

Evidence Snapshot

Occlusion between heparin saline and 0.9% sodium chloride in adults: A Snapshot

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Executive Summary

Background

The Centre for Clinical Effectiveness have been requested to complete a review of evidence from the Pharmacy Department. Currently, Pharmacy is experiencing issues in sourcing heparinised saline, and the alternative product is 5 times the cost. Therefore, this Department is reviewing the use of heparinised saline and are interested in knowing the effectiveness of using a 0.9% Sodium Chloride solution compared to heparinised saline.

Objective

The objective of this Snapshot is to review the evidence to compare the difference regarding patency between heparinised saline and 0.9% Sodium Chloride solution in Adults. Specifically, the review will focus on central lines only.

Findings

- Given the very low-quality of the evidence, it is uncertain whether heparin saline results in fewer occlusions than normal saline.^{3,4}
- Low quality evidence suggests there is no difference in occlusion of line access, lumen and patient between heparin saline and normal saline.⁴
- In the short term (<30 days), heparin saline led to slightly less occlusions than normal saline for patient, lumen and line access (low-quality evidence). There was however, a significant difference in catheter occlusion favoring heparin saline, but the limited number of studies and effect sizes bring caution to this finding (low-quality evidence).⁴
- In the long term (>30 days) there was not difference in occlusion between normal saline heparin saline for patient, catheter, lumen and line access (low-quality evidence).⁴
- There was no evidence of differences in safety (sepsis, mortality, or haemorrhage) (low-quality evidence).³
- When arterial lines are concerned, there is no difference in occlusion between heparin at a dose of 1-2 IU/mL and normal saline (low-quality evidence).⁵
- A difference in occlusion was found at 4 IU/mL for arterial lines however, this was only from one low-quality study.⁵

Conclusions

As stated, given the low-quality of evidence, it is uncertain if the use of normal saline leads to more occlusions than heparin saline.

Background

The Centre for Clinical Effectiveness have been requested to complete a review of evidence by Claire McAvaney from Pharmacy. Pharmacy are currently experiencing issues in sourcing heparinised saline, and the alternative product is 5 times the cost. Therefore, Pharmacy are reviewing their use of heparinised saline and are interested in knowing what is the effectiveness of using a 0.9% Sodium Chloride solution compared to heparinised saline.

Objectives

The objective of this Snapshot is to review the evidence to compare the difference regarding patency between heparinised saline and 0.9% Sodium Chloride solution in Adults. Specifically, the review will focus on central lines only.

Search strategy

Inclusion/Exclusion Criteria

The following criteria were applied to source searching (Table 1).

Table 1. Inclusion/Exclusion criteria

Population	Include: Adults Exclude: Paediatric, neonatal, adolescent
Interventions	Include: 0.9% Sodium Chloride solution, saline
Outcomes	Include: Patency, occlusion, blockage Exclude:
Context	Include: Central line access Exclude: Peripheral line access
Types of evidence	Include: Systematic reviews Exclude: All other types of evidence
Limits	Date: Since 2014 Language: Publications in English.

Search strategy

Given this is an Evidence Snapshot, two sources were searched for evidence (Table 2).

Table 2. Sources searched and the search terms used

Source	Search terms
Google Scholar	heparin OR sodium AND catheter AND review
TRIP database	heparin OR sodium AND catheter

Study Selection

Papers identified were screened using inclusion and exclusion criteria established *a priori*. Searches were screened by one reviewer in consultation with colleagues as necessary. Literature was included based on the above criteria (Table 1).

Quality Appraisal

Quality appraisal of the included reviews was performed by one author (CJ) using the AMSTAR tool¹.

Summary of findings

Of the two sources for evidence that were searched, 4 systematic reviews were found²⁻⁵. One review² was a previous, out-dated version of a new review³ so we have not reported this data, and only the current review data. The table below summarises their characteristics and results (Table 3).

Central Venous Catheters³

Low-quality evidence showed that fewer occlusions with heparin than with normal saline when using central venous catheters (Figure 1). The number needed to treat for an additional beneficial outcome was reported as 42.

