescent girls: The abdominal cocoon. Br J Surg 1978;65:427-30
2. Mohanty D, Jain BK, Agrawal J, Gupta A, Agrawal V. Abdominal cocoon: clinical presentation, diagnosis, and management. J Gastrointest Surg. 2009;13:1160–62.
3. Xu P, Chen LH, Li YM. Idiopathic sclerosing encapsulating peritonitis (or abdominal cocoon): a report of 5 cases. World J Gastroenterol. 2007;13:3649–51.
4. Cleffken B, Sie G, Riedl R, Heineman E. Idiopathic sclerosing encapsulating peritonitis in a young female-diagnosis of abdominal cocoon. J Pediatr Surg. 2008;43:27–30.
5. Masuda C, Fujii Y, Kamiya T, Miyamoto M, Nakahara K, Hattori S, Ohshita H, Yokoyama T, Yoshida H, Tsutsumi Y. Idiopathic sclerosing peritonitis in a man. Intern Med. 1993;32:552–55.
6. Célicout B, Levard H, Hay J, Msika S, Fingerhut A, Pelissier E. Sclerosing encapsulating peritonitis: early and late results of surgical management in 32 cases. French Associations for Surgical Research. Dig Surg. 1998;15:697 702.
7. Slim R, Tohme C, Yaghi C, Honein K, Sayegh R. Sclerosing encapsulating peritonitis: a diagnostic dilemma. J Am Coll Surg. 2005;200:974–75.
8. Wei B, Wei HB, Guo WP, Zheng ZH, Huang Y, Hu BG, Huang JL. Diagnosis and treatment of abdominal cocoon: a report of 24 cases. Am J Surg. 2009;198:348–353.

Bangladesh Crit Care J March 2014; 2 (1): 44-45

Case Report

Prolonged QTc: "Mind the Gap"

Ahmad Mursel Anam[1], Raihan Rabbani[2], Farzana Shumy[3], M Mufizul Islam Polash[4], M Motiul Islam[5], ARM Nooruzzaman[6], Mirza Nazim Uddin[7]

Abstract

We report a case of drug induced torsades de pointes, following acquired long QT syndrome. The patient got admitted for shock with acute abdomen. The initial prolonged QT-interval was missed, and a torsadogenic drug was introduced post-operatively. Patient developed torsades de pointes followed by cardiac arrest. She was managed well and discharged without complications. The clinical manifestations of long QT syndromes, syncope or cardiac arrest, result from torsades de pointes. As syncope or cardiac arrest have more common differential diagnoses, even the symptomatic long QT syndrome are commonly missed or misdiagnosed. In acquired long QT syndrome with no prior suggestive feature, it is not impossible to miss the prolonged QT-interval on the ECG tracing. We share our experience so that the clinicians, especially the junior doctors, will be more alert on checking the QT-interval even in asymptomatic patients.

Key Words: *QT-interval, Long QT Syndromes, Torsades de Pointes.*

Case Summary

In May 2012, an 18-year-old lady, with no significant past medical history, got admitted in our ICU with shock and acute abdomen, due to perforation of the gut. All her initial haematological and biochemical results were normal, other than hyponatraemia (133 mmol/L), hypokalaemia (3·3 mmol/L), and raised C-Reactive Protein (404·5 mg/L). No apparent abnormality was noticed on the 12-lead-ECG tracing [Fig.1].

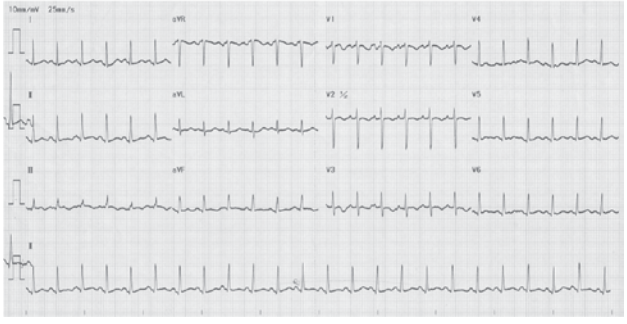

Fig. 1: *12-lead-ECG tracing on admission*

1. Ahmad Mursel Anam, MBBS, Chief Resident, ICU. Square Hospitals Ltd. 18/F, BU Qazi Nuruzzaman Sarak, Dhaka 1205, Bangladesh.
2. Raihan Rabbani, FCPS (Medicine), MD(USA), Associate Consultant, ICU & Internal Medicine. Square Hospitals Ltd. 18/F, BU Qazi Nuruzzaman Sarak, Dhaka 1205, Bangladesh.
3. Farzana Shumy, FCPS (Medicine), Medical Officer, Dept. of Internal Medicine. BSM Medical University, Shahbagh, Dhaka 1000, Bangladesh.
4. M Mufizul Islam Polash, MBBS, Clinical Staff, ICU. Square Hospitals Ltd., 18/F, BU Qazi Nuruzzaman Sarak, Dhaka 1205, Bangladesh.
5. M Motiul Islam, MBBS, Clinical Staff, ICU., Square Hospitals Ltd., 18/F, BU Qazi Nuruzzaman Sarak, Dhaka 1205, Bangladesh.
6. ARM Nooruzzaman, MRCP (UK), Consultant, ICU & Internal Medicine., Square Hospitals Ltd., 18/F, BU Qazi Nuruzzaman Sarak, Dhaka 1205, Bangladesh.
7. Mirza Nazim Uddin, MRCP (UK), Consultant, ICU & Internal Medicine., Square Hospitals Ltd., 18/F, BU Qazi Nuruzzaman Sarak, Dhaka 1205, Bangladesh.

