

# Torsade de Pointes, Prolonged QT Intervals, and Patients With Cancer

Lisa Hartkopf Smith, RN, MS, AOCN®, CNS

Many kinase inhibitors, chemotherapeutic agents, antiemetics, antibiotics, and antifungal agents can prolong QT intervals, placing the patient at risk for the life-threatening ventricular arrhythmia Torsade de pointes (Tdp). In addition, common electrolyte imbalances experienced by many patients with cancer compound the risk. Because numerous medications used in oncology and common electrolyte imbalances in patients with cancer increase the risk for Tdp, oncology nurses must be informed about this life-threatening arrhythmia.

Lisa Hartkopf Smith, RN, MS, AOCN®, CNS, is an oncology clinical nurse specialist at Riverside Methodist Hospital in Columbus, OH. The author takes full responsibility for the content of the article. The author did not receive honoraria for this work. No financial relationships relevant to the content of this article have been disclosed by the author or editorial staff. Smith can be reached at [lsmith2@ohiohealth.com](mailto:lsmith2@ohiohealth.com), with copy to editor at [CJONEditor@ons.org](mailto:CJONEditor@ons.org).

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**T**orsade de pointes (Tdp) is a French term meaning “twisting of the points” and was first described by Dessertenne in 1966 (Luderitz, 2009). This ventricular tachycardia can rapidly change to ventricular fibrillation and result in cardiac arrest. The Tdp electrocardiogram (ECG) tracing shows a QRS that changes in height and shape, and twists around the isoelectric line, sometimes pointing downward and sometimes pointing upward (see Figure 1). Tdp usually occurs when ventricular depolarization is delayed, as evidenced by a prolonged QT interval.

## QT Intervals

The QT interval represents ventricular depolarization and repolarization. Ventricular depolarization is the stimulation of ventricular cardiac cells to contract, and ventricular repolarization is the recovery or relaxation of the ventricular cardiac cell. The QT interval starts at the beginning of the Q wave, finishes at the end of the T wave (see Figure 2), and varies depending on gender, age, and heart rate. To determine whether the QT

interval is within normal limits for the patient’s heart rate, count the number of small boxes between two consecutive R waves and divide by two. Then count the number of small boxes in the QT interval. Compare the difference. A normal QT interval should be less than half of the distance between the R waves. To determine the QT interval, multiply the number of small boxes in the QT interval by 0.04 seconds (Huff, 2006).

A normal QT interval is usually half the distance between two consecutive R waves (Huff, 2006); a QT interval higher than 440–500 msec is considered prolonged (Huff, 2006). The QT interval is affected by the heart rate. A faster heart rate results in a shorter QT interval, whereas a slower heart rate results in a longer QT interval. To improve the detection of patients at risk for Tdp and to measure the QT interval more accurately, the QT interval should be corrected for the heart rate.

## Prolonged QT intervals

Prolonged QT intervals indicate that ventricular repolarization is delayed,

which allows time for an ectopic focus to take control and, therefore, places the ventricles at risk for a ventricular arrhythmia, such as Tdp. Causes of prolonged QT intervals include hereditary long QT interval syndrome, predisposing DNA polymorphisms, bradyarrhythmias, myocardial ischemia, electrolyte imbalances (hypocalcemia, hypokalemia, and hypomagnesemia), and medications (Drew et al., 2010). The risk also is increased with older age and in women (Drew et al., 2010). Significant medication classifications that can prolong QT intervals include antipsychotics, tricyclic antidepressants, antibiotics, antifungals, and antidysrhythmics (Drew et al., 2010; Zareba, 2007).

## Prolonged QT Intervals and Patients With Cancer

Hypokalemia, hypomagnesemia, and hypocalcemia are electrolyte imbalances commonly found in patients with cancer. Low levels of those electrolytes can prolong QT intervals (Drew et al., 2010; Huff, 2006). Diarrhea, a common issue in patients with cancer, can cause hypokalemia. Cancer, surgery to the bowel, radiation involving the gastrointestinal tract, antibiotics, epithelial growth factor inhibitors, and certain chemotherapeutic agents (e.g., 5-fluorouracil, capecitabine, cytarabine) all can cause diarrhea and, therefore, hypokalemia (Muehlbauer et al., 2009; Polovich, Whitford, & Olsen, 2011). Examples of chemotherapeutic agents that can cause hypomagnesemia include cisplatin and carboplatin (Polovich et al., 2011). Renal damage and amphotericin B also can cause hypomagnesemia (Novello & Blumstein, 2010). Chemotherapeutic agents (e.g., cisplatin), tumor lysis syndrome, diuretics, bisphosphonates