Subgroup analysis showed when using a catheter fewer occlusions occurred with heparin use compared to normal saline (low-quality evidence) (Figure 1). When the unit of analysis was line access, results show no clear differences in occlusions between heparin and normal saline. No clear differences in the duration of catheter patency (low-quality evidence).

There was no clear evidence of a difference in: CVC-related sepsis, mortality, or heparin-induced thrombocytopenia (low-quality evidence).

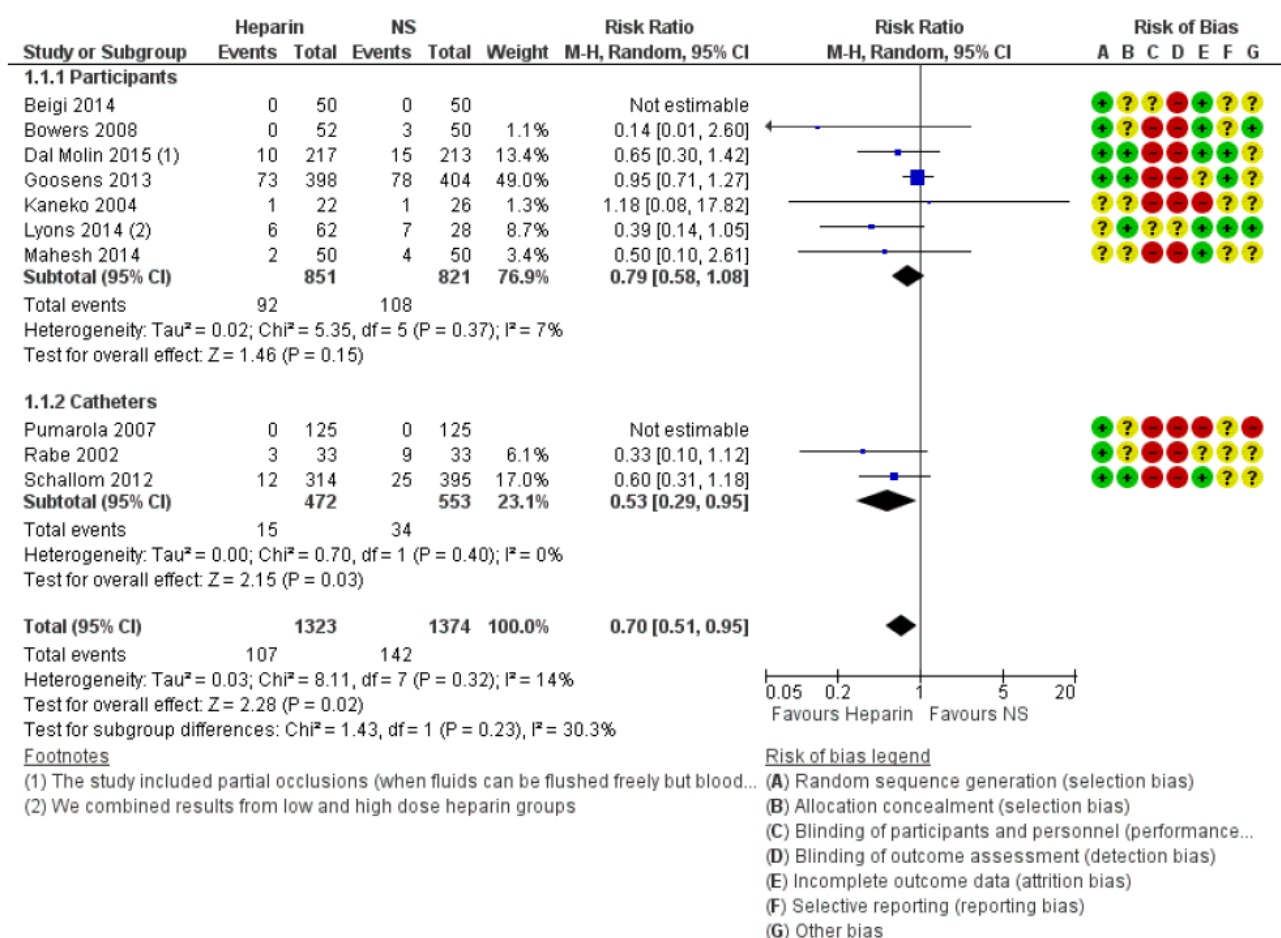


Figure 1. Forest plot comparing occlusions between heparin to normal saline³

Patient, catheter, lumen and line access and indwelling time (i.e. <30 and >30 days)⁴

There is no general difference in heparin saline and normal saline in patient, catheter, lumen and line access (low-quality evidence).