Corresponding Author :
Ahmad Mursel Anam, MBBS, Chief Resident, ICU., Square Hospitals Ltd., 18/F, BU Qazi Nuruzzaman Sarak, Dhaka 1205, Bangladesh.
E-mail: murselanam@gmail.com

After haemodynamic stabilization, she underwent emergency laparotomy. Jejunostomy and peritoneal toileting was done. She was returned to the ICU for management of hypotension, which was managed accordingly. Post-operatively, excessive secretion from gut started to flow through the jejunostomy. To control the secretion, intravenous infusion of Octreotide was advised.

About 24-hours after the infusion started, she suddenly developed hypotension and lost consciousness. Cardiac monitor and rhythm strip tracings showed typical short-long-short ventricular cycle, followed by torsades de pointes (TdP) [Fig.2].

Intravenous magnesium-sulphate was infused and rhythm became sinus. A few minutes later, she again developed TdP, and had a witnessed cardiac arrest, immediately managed with advanced cardiac life support protocol, including DC-cardio-version. Her rhythm became sinus.

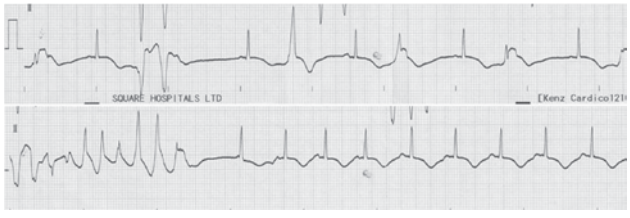

Fig. 2 : *Rhythm strip tracing, showing typical short-long-short ventricular cycle, with premature ventricular contraction (PVC), post-ectopic pause, and abnormal T-wave, leading to classical "twisting of a point" of cardiac axis (torsades de pointes), followed by sinus rhythm after intervention.*

To identify the cause of the TdP, all her clinical and laboratory findings were re-evaluated, and the corrected QT-interval (QTc) in the first EGC-tracing was found to be 0·536 sec. After checking all possibilities, consensus was reached that, she had acquired Long QT syndrome due to hypokalaemia, which provoked development of TdP after administration of octreotide. The drug was discontinued. Her further stay in hospital and recovery were uneventful. She was discharged in stable condition, with a normal QTc on her ECG. On her follow-up two months later, she was found well and without any complaint.

Discussion

The QT-interval needs to be corrected (QTc) for heart rate. QTc is calculated by dividing the QT-interval (measured from the beginning of the QRS-complex to the end of the T-wave, usually in the rhythm strip) by square-root of RR-interval (QTc=QT/√RR). QTc >0·450 sec. in men and >0·470 sec. in women are considered abnormal.[1] The clinical manifestations of Long QT syndromes (LQTS), syncope or cardiac arrest, result from TdP, a distinctive polymorphic ventricular tachyarrhythmia, triggered by the early after-depolarisations. LQTS result from malfunction of ion-channels at the myocardial cell membranes that delays ventricular repolarisation and causes early after-depolarisations.[2]

LQTS are either inherited or acquired. Acquired LQTS also have some genetic predisposition and silent gene carriers are also not uncommon. Known causes for acquired LQTS are drugs, dyselectrolytaemias (hypokalaemia, hypomagnesaemia, and hypocalcaemia), bradyarrhythmias (complete atrioventricular block or any bradyarrhythmia, even transient), starvation (anorexia nervosa, "liquid protein" diets), anorexia nervosa, coeliac disease, gastro-intestinal surgery, nervous system injury (subarachnoid haemorrhage, thalamic haematoma, right neck dissection or haematoma, pheochromocytoma) and many others.[2] The continuously expanding list of drugs that may cause prolongation of QT-interval and trigger TdP includes antibiotics (erythromycin, clarithromycin, clindamycin, trimethoprim-sulphamethoxazole, ketoconazole), antiarrhythmics class IA (Quinidine, disopyramide, procainamide) & class III (sotalol, amiodarone), antihistamins (terfenadine, astemizole), antipsychotics (phenothiazines, haloperidol), antidepressants (tetra/tricyclic), cytotoxics, and many others, including hormones like octreotide.[1-4]

