ASHP Therapeutic Position Statement on the Institutional Use of 0.9% Sodium Chloride Injection to Maintain Patency of Peripheral Indwelling Intermittent Infusion Devices

Statement of Position

0.9% Sodium chloride injection is a safe and effective indwelling solution for maintaining catheter patency of peripheral indwelling intermittent infusion devices (PIIIDs) in adults and children age one year or older. ASHP supports the use of 0.9% sodium chloride injection in preference to heparin-containing flush solutions (heparin flush) in the institutional setting, on the basis of clinical evidence indicating that 0.9% sodium chloride injection (1) is as effective as heparin flush in maintaining the patency of PIIIDs when blood is not aspirated into the device, (2) is safer to use than heparin flush because of a lower potential for adverse effects, (3) avoids drug incompatibilities associated with heparin flush, and (4) is a cost-effective alternative to heparin flush. Because of limited and conflicting available scientific evidence to date, this recommendation is not applicable to children under the age of one year or patients in the home or other outpatient settings. This document is not applicable to catheters used for central venous or arterial access (including peripherally inserted central catheters and midline catheters) and the maintenance of patency in indwelling venipuncture devices used to obtain blood samples. Further research on PIIID patency in the aforementioned patient populations and settings is warranted.

Background

PIIIDs, often referred to as “saline locks” and frequently and inappropriately called “heparin locks,” are used to provide convenient i.v. access in patients who require intermittent i.v. administration of medications without a continuous infusion of i.v. fluids. The advantages of PIIIDs include patient mobility and comfort and reduced fluid load. PIID most commonly consist of an intravenously inserted catheter attached to a short external cannula with a resealable injection port that is designed to facilitate multiple needle entries; thus, these devices eliminate the unnecessary trauma of multiple venipunctures. A problem frequently encountered with PIIIDs is the loss of patency because of clot formation within the catheter. To prevent clot formation, catheters are commonly flushed after each administration of i.v. medication and every 8–12 hours when the device is not in use. Because of heparin’s anticoagulant effects, diluted solutions of heparin in 0.9% sodium chloride injection (e.g., 10 or 100 units/mL) have traditionally been used to periodically flush and fill these devices and prevent the formation of clots. Diluted heparin solutions are used to maintain patency while avoiding the systemic effects associated with therapeutic doses of heparin.

However, due to the aforementioned concerns regarding heparin administration and the potential for medication dose error, many clinicians preferentially began using sodium chloride for flushes even before evidence was available that supported the use of sodium chloride instead of heparin.

Efficacy

Studies have indicated that 0.9% sodium chloride injection alone is as effective as heparin-containing solutions in maintaining PIIID patency. In several randomized, double-blind studies in which PIIIDs composed principally of fluoroethylene propylene (Teflon) were used, 0.9% sodium chloride injection for flushing was associated with patency rates similar to those achieved with flush solutions containing heparin sodium 10 or 100 units/mL. The frequency of phlebitis associated with the use of these solutions was also similar. Several studies provide a scientific basis for using heparin flush, but most published research supports 0.9% sodium chloride injection as an effective alternative to heparin flush in maintaining the patency of PIIIDs. However, 0.9% sodium chloride or heparin flush may not be the appropriate flush solution when flushing drugs that may not be compatible with 0.9% sodium chloride or heparin. Specific examples of such drugs include liposomal amphotericin B, doxorubicin, and i.v. immune globulin. These drugs may need to be “preflushed” with another compatible solution such as 5% dextrose injection before and after administering the incompatible drug.

In addition, the size of the i.v. catheter in pediatric patients appears to be a contributing factor in determining success with 0.9% sodium chloride for maintaining the patency of PIIIDs. Evidence supports the use of 0.9% sodium chloride flushes over heparin in pediatric patients, and 0.9% sodium chloride injection is the preferred solution mentioned in the available nursing guidelines on infusion standards.

One survey found that in neonates, it was common practice to flush catheter devices with heparin 1–2 units/mL, and the literature supports the use of heparin 0.5 unit/mL added to continuous infusions through peripheral lines. Concentrations of heparinized 0.9% sodium chloride injection 1–10 units/mL for flushing have been studied in neonatal patients, with no significant difference in catheter life or patency between 0.9% sodium chloride injection and heparinized 0.9% sodium chloride injection. A limitation of these studies is small sample size, indicating low statistical power. Despite the lack of evidence-based literature supporting the superiority of heparin over 0.9% sodium chloride injection or vice versa for neonatal peripheral i.v. flushes, current guidelines published by the National Association of Neonatal Nurses state that heparinized 0.9% sodium chlo-
ride 0.5 unit/mL should be used to flush peripheral i.v. catheters using 0.2–0.5 mL every three to four hours. If using 0.9% sodium chloride injection in pediatric patients, avoid bacteriostatic 0.9% sodium chloride, especially in neonates.

One trial of pregnant women demonstrated significantly increased efficacy and decreased complication rates with heparin-infused catheters compared with those flushed with 0.9% sodium chloride. A subsequent study of pregnant women found no significant differences in the number of patent catheters or in complications with catheters flushed with either heparin or 0.9% sodium chloride. However, the authors from both studies noted that their sample sizes were small and not powered sufficiently to detect a significant difference in patency or complications, possibly affecting the true clinical significance of their results. While published data from pregnant patients are conflicting, common practice is to use 0.9% sodium chloride flushes for peripheral i.v. catheters in this patient population.

**Adverse Effects of Heparin Flush**

Heparin, even when used in small doses, may elicit adverse reactions in some patients. The potential for bleeding complications increases when patients receive multiple unmonitored heparin flushes. Repeated injections of heparin, even in small doses, can alter activated partial thromboplastin time. Allergic reactions are an inherent risk of using heparin. Although rare, heparin-flush-associated thrombocytopenia and hemorrhage have been reported. The risks of these adverse effects may be avoided by using 0.9% sodium chloride injection instead of heparin flush. Heparin is incompatible with many anthracyclines, including daunorubicin and doxorubicin, as well as benzodiazepines such as diazepam and midazolam.

**Cost Implications**

Enhanced quality of patient care should be the primary reason for deciding to use 0.9% sodium chloride injection for flushing. Secondarily, the choice of 0.9% sodium chloride injection may avoid substantial costs associated with drugs, related supplies, and staff time.

**Summary**

Because current therapeutic evidence supports the efficacy of 0.9% sodium chloride injection in maintaining PIHD patency and due to the inherent risks associated with heparin, ASHP believes that the use of 0.9% sodium chloride injection is appropriate for maintaining the patency of PIHDs in adults and children age one year or older in institutional settings. Because of limited and conflicting scientific evidence available to date, this recommendation is not applicable to neonates, patients in the home or other outpatient settings, catheters used for central venous or arterial access (including peripherally inserted central catheters and midline catheters), which was beyond the scope of this therapeutic position statement, and the maintenance of patency in indwelling venipuncture devices used to obtain blood samples.

**References**