Subgroup analysis based on catheter indwelling time (e.g. <30 days and >30 days) showed conflicting conclusions. In the short term (<30 days), heparin saline was slightly better than normal saline for patient, lumen and line access, which is possibly due to normal saline not having an anticoagulant behavior (low-quality evidence). There was however, a significant difference in catheter occlusion but the limited number of studies and effect sizes bring caution to this finding (low-quality evidence).

In use greater than 30 days, normal saline could be equal, if not more effective, than heparin saline for patient, catheter, lumen and line access (low-quality evidence). This has several advantages; normal saline is an isotonic solution, which is in accordance with basic physiological needs. In addition, the use of normal saline will result in fewer side effects from heparin related complications.

Heparin saline is several times more expensive than normal saline, eliminating its use in flushing solutions has economic benefits.

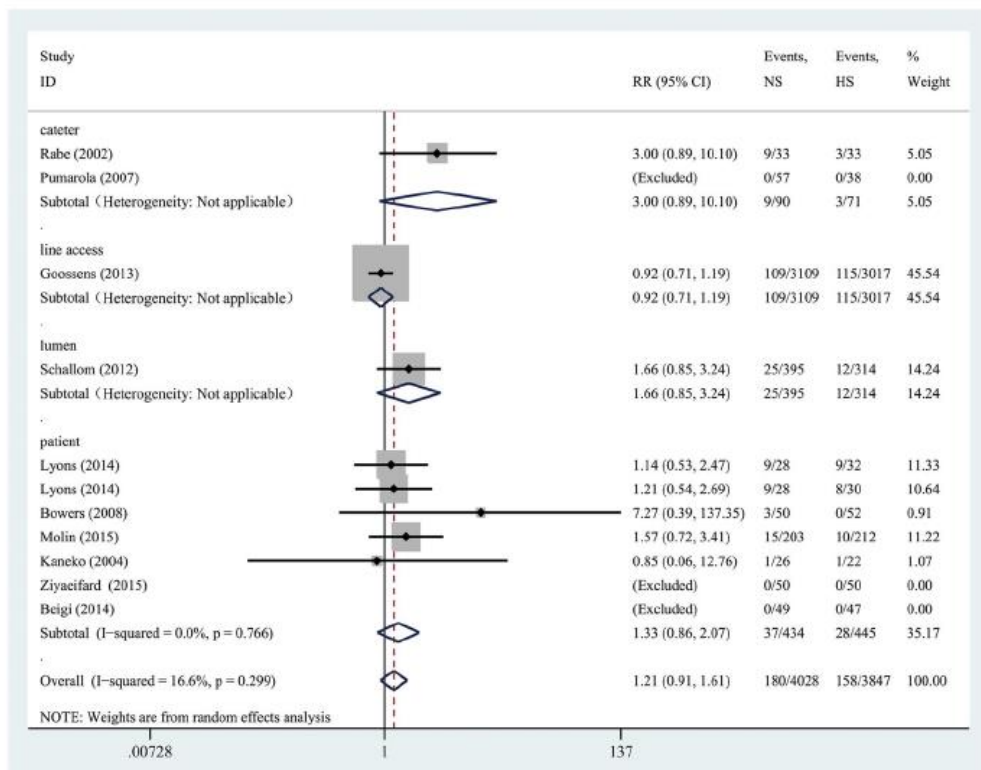


Figure 2. Forest plot showing catheter occlusion between heparin saline and normal saline⁴

Arterial catheters⁵

There is no difference in patency between heparin at a dose of 1-2 IU/mL and normal saline. A difference in patency was found at 4 IU/mL however, this was only from one low-quality study. Meta-analysis was not performed due to the high degree of clinical and statistical heterogeneity of the included studies.