Risk factors for developing TdP with torsadogenic agents are female gender, hypokalaemia, hypomagnesaemia, diuretics, bradycardia, cardiac failure, hypertrophic cardiomyopathy, congenital LQTS, baseline ECG with prolonged QTc, and post-exposure QTc prolongation.[2] QTc is the best predictor for development of TdP, >0·500 sec is associated with increased risk.[1,3]

"Torsade de pointes" (twisting of the points) denotes a distinctive polymorphic ventricular tachycardia, with QRS complexes of changing amplitude that appear to "twist" around the isoelectric line. Almost all arrhythmias caused by acquired LQTS or congenital LQTS (especially in adults), are preceded by pauses, usually due to sinus arrhythmia or sinus arrest, more commonly "post-extrasystolic pauses".[2,4] Typical short-long-short initiating ventricular cycle, pause dependent QT prolongation, and abnormal TU wave leading to the classical "twisting of a point" of the cardiac axis are seen on the ECG tracing.[4] However, this "twisting" morphology may not be apparent when only short bursts occur or when only single-lead recordings of the arrhythmia are available. Even the symptomatic LQTS are commonly missed or misdiagnosed, as syncope or cardiac arrest have more common differential diagnoses.[5] In acquired LQTS with no prior suggestive feature, it is not impossible to miss the prolonged QTc on the ECG tracing. The diagnosis of TdP should be considered whenever ventricular tachycardia seems to be "pause-dependent".[2]

In clinical practice, adverse effects of torsadogenic agents can be prevented by not exceeding the recommended dose, avoiding use in patients with pre-existing heart disease or risk factors, previous ventricular arrhythmias, and/or electrolyte imbalance (eg. Hypokalaemia). Concomitant administration of drugs that inhibit the cytochrome P450 (for example, imidazole antifungals, macrolide antibiotics) or those that can prolong the QT interval or drugs that cause electrolyte disturbance should be avoided. The serum potassium concentration should be checked, especially when the patient is on potassium wasting diuretics. Furthermore, it is a sound clinical practice to perform ECGs routinely before and after an initiation or increment of dosage of a drug that may prolong the QT interval. If the patient develops TdP, the offending drug should be stopped and electrolyte abnormalities corrected.[4]

Conclusion

Although no harm was done eventually, the incidence could have easily been avoided. This case has taught us a lesson. A little more attention towards ECG-tracings and more cautious selection of drugs have improved our continued effort to prevent such unwanted events. We share our experience so that the clinicians, especially the junior doctors, will be more alert on checking the QTc even in asymptomatic patients, and will remember to "mind the gap".

References

1. Letsas KP, Efremidis M, Filippatos GS, Sideris AM. Drug-Induced Long QT Syndrome. *Hellenic J Cardiol* 2007;48:296-299.
2. Viskin S. Long QT Syndromes and Torsades de Pointes. *Lancet* 1999;354:1625-1633.
3. Fermini B, Fossa AA. The Impact of Drug-Induced QT Interval Prolongation on Drug Discovery and Development. *Nat Rev Drug Discov* 2003;2:439-447.
4. Yap YG, Camm AJ. Drug induced QT prolongation and torsades de pointes. *Heart*. 2003;89:1363-72.
5. Abrams DJ, Perkin MA, Skinner JR. Long QT Syndrome. *BMJ* 2010;340:b4815.

Bangladesh Crit Care J March 2014; 2 (1): 46-47

Case Report

An Unusual Presentation of Type 2 Diabetes Mellitus

Mukut Roy[1], Pranab Kumar Sahana[2], Nilanjan Sengupta[3], Chanchal Das[4], Prashant Somani[5], Ranen Dasgupta[6]

Abstract:

In this part of world, the mode of presentation of type 2 diabetes is enormously varied and infections may be the first presenting feature of previously unknown diabetes. In this case, we report an initial way of presentation of type 2 diabetes mellitus as emphysematous pyelonephritis. He was treated successfully by antibiotics and percutaneous drainage. Emphysematous pyelonephritis is a rare life-threatening gas-producing, necrotizing infection of the renal parenchyma and surrounding areas which can be focal or diffuse and may spread to the collecting system or perinephric tissues. It is rapidly progressive and fatal if untreated. Prompt recognition and aggressive treatment helps in complete recovery of patients.

Key words: *Diabetes mellitus, Emphysematous pyelonephritis, Percutaneous drainage, Nephrectomy.*

Introduction:

Emphysematous pyelonephritis (EPN) is a life-threatening, necrotizing infection of renal parenchyma and peri-renal tissues caused by gas-forming organisms.[1] It predominantly affects female diabetics.[1,2] Though, this entity remains a distinctive complication of diabetes mellitus patients, case reports of EPN as initial way of presentation of diabetes mellitus is rare. Here, we report an interesting mode of presentation of type 2 diabetes mellitus as EPN.

