A Comparison of Peripheral and Centrally Collected Cyclosporine A Blood Levels in Pediatric Patients Undergoing Stem Cell Transplant

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Purpose/Objectives: To measure differences in cyclosporine A (CSA) trough concentrations from blood collected as a peripheral sample and from a CSA-uncontaminated (naive) lumen of a double-lumen central line.

Design: Prospective, comparative study.

Setting: Pediatric university teaching hospital in metropolitan Australia.

Sample: 71 paired central and peripheral CSA blood samples from a convenience sample of 14 pediatric allogeneic stem cell transplant recipients receiving IV CSA as prophylaxis or treatment for graft-versus-host disease. Ages ranged from 2 months to 14 years, 5 months.

Methods: Comparing blood samples collected from a peripheral site and a CSA-naive lumen of a double-lumen central line. Data were analyzed using a paired student t test and calculation of the 95% confidence interval of the concentration ratio from different sampling sites.

Main Research Variables: Site of blood sampling and CSA trough concentrations.

Findings: No significant difference existed between CSA concentration in samples collected from the different sites in children receiving intermittent infusions of CSA ($p = 0.13$). The 95% confidence interval of the CSA concentration ratio was 0.92–1.04.

Conclusions: When CSA is administered on an intermittent dosing schedule, comparable CSA trough concentrations can be determined from blood collected via the CSA-naive lumen of a double-lumen central line or at a peripheral sampling site.

Implications for Nursing: Pediatric allogeneic stem cell transplant recipients who require regular CSA trough concentrations no longer will require peripheral blood samples when receiving an intermittent dosing schedule.

Key Points . . .

- Blood sampling from the cyclosporine A- (CSA-) naive lumen of a double-lumen central line is appropriate for monitoring CSA trough concentrations when a patient is receiving intermittent-dose CSA.
- If CSA is administered as a continuous infusion, the accuracy of CSA trough concentrations cannot be ensured; therefore, the authors recommend collection for CSA trough concentrations via a peripheral sample.
- Whenever possible, painful procedures should be avoided in children.

Cyclosporine A (CSA) is an immunosuppressant agent used either alone or in combination with other therapies in allogeneic stem cell transplant (SCT), for prophylaxis and treatment of graft-versus-host disease (GVHD). GVHD is a potentially serious complication of SCT, and subtherapeutic blood CSA concentrations may increase a patient's risk for developing GVHD (Yee et al., 1988). CSA concentration monitoring is essential in the clinical management of patients undergoing SCT to ensure adequate dosing and to minimize the toxicity of the medication (Kami et al., 2000; Morris et al., 2002). Significant variability among patients in the metabolism of CSA, medication interaction, and clinical condition requires regular monitoring.

To ensure reliable CSA concentrations, the standard of practice at the authors' institution was changed from monitoring CSA trough concentrations in blood collected from the double-lumen tunneled central venous line to peripheral blood (venipuncture or capillary sample) sample. This change occurred because of an apparent variability in CSA trough concentrations when collected via the central line.

Several investigations have evaluated the administration and therapeutic monitoring of CSA with attention to the method of blood collection. Blifeld and Ettenger (1987) reported their experiences with two renal allograft recipients who received IV CSA via an indwelling, single-lumen, polyurethane catheter and subsequently had trough CSA concentrations collected from the same catheter. These researchers reported unusually elevated CSA trough concentrations and subsequently collected peripheral and indwelling catheter trough levels that showed a significant difference between the two samples. They postulated that CSA adheres to the intraluminal plastic in the central venous line. This finding highlighted a potential problem with the reliability of the CSA trough concentration blood samples that were collected from the same lumen by which the CSA was administered. Leson, Bryson, Giesbrecht, and Saunders

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