Table 3. Summary of included study characteristics and findings

Paper	Review quality	Evidence quality	Intervention	Comparator	Outcome	Findings
Lopez-Briz et al., 2018 ³	High quality	Low quality	Central venous catheters	Heparin v 0.9% sodium chloride	Occlusion	<p><u>Combined results from these studies showed fewer occlusions with heparin than with NS</u> from very low-quality evidence Risk ratio (RR) 0.70, 95% confidence interval (CI) 0.51 to 0.95; P = 0.02; 1672 participants; 1025 catheters from 10 studies; I² = 14%)</p> <p>Subgroup analysis When the unit of analysis was the type of participant, results show <u>no clear differences</u> in all occlusions between heparin and NS RR 0.79, 95% CI 0.58 to 1.08; P = 0.15; (1672 participants; seven studies).</p> <p>When the unit of analysis was the type of catheter results shows <u>fewer occlusions with heparin use</u> RR 0.53, 95% CI 0.29 to 0.95; P = 0.03; (1025 catheters; three studies).</p> <p>When the unit of analysis was line access, results show <u>no clear differences</u> in occlusions between heparin and NS (RR 1.08, 95% CI 0.84 to 1.40; 770 line accesses; one study).</p> <p><u>No clear differences in the duration of catheter patency</u> Mean difference (MD) 0.44 days, 95% CI -0.10 to 0.99; P = 0.11; 1036 participants; 752 catheters; six studies; low-quality evidence.</p> <ul style="list-style-type: none"> • <u>No clear evidence of a difference</u> in the following: <u>CVC-related sepsis</u> (RR 0.74, 95% CI 0.03 to 19.54; P = 0.86; 1097 participants; two studies; low-quality evidence); • <u>Mortality</u> (RR 0.76, 95% CI 0.44 to 1.31; P = 0.33; 1100 participants; three studies; low-quality evidence); • <u>Haemorrhage</u> at any site (RR 1.32, 95% CI 0.57 to

Paper	Review quality	Evidence quality	Intervention	Comparator	Outcome	Findings
						<p>3.07; P = 0.52; 1245 participants; four studies; moderate quality evidence); or</p> <ul style="list-style-type: none"> • <u>Heparin-induced thrombocytopenia</u> (RR 0.21, 95% CI 0.01 to 4.27; P = 0.31; 443 participants; three studies; low-quality evidence). <p>Summary</p> <p>The main reasons for downgrading the quality of evidence were unclear allocation concealment, imprecision, and suspicion of publication bias.</p> <p>Given the very low quality of the evidence, there is uncertainty whether intermittent locking with heparin results in fewer occlusions than intermittent locking with NS.</p> <p>Low-quality evidence suggests that heparin may have little or no effect on catheter patency.</p> <p>Although there is no evidence of differences in safety (sepsis, mortality, or haemorrhage), <u>the combined trials are not powered to detect rare adverse events such as heparin-induced thrombocytopenia.</u></p>
Zhong et al., 2017 ⁴	High quality	Low quality	Central venous catheters	Heparin v normal saline	Patency	<p><u>Whether in terms of pooled or local analysis (RR with 95% confidence interval spans 1), normal saline can be equally, if not more effective, in keeping the CVCs open.</u></p> <p><u>For secondary outcomes (manoeuvre needed, heparin-induced thrombocytopenia, haemorrhage, central venous thrombosis and catheter-related bloodstream infection), heparinised saline was shown not to be superior to non-heparinised solution.</u></p> <p>Subgroup analysis in patients with short vs long term CVC placement was consistent with the main outcome partly and in particular for maintenance of catheter patency in patients with a long-term placement i.e. >30 days, the RR was 0.97 (n = 6589; 95% CI = 0.76 to 1.23; P = 0.796). However, for patients in whom the catheter was in place for <30 days, the RR was 1.52 (n = 1286; 95% CI = 1.02 to 2.27; P = 0.041).</p>

Paper	Review quality	Evidence quality	Intervention