Case Report:

A 60 year old gentleman presented with fever, right flank pain and vomiting since last 5 days. He did not contribute other significant present, past or personal history. On admission, he was toxic and confused. Examination revealed body temperature of 39°C, pulse rate of 112/min, respiratory rate of 32/min and blood pressure of 80/50 mmHg. He had severe tenderness and a bimanually palpable mass in the right lumbar region. No costovertebral angle tenderness or flank crepitus was noted. His random plasma glucose was 574 mg/dl. On complete hemogram, there was leukocytosis [Total count (TC): 20,900/mm^3] (ref. range: 4000-11000) with neutrophilia and toxic granules in the blood film. Serum urea: 42 mg/dl (ref. range: 7- 20) and creatinine: 1.6 mg/dl (ref. range: 0.6 – 1.2 mg/dL in males) were respectively.

1 Mukut Roy, M.B.B.S, MD (Medicine), Post Doctoral Trainee (Endocrinology)

2 Pranab Kumar Sahana, MD (Medicine), DM (Endocrinology), Associate Professor

3 Chanchal, Das, M.B.B.S (Cal), DCH (Cal), MD (Medicine), Post Doctoral Trainee (Endocrinology)

4 Nilanjan Sengupta, MD (Medicine), DM (Endocrinology), Associate Professor & Head

5 Prashant Somani, M.B.B.S, MD (Medicine), Post Doctoral Trainee (Endocrinology)

6 Ranen Dasgupta, MD (Medicine), DM (Endocrinology), Professor & Ex-Head Department of Endocrinology, N.R.S. Medical College & Hospital, Kolkata-700014, West Bengal, India.

Corresponding Author:
Mukut Roy
Department of Endocrinology,
Nilratan Sircar Medical College, Kolkata,
West Bengal, India,
Email: mukutdoc@gmail.com

Electrolytes values were: serum sodium: 134 meq/l (ref. range: 136-146) and potassium: 3.9 meq/l (ref. range: 3.5-5). Urine for ketone bodies was negative. After transferring the patient to intensive care unit, he was managed with volume repletion, insulin infusion and supportive conservative measures along with central venous pressure (CVP) monitoring. Empirically intravenous piperacillin-tazobactam and linezolid were initiated.

Next day, fasting plasma glucose (FPG) was 286 mg/dl (ref. range:<100) and ultrasound (USG) abdomen revealed an enlarged right kidney. On the 3rd day, computed tomography (CT) scan abdomen (Fig.1) confirmed multiple air pockets in the right renal parenchyma and extension to perinephric space with heterogeneous contrast enhancement.

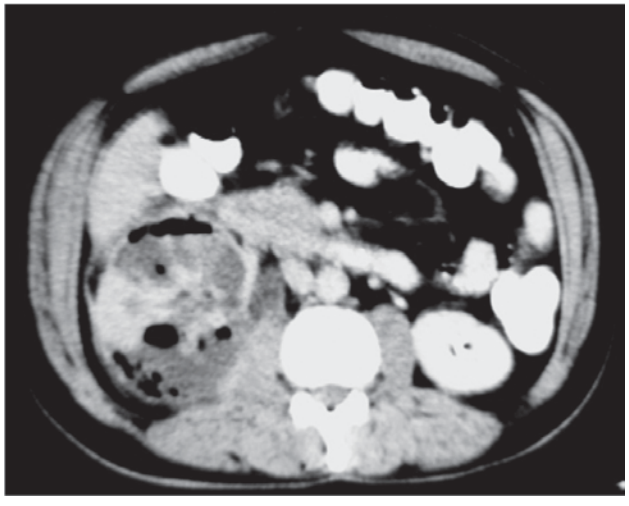

Fig. 1 : *CT abdomen with contrast showing evidence of pyelonephritis involving right kidney with enlargement, multiple air pockets and heterogeneous contrast enhancement.*

On this basis, percutaneous drainage (PCD) of approximately 200 ml of pus was performed, in two sittings, on the third & fifth day. His urine culture and sensitivity (C/S) picked up growth of *Escherichia coli* (>10^5 CFU/ml of urine); sensitive to imipenem-cilastatin and full dose was commenced (1gm i.v thrice daily). Glycated hemoglobin (HbA_{1c}) was 11.2% (ref. range: <6.5). As he started taking orally, insulin infusion was changed to subcutaneous (s.c.) basal-bolus insulin regimen which he tolerated well.

On 14th Day, he was hemodynamically stable and his abdominal mass was not palpable. TC was 10,600/mm³ with creatinine: 1.2 mg/dl. FPG was 116mg/dl with post-prandial plasma glucose (PPPG) of 170mg/dl (ref. range: <140). He was receiving regular insulin s.c. 6-6-4 units before each meal and neutral protamine hagedron (NPH) Insulin s.c 6 units at bedtime. Imipenem-cilastatin was continued till 21st day. On 22nd day, he was asymptomatic, afebrile with BP of 130/80mmHg. Repeat investigations revealed TC: 6,400/mm³, creatinine: 0.7 mg/dl, FPG: 98mg/dl and PPPG: 152mg/dl. Basal bolus regimen was changed to glimepiride 1mg and metformin 500mg. He was discharged and advised to follow up after 7 days with repeat CT abdomen report.

