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 for injection is a safe and effective indwelling solution for maintaining catheter patency of peripheral indwelling intermittent infusion devices (PIIIDs) in adults. ASHP supports the use of 0.9% sodium chloride for 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 12 years, patients who are pregnant, patients in the home or other outpatient settings, 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, commonly referred to as "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.[1–4] PIIIDs 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.[4] A problem frequently encountered with a PIIID 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.[5] Because of heparin's anticoagulant effects, diluted solutions of heparin in 0.9% sodium chloride injection (e.g., 10–100 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.[6] The optimum concentration of heparin and whether the drug is needed at all have not been established.[4,7–11]

Efficacy

Studies have indicated that 0.9% sodium chloride injection alone is as effective as heparin-containing solutions in maintaining PIIID patency.[5,9,10,12–19] 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 10 or 100 units of heparin sodium per milliliter.[13–15] The frequency of phlebitis associated with the use of these solutions was also similar.[7–11,13–15] The type of solution used to maintain PIIID patency may not be as important as the positive pressure maintained in the i.v. line by the capped (sealed) injection device, which appears to prevent blood reflux and clot formation in the devices.[10,11] Several studies provide a scientific basis for using heparin,[6,20,21] but most published research supports 0.9% sodium chloride injection as an effective alternative to heparin flush in maintaining the patency of PIIIDs. Data from neonates and children four weeks to 18 years of age are conflicting, with some studies suggesting no advantage of heparin over 0.9% sodium chloride injection and other studies demonstrating that heparin flushes maintain device patency significantly longer than 0.9% sodium chloride injection. Definitive conclusions cannot be made for pediatrics based on currently available data due to differences in trial methodologies and outcome measures, as well as trial limitations, such as insufficient or unknown statistical power and protocol violations.[22–30] One survey showed that it was common practice to flush catheter devices used in neonates with heparin 1–2 units/mL[31]; however, the majority of published trials have evaluated heparin concentrations up to 10 units/mL, and nursing guidelines state that heparin concentrations of 1–10 units/mL should be given to pediatric patients.[23,31,32] Although the risk appears to be low, the potential for intraventricular hemorrhage and the additional volume received through heparin flushes should be considered in neonates.[33,34]

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.[35] 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, but the authors noted that their small sample size provided only 11% power to detect a significant difference in patency and even less power to detect a significant difference in complications.[36] Data from pregnant patients are conflicting; therefore, a recommendation cannot be made until more data are available.

Adverse Effects of Heparin Flush Therapy

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.[37] Repeated injections of heparin, even in small doses, can alter activated partial thromboplastin time.[38] Allergic reactions are an inherent risk of using heparin. Although rare, heparin-flush-associated thrombocytopenia and hemorrhage have been reported.[37,39–41] The risks of these adverse effects may be avoided by using 0.9% sodium chloride injection instead of heparin flush.

Drug Incompatibility

Heparin has been shown to be incompatible with many commonly used i.v. drugs.[42] If heparin flush has been used to maintain the patency of a PIIID and a drug must be administered that is incompatible with heparin, it is necessary to flush the catheter with 0.9% sodium chloride injection before and after administering the incompatible drug and then to refill the PIIID with heparin. This procedure is commonly referred to as "SASH" (sodium chloride—administration [of drug]—sodium chloride—heparin).[43] The use of 0.9% sodium chloride injection as a flushing agent avoids the numerous drug incompatibilities associated with heparin and obviates the need for SASH.

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.[11]

Summary

Because of current therapeutic evidence supporting the efficacy of 0.9% sodium chloride and the inherent risks associated with heparin, ASHP believes that the use of 0.9% sodium chloride injection is appropriate for maintaining the patency of PIIIDs in nonpregnant adults in institutional settings. Because of limited and conflicting available scientific evidence to date, this recommendation is not applicable to children under the age of 12 years, patients who are pregnant, patients in the home or other outpatient settings, catheters used for cen-tral 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.

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This document supersedes the ASHP therapeutic position statement on the institutional use of 0.9% sodium chloride injection to maintain patency of peripheral indwelling intermittent infusion devices approved by the ASHP Board of Directors on April 27, 1994, and reaffirmed in 1997.

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