Should heparin based flushing solutions be used in preference to saline to maintain the patency of indwelling intravascular catheters and cannulae?

Prepared by UK Medicines Information (UKMi) pharmacists for NHS healthcare professionals
Date prepared: 24 April 2012

Background
The use of peripheral intravascular catheters to provide access for the administration of medicines, fluids and parenteral nutrition, and providing access for venepuncture and monitoring is widespread. Maintenance of their patency is important to reduce the discomfort and expense of replacement. It is common practice to flush the catheters with solutions of various strengths of heparin in saline (0.9% sodium chloride injection), before and after use (phlebotomy or drug administration), in order to reduce the risk of clots forming in the lumen and hence to maintain their patency.

Unnecessary exposure to heparin should be avoided as there are risks and disadvantages (1,2) in using these products including:
- Allergic reactions
- The potential for bleeding complications
- Risk of medication error
- Risk of heparin induced thrombocytopenia
- Cost

Another disadvantage is if a heparin based flushing solution is used then it may also be necessary to flush the device with a separate saline flush before and after administering medicines that are incompatible with heparin (2).

There is a distinction between “simple” peripheral intravenous venous catheters and more complex devices such as central venous or arterial catheters. Peripheral venous catheters have low volumes and, typically, are required to last only for a few hours or days during an in-patient stay. Other indwelling devices can have larger volumes and pose other problems as they may be required to remain in situ for longer periods of time whilst being accessed far less frequently.

Answer
There are many studies in this area as well as a number of systematic reviews and evidence based guidelines. These are summarised in Table 1. There is a degree of heterogeneity in the studies; in the flushing technique, the duration of study, the strength of heparin used and in the precise way that catheter patency is assessed. The evidence is discussed in terms of the particular kind of device being used. Whilst some of the individual studies have methodological limitations e.g. some are non-randomised or do not use intention-to-treat analysis, there are some systematic reviews and meta-analyses that can be used to provide definitive advice where the evidence is available.

Devices providing peripheral venous access in adults. The general finding of research in this area of practice is that using heparin based flushing solutions does not have any advantage, in terms of patency rates, over using saline (2-10). The catheter gauges studied, where stated, included 18-22 gauge. Two studies in pregnant women (4, 8) disagree in their findings; one study demonstrated no difference in catheter life over the study period of 12 hours (4). The second study showed that a heparin based flushing solution (100 units/mL) was significantly better than saline at 48 and 72 hours (8). The risk of phlebitis with heparinised saline varies between studies.

Devices providing peripheral venous access in children and neonates. There are some studies looking specifically at devices, which are generally of a narrower gauge (22 and 24 gauge), used in children and neonates (11-16). As in adults, the general conclusion of this research is that heparin confers no advantage over saline. These studies highlight other determinants that affect the risk of device blockage such as the gestational age of neonates/age of children and the site used for...
cannulation (11-18). A non-randomised study reports a statistically significant advantage of heparin over saline in babies (19).

**Central Venous Catheters.** The research in this area is more limited and individual studies have looked at specific devices. The findings are mixed with some studies concluding that heparin provides no advantage in maintaining the patency of indwelling central venous catheters used for chemotherapy (20), apheresis (21) and triple lumen central catheters used in intensive care (22). Other studies provide contradictory results for Groshong catheters used for oncology in-patients and out-patients (23) and central venous lines (24-28).

**Arterial Catheters.** In these catheters, a flushing solution is continuously infused through the line. The findings of research in this area are mixed. A number of studies have found that heparin confers advantages in maintaining the patency of arterial catheters and also providing more accurate blood pressure readings (29-32). Other studies however report no difference between arterial lines flushed with heparin and saline solutions (33,34); one of these studies (34) noted a prolonged aPPT in patients using heparinised solutions.

**Reviews and Evidence Based Guidelines.** Reviews that address peripheral IV catheters in adults (35-39) conclude that heparinised saline solutions have no advantage over normal saline for maintaining peripheral venous catheters. The Cochrane Review, updated in 2010 (40), however concludes that there is insufficient evidence in neonates for firm recommendations about heparin to be made. Another reviewer concluded that the evidence in children cannot determine if heparinised or plain saline is best for cannula patency (41).

For arterial catheters and for central venous lines, the picture is less clear (35,38,42,43). An evidence based guideline published in 2007 (42) notes that heparin has a role in maintaining these catheters but, due to their heterogeneity, specific policies will probably need to be devised for individual circumstances. A number of factors are important including the volume of the catheter, any specific manufacturer’s recommendations, the presence of valves and the need to remove flushing solutions prior to use. Cochrane reviews are underway to explore the use of heparin/saline in central venous catheters in adults (44) and in arterial lines in adults (45).

**Summary**

There is evidence available to address the question of whether heparin has any advantage over saline solution to flush peripheral intravenous catheters to reduce the risk of blockage and the need for replacement. The research identifies other issues that may impact on catheter patency including flush technique, patient's age and site of cannulation.

- There seems to be a reasonable consensus that heparin solutions have no advantage over normal saline for maintaining peripheral intravenous catheters. This is also noted in the British National Formulary (section 2.8.1) (46).
- For arterial and for central venous catheters, the picture is less clear and more specific policies may be required depending on the individual devices in use.

**Limitations**

The studies cited vary in their design, for example in -

- The frequency of flushing of catheters
- The volumes of flushing solutions used
- The catheter type studied
- The duration of time that catheter function was assessed
- The concentration of heparin used.

No attempt is made here to recommend the optimal flushing regimen in terms of the volume, frequency or technique best employed. This review does not include comparisons of different heparin regimens.
Disclaimer

- Medicines Q&As are intended for healthcare professionals and reflect UK practice.
- Each Q&A relates only to the clinical scenario described.
- Q&As are believed to accurately reflect the medical literature at the time of writing.
- The authors of Medicines Q&As are not responsible for the content of external websites and links are made available solely to indicate their potential usefulness to users of NeLM. You must use your judgement to determine the accuracy and relevance of the information they contain.
- This document is intended for use by NHS healthcare professionals and cannot be used for commercial or marketing purposes.
- See www.ukmi.nhs.uk/activities/medicinesQAs/default.asp for full disclaimer.