On follow up, on the 30th day, in endocrine outpatient department, he was asymptomatic.

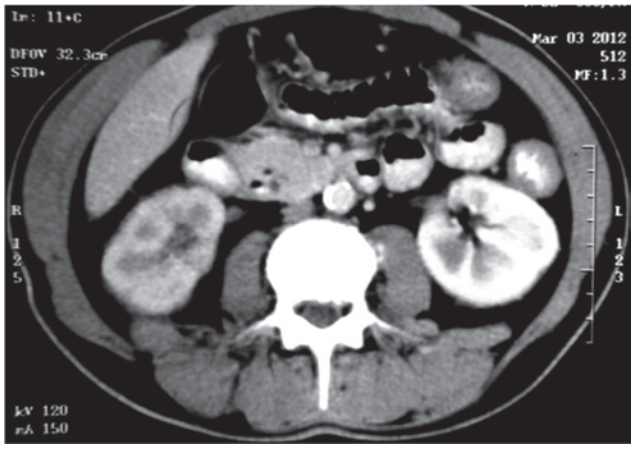

Fig. 2 : *CT abdomen (on 30th day) showing improved findings of the right kidney.*

His FPG was 92mg% with PPPG of 148mg%. His repeat urine C/S was sterile. Follow up CT abdomen (Fig.2) also showed improved findings.

Discussion:

Emphysematous pyelonephritis (EPN) is an uncommon, life-threatening suppurative infection of the renal parenchyma and surrounding areas leading to gas formation in the collecting tubules, renal parenchyma or perinephric tissues.[1] More than 90% of cases of EPN occur in patients with diabetes.[2,3,4] EPN also may occur in immunocompromised patients, alcoholic individuals, ureteral obstruction, urinary tract infection and hydronephrosis.[1] This is thought to be due to high levels of glucose in the tissues of diabetic patients which certain bacteria use for aerobic and anaerobic metabolism; decreased tissue perfusion and defective immune response.[2,5] Most infections are due to *Escherichia coli* (approximately 70%), *Klebsiella pneumoniae* (29%), *Proteus*, *Streptococci* or mixed organisms (10%).[2,5] For indefinite explanations, the left kidney involved more frequently than the right (67% vs. 25%).[2] In our case, we found EPN involving the right kidney only.

Presentations of EPN consists of fever, pyuria and flank or back pain usually; however, nausea, vomiting, shock and crepitus overlying the affected kidney are also common signs and symptoms. Younger patients with EPN have symptoms of acute pyelonephritis, whereas older patients may appear less critically ill.[1,2] Pontin et al reviewed 22 diabetic patients with EPN and found most of them had poor control of their diabetes in which 16 of them presented with ketoacidosis.[6] Our patient presented with fever, vomiting, right flank pain and a bimanually palpable mass in the right lumbar region but without any previous history of diabetes mellitus or any evidence of ketoacidosis. Subsequently, he was diagnosed as diabetes mellitus and managed accordingly.

The prognosis depends on the underlying disease, clinical status and treatment modalities.[2] CT has played an important role in improving EPN outcomes due to earlier diagnosis. CT scan is highly sensitive and specific for detecting air in the renal tract and clear depiction of renal and perirenal anatomy.[7] Based on CT, EPN can be classified into four classes; Class-1: Gas in the collecting system only; Class-2: Gas in the renal parenchyma without extension into the extra renal space; Class-3a: Extension of gas/abscess to perinephric space; Class-3b: Extension of gas/abscess into pararenal space; and Class-4: Bilateral EPN or solitary kidney with EPN.[2] Class-1 and 2 EPN are usually managed with antibiotics with or without PCD. Class-3 and 4 are usually managed surgically.[2] Our patient although presented as class 3 EPN but considering all the factors, a trial of PCD with antibiotic therapy was given which he tolerated well. Also, Chen MT et al established that PCD was a suitable means of treating EPN, including patients who were too ill to undergo nephrectomy.[8]

To conclude, emphysematous pyelonephritis, though unusual, could be an initial presentation of type 2 diabetes mellitus patients. Therefore, prompt recognition and appropriate treatment are needed to improve clinical outcome of this unusual and grave amalgamation.

