

Use of Commercially Available Heparin Solution for Neonates

Arterial lines are commonly used to allow access for monitoring of neonates in neonatal intensive care units. Catheter occlusion and thrombosis are complications associated with the use of umbilical artery catheters, one type of arterial line used in this setting. The incidence of clinically symptomatic thrombosis with this type of catheter has been estimated at 1% to 3%.¹ To minimize these complications, staff in neonatal intensive care units use various strategies, including choice of catheter design, material, and location of the catheter tip.^{1,2} In most neonatal intensive care units, some type of heparin infusion is also used to help maintain patency of the catheter.²

The frequency of catheter occlusion is reduced when heparin is infused through the umbilical artery catheter.² A continuous infusion of heparin is required, as heparinization of the flush solution is ineffective on its own.² The exact amount of heparin required to maintain patency and avoid adverse effects is unknown. However, care is required in selecting the dosage, because heparin is a high-risk medication that carries a risk of hemorrhage if too much is administered.

Recently reported medication incidents have illustrated this risk. For example, in the neonatal intensive care unit of a Texas hospital, 14 to 17 neonates received heparin overdoses in the summer of 2008.³ No ready-to-administer solutions appropriate for neonates were commercially available at the time,³ so the required heparin solutions had to be prepared in the pharmacy. However, pharmacy staff prepared the heparin solutions incorrectly, and the neonates received up to 100 times more heparin than had been ordered.³ In Canada, a premixed heparin solution, at a concentration of 2 units/mL in 0.9% sodium chloride, is commercially available.⁴ Whenever possible, using commercially available premixed solutions is preferable to the preparation of solutions by nurses or pharmacists to reduce the risk of mixing errors. However, the concentration of 2 units/mL is greater than the 0.25 to 1 unit/mL recommended for neonates by the American College of Chest Physicians.¹ Therefore, at many Canadian sites, the premixed solution is not used, and heparin for neonates (at the recommended concentration) is prepared in 0.45% sodium chloride.⁵

At a hospital in British Columbia, the charts of neonates who received commercially available heparin 2 units/mL in 0.9% sodium chloride from 2006 to 2009 were reviewed. During the study period, 66 neonates received heparin via an umbilical artery catheter. The mean gestational age of the patients was 27.3 weeks (range 24 to 40 weeks), and the mean birth weight was 1040 g (range 460 to 4075 g). Sixty of the neonates initially received the commercially available solution, and the other 6 initially received a solution prepared on the ward, using 0.45% sodium chloride, but were switched to the commercially available

solution at some point. The catheters were removed electively for 54 (82%) of the neonates. Of the remaining 12 neonates whose umbilical artery catheters were removed because of complications, 7 (11% of the total sample) of these removals were due to occlusion. This occlusion rate is similar to rates of about 13% reported from a few small randomized studies.⁶⁻⁸ Studies evaluating the recommended heparin concentrations of 0.25 to 1 unit/mL have reported variations in the dose of heparin from 25 to 220 units/kg daily.^{6,9} In the review reported here, the mean heparin dose was 29.3 units/kg daily (range 7.2 to 55 units/kg daily).

One concern identified in this review was the need to switch from the commercially available solution (0.9% NaCl) to the 0.45% NaCl solution, because of hypernatremia, for 23 (35%) of the neonates; as such, a total of 29 (44%) of the neonates received the ward-mixed solution at some point. In particular, of the 58 very-low-birth-weight neonates (weighing less than 1500 g), 28 (48%) required the reduced-sodium solution. Administering exogenous sodium during early postnatal adaptation can prevent postnatal diuresis and may contribute to hypernatremia.¹⁰ Development of hypernatremia and subsequent administration of fluids may increase the risk of prolonged respiratory distress syndrome, patent ductus arteriosus, and bronchopulmonary dysplasia.¹⁰ In addition, hypernatremia and significant changes in sodium concentration may cause significant morbidity, including intraventricular hemorrhage and impairment of functional outcomes.¹¹⁻¹³ The sodium in medications is often not considered as a contributing source, but use of 0.9% sodium chloride in an arterial line can deliver a substantial amount of sodium.

Given the morbidities associated with hypernatremia and large changes in serum sodium, the contributions of all exogenous sources of sodium must be carefully considered. Almost half of the neonates in this review required heparin in a reduced-sodium solution. Therefore, commercially available heparin (2 units/mL in 0.9% sodium chloride) should not be administered routinely to very-low-birth-weight neonates (i.e., less than 1500 g) without further studies. The US Institute for Safe Medication Practices recently suggested that the standard concentration of heparin for neonates be 0.5 units/mL in 0.45% sodium chloride.¹⁴ Given this recommendation, perhaps the manufacturer will consider preparing a ready-to-administer product suitable for neonates.

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Integrating a Pharmacist into an Already-Established Primary Health Care Team

Defining the role of pharmacists in a variety of health care settings has been widely discussed over the past several years, and it continues to be an area of significant interest to our profession. In particular, pharmacists have been encouraged to establish and/or enhance clinical pharmacy services in ambulatory, hospital, and community practices.

However, in these collaborative efforts, it is important to have clearly defined roles to reduce ambiguity or overlap of roles with other health care professionals and also to promote a cohesive approach when more than one pharmacist is involved with the team. Several factors must be considered before a pharmacist joins a health care team: Is this an established team? Have the team members interacted with a pharmacist before? What are their expectations of the pharmacist?

We would like to direct readers of the *CJHP* to our recently published study, in which we investigated how to integrate a pharmacist into an already-established primary health care team.¹ The study setting was designated as a primary care site, but a

clinical pharmacist had never been a member of the team. The only previous interactions that team members had had with pharmacists were brief communications with community practitioners regarding dispensing functions.

We used an approach known as action research, a qualitative methodology involving a cyclical, dynamic, and collaborative process in which researchers strive to improve their practices. We worked with established primary and ambulatory care pharmacists and members of the primary care team to define and tailor the activities of the proposed clinical pharmacist position. A pharmacist then joined the team and carried out the agreed-upon services. Focus groups were held with the team at the end of the study period to evaluate the pharmacist's role. The results of this process were ultimately used to create an 8-step guide for this integration process. This guide or template may be of interest to all clinical pharmacists who wish to become part of a primary health care team but who are unclear about what their roles or expectations should be.

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Sharing Data from Pharmacy Information Systems

In a recent issue of the *CJHP*, Brisseau and others¹ discussed the topic of sharing data from pharmacy information systems to electronic health records. I was dismayed by some of the misleading and inaccurate information presented in this letter.

I would first take issue with the number that the authors quoted from the Hospital Pharmacy in Canada Survey, suggesting that "6% of departments were using this type of medical record" [i.e., electronic health records].¹ I seriously doubt this number and could not find its source anywhere in the published survey. In fact, Table J-5 of the survey report² states an 81% achievement rate among pharmacists in using medication-relevant portions of patients' electronic medical records for managing patients' medication therapy. This rate of use necessarily implies that such electronic medical records actually exist. I suspect that the authors were confusing the rate of implementation of electronic health records with the rate of uptake of