

## Case Report

# Prolonged QTc: “Mind the Gap”

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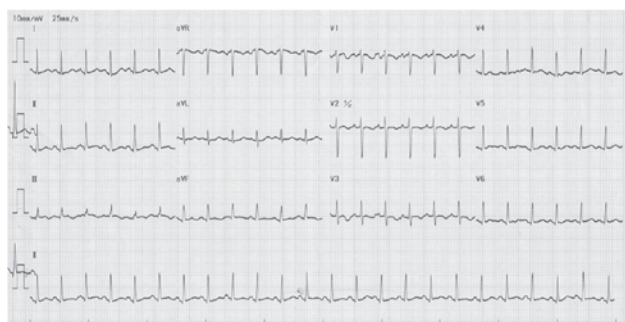
### Abstract

*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

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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 ECG-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 ( $QTc = QT/\sqrt{RR}$ ). QTc >0.450 sec. in men and >0.470 sec. in women are considered abnormal.<sup>1</sup> 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.<sup>2</sup>

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.<sup>2</sup> 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.<sup>1-4</sup>

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.<sup>2</sup> QTc is the best predictor for development of TdP, >0.500 sec is associated with increased risk.<sup>1,3</sup>

“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”.<sup>2,4</sup> 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.<sup>4</sup> 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.<sup>5</sup> 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”.<sup>2</sup>

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.<sup>4</sup>

## 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”.

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