References:

1. Michaeli J, Mogle P, Perlberg S et al. Emphysematous Pyelonephritis. *J Urol* 1984; 131: 203–208.
2. Huang JJ, Tseng CC. Emphysematous Pyelonephritis: Clinicoradiological Classification, Management, Prognosis and Pathogenesis. *Arch Intern Med* 2000; 160:797–805.
3. Smitherman KO, Peacock JE Jr. Infectious Emergencies in Patients with Diabetes Mellitus. *Med Clin North Am* 1995;79:53–77.
4. Cook DJ, Achong MR, Dobranowski J. Emphysematous Pyelonephritis: Complicated Urinary Tract Infection in Diabetes. *Diabetes Care* 1989;12: 229–232.
5. Huang JJ, Chen KW, Ruaan MK. Mixed Acid Fermentation of Glucose as a Mechanism of Emphysematous Urinary Tract Infection. *J Urol* 1991;146:148–151.
6. Pontin AR, Barnes RD, Joffe J, Kahn D. Emphysematous Pyelonephritis in Diabetic Patients. *Br J Urol* 1995;75(1):71-74.
7. Craig WD, Wagner BJ, Travis MD. Pyelonephritis: Radiologic-Pathologic Review. *Radiographics* 2008;28:255-277.
8. Chen MT, Huang CN, Chou YH et al. Percutaneous Drainage in the Treatment of Emphysematous Pyelonephritis: 10-year Experience. *J Urol* 1997; 157:1569–1573.

Bangladesh Crit Care J March 2014; 2 (1): 48-49

Case Report

Guillain –Barrè Syndrome following Hepatitis E

Poly Sengupta[1], Rama Biswas[2], Hasan Shahrear Ahmed[3], Kaniz Fatema[4]

Abstract:

Guillain- Barrè Syndrome is characterized by acute progressive symmetric limb weakness and areflexia. A 32 year old female presented with progressive ascending areflexic muscular weakness and bilateral lower motor neuron type of facial palsy. She had anorexia, nausea and upper abdominal pain for 2 weeks. The findings of motor nerve conduction study are consistent with acute inflammatory demyelinating polyradiculoneuropathy. She had elevated liver enzyme and positive immunoglobulin M antibody against hepatitis E in blood. Based on clinical features, laboratory findings and electrophysiological study, she was diagnosed as Guillain- Barrè Syndrome following hepatitis E. She was treated with intravenous immunoglobulin and recovered fully.

Key words: *Guillain- Barrè Syndrome, acute inflammatory demyelinating polyradiculoneuropathy, Hepatitis E.*

Introduction:

Guillain- Barrè Syndrome (GBS) is a post infectious, immune mediated disease targeting peripheral nerves. The annual incidence of GBS is 0.6-4 cases per 100000 throughout the world.[1] Up to two third of cases, an infection precedes the onset of neuropathy by 1 to 3 weeks. Campylobacter jejuni is the commonest and cytomegalovirus is the second most common infection reported.[2] There are many reports linking hepatitis A, B and C with GBS.[3,4,5] Association of GBS with hepatitis E is rare. Here we report a case of acute inflammatory demyelinating polyradiculoneuropathy (AIDP) variety of GBS following hepatitis E.

Case report:

A 32 year old female presented with progressive weakness of both lower and upper limbs for 3days. She had anorexia, nausea and right upper abdominal pain for last 2 weeks. There was no history of blood transfusion, needle injury, vaccination or drug intake. On examination, she had pulse -72/min, blood pressure 120/80 mm of Hg, respiratory rate 18/min and single breath count of 24. She was afebrile and mild icteric. Nervous system examination on day 1 revealed normal higher psychic function with right lower motor neuron type (LMN) facial palsy, muscle power 3/5 in lower limbs, 4/5 in upper limbs and planter response were bilateral equivocal. Deep tendon reflexes were absent in both limbs. On day 2, she developed difficulty of swallowing to both liquid and solid food , her muscle power reduced to 2/5 in both limbs, single breath count reduced to 18 and bilateral LMN type facial palsy. All sensory functions were intact and there was no sign of meningeal irritation. Abdominal examination revealed mild tenderness in right hypochondrium and 3cm enlarged tender liver from right costal margin.

1. Poly Sengupta, MBBS, MCPS, FCPS, MRCP, Specialist, Neuromedicine, Square Hospital Ltd, Dhaka.
2. Rama Biswas, MBBS, FCPS. Specialist, Medicine, Square Hospital Ltd, Dhaka.
3. Hasan Shahrear Ahmed, MBBS. Medical officer, Surgery, Bangabandhu Sheikh Mujib Medical University, Dhaka.
4. Kaniz Fatema, MBBS, Medical officer, Medicine, Square Hospital Ltd, Dhaka.

Corresponding Author:
Rama Biswas, Specialist, Medicine . Square Hospital Ltd. 18/F Bir Uttam Qazi Nuruzzaman Sarak (West Panthapath), Dhaka-1205
E mail: drramabiswas@gmail.com

Laboratory investigation revealed normal complete blood count , renal function test, coagulation profile and arterial blood gas analysis. Liver enzyme were elevated- ALT 310 U/L, AST 280 U/L, Alkaline phosphatase 130 U/L, Gamma GT 147 U/L, serum Bilirubin 4.2mg/dl. Immunoglobulin antibody against hepatitis E was positive and markers of hepatitis A, B, C were absent. Ultrasound abdomen revealed mild hepatomegaly with altered echotexture of liver parenchyma suggestive of acute hepatitis. The findings of motor nerve conduction study are consistent with Acute Inflammatory Demyelinating Polyradiculoneuropathy (AIDP). Cerebrospinal fluid analysis showed increase in protein concentration of 130mg/dl without an increase number of leucocyte. Clinical, serological and electrophysiological study suggested a diagnosis of AIDP variety of GBS with acute hepatitis E virus infection.

She was managed with intravenous immunoglobulin in the dose of 0.4gm/kg/day for 5days. She recovered muscle power of 4/5 within 7days. Liver enzymes and muscle power returned to normal after 2 weeks of follow up.

Discussion:

GBS is considered to be an autoimmune disease triggered by a preceding bacterial or viral infection. The most common agents are Campylobacter jejuni followed by Cytomegalovirus, Epstein-Barr virus, Mycoplasma pneumoniae, Haemophylus influenza, HIV, Influenza A and B, Varicella zoster virus, Clostridium and Shigella. Vaccine like polio, tetanus toxoid, hepatitis B have also been reported to cause GBS.[2]

The exact pathogenesis of hepatitis causing GBS is not known. It is thought that the immune system mistakenly attacks myelin or axon by a molecular mimicry mechanism.[6] There are four common subtypes of GBS based on clinical and electrophysiological studies e.g. 1. Acute Inflammatory Demyelinating Polyradiculoneuropathy (AIDP), 2.Acute Motor Axonal Neuropathy (AMAN), 3.Acute Motor Sensory Axonal neuropathy (AMSAN), 4. Millar Fisher's syndrome.[6] Nerve conduction study in this case was suggestive of AIDP subtype.

Hepatitis E is a frequent cause of acute hepatitis in Asia, Middle east, North Africa and South America and locally acquired hepatitis E has becoming an emerging problems.[7] The actual incidence of GBS with hepatitis E is still unknown because autochthonous hepatitis E is still underdiagnosed.[8]

Management of GBS is multidisciplinary. Both plasma exchange and intravenous immunoglobulin are equally effective in reducing disease severity and neurological deficits.[9]Our patient was managed with intravenous immunoglobulin and she recovered fully.

Our patient had the AIDP variety of GBS following acute hepatitis E infection. AIDP is characterized by segmental demyelination and subsequent remyelination associated with good recovery.[2]Determination of causative agent is important to assess prognosis of GBS subtype. Considering the GBS-HEV cases reported, it can be said that HEV testing should be done in patients of GBS with altered liver function.

References:

1. Hubhes RAC, Rees JH. Clinical and epidemiological features of Guillain –Barre syndrome. J Infect Dis 1997; 176 (suppl):92-98.
2. Seneviratne U. Guillain –Barre syndrome. Postgrad Med J 2000; 76: 774-82.
3. Ono S, Chida K, Takasu T. Guillain –Barre syndrome following fulminant hepatitis A. Internal Medicine 1994; 33: 799-801.
4. Tsukada N, Koh CS, Inoue A, et al. Demyelinating neuropathy associated with hepatitis B infection. J Neurol sci 1987; 77:203-16.
5. Klippel ND, Hautekeete ML, Keyser JD, et al. Guillain –Barre syndrome as the presenting manifestation of hepatitis C infection. Neurology 1993; 43: 2143.
6. Hughes RA, Cornblath DR. Guillain –Barre syndrome. Lancet 2005; 366:1653-1666.
7. Dalton HR, Bendall R, Ijaz S, Banks M. Hepatitis E: an emerging infection in developed countries. Lancet infect Dis 2008; 8:698-709.
8. Teshale EH, Hu DJ, Holmberg SD. The two faces of hepatitis E virus. Clin Infect Dis 2010; 51(3):328-34.
9. Cosi V, Versino M. Guillain –Barre syndrome. Neurol Sci 2006; 27(suppl 1):347.

Bangladesh Crit Care J March 2014; 2 (1): 50

Clinical Image

Pseudo Sub-Arachnoid Hemorrhage

Ahmad Mursel Anam[1], M Mufizul Islam Polash[2], Farzana Shumy[3], Mahmudul Hasan[4], Raihan Rabbani[5]

A 21-year-old normotensive and non-diabetic gentleman was found unconscious at home following ingestion of some indigenous medication. He was presented to the emergency of Square Hospital the next day with history of two episodes of convulsion in addition to the altered consciousness. On admission, he was found with Glasgow Coma Scale (GCS) 3/15, and hypotension (BP 90/70 mmHg). Pupils were mid-dilated and fixed, with no reaction to light. All deep jerks and plantar reflexes could not be elicited. All other systemic examination was normal. All the laboratory investigations were within normal range. Plain CT-scan of brain was consistent with sub-arachnoid hemorrhage (SAH) [Fig. A & B]. Urgent neurosurgical consultation was sought & surgery was planned.

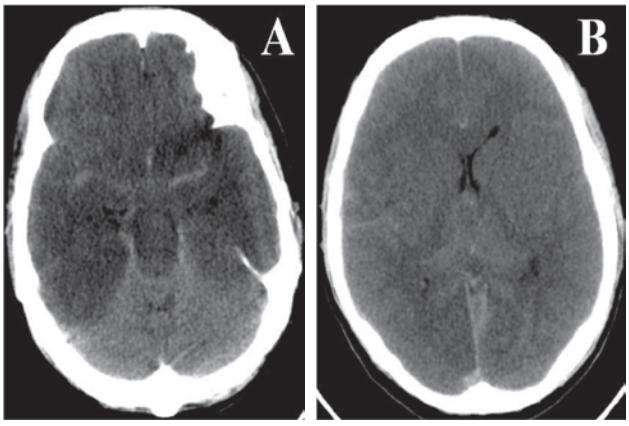

Fig. A & B: *Non-contrast CT brain scans consistent with diffuse sub-arachnoid haemorrhage, with effacement of the sulci and lateral ventricles, consistent with cerebral oedema. Note the loss of grey-white differentiation, sulcal and basal cistern effacement, increased density of falx and sylvian fissures.*

The history of convulsion following ingestion of indigenous medicine, and hypotension as a presenting feature, also aroused the possibility of either toxic encephalopathy or hypoxic brain injury. An MRI of brain [Fig. C & D] was consistent with hypoxic-ischemic brain damage, and the CT-scan findings turned out to be `pseudo sub-arachnoid haemorrhage'. The patient was managed accordingly, but his family took him home the next day owing to financial reasons.

Pseudo sub-arachnoid haemorrhage is a rare CT scan finding that has been reported in different cerebral disease with cerebral oedema, like bacterial meningitis, subdural haematoma and spontaneous intracranial hypotension.[1,2] Increased density on CT scan has been noted along the falx, tentorium, Sylvian fissures and around the basal cisterns. Loss of grey-white differentiation, consistent with cerebral oedema, is frequently associated with these appearances.[1]

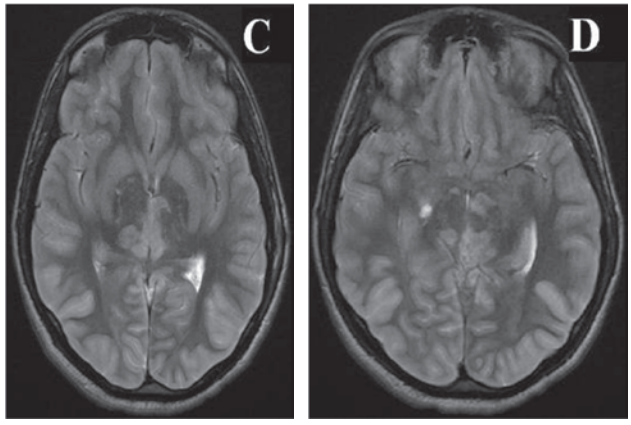

Fig. C & D: *MRI brain (T2-weighted sequence) of the same patient showing diffusely increased signal, consistent with hypoxic-ischemic brain damage.*

The mechanisms causing the appearance of pseudo sub-arachnoid haemorrhage remain unclear. Cerebral oedema may produce venous congestion and impaired circulation, with increased density along the dura and cerebral sulci. These hyperdense areas may then appear more marked alongside the hypodensity of cerebral oedema.[1,2]

Clinicians should be familiar with such rare neuroradiological appearances, as well as the disease associations, so that they may suspect and make prompt diagnosis and facilitate appropriate management in such cases.

References:

1. Thomas GL, Stachowski ER. Pseudosubarachnoid haemorrhage on CT brain scan: An unusual presentation of diffuse hypoxic brain injury. *Intensive Care Med* 2007;33:2038–2040.
2. Given CA 2nd, Burdette JH, Elster AD, Williams DW 3rd. Pseudo-subarachnoid hemorrhage: a potential imaging pitfall associated with diffuse cerebral edema. *AJNR Am J Neuroradiol.* 2003;24(2):254-256.

1 Dr. Ahmad Mursel Anam, MBBS, Chief Resident, ICU, Square Hospitals Ltd, Dhaka, Bangladesh.

2 Dr. M Mufizul Islam Polash, MBBS, Clinical Staff, ICU, Square Hospitals Ltd, Dhaka, Bangladesh.

3 Dr. Farzana Shumy, MBBS, FCPS (Medicine), Medical Officer, Department of Internal Medicine BSMMU, Dhaka Bangladesh.

4 Dr. Mahmudul Hasan, MBBS, Resident Medical Officer, ICU, Square Hospitals Ltd, Dhaka, Bangladesh.

5 Dr. Raihan Rabbani, MBBS, FCPS (Medicine), MD (USA), Associate Consultant, Square Hospitals Ltd, Dhaka, Bangladesh.

Corresponding Author:

Dr. Ahmad Mursel Anam, MBBS, Chief Resident, ICU, Square Hospitals Ltd, Dhaka, Bangladesh. Email: murselanam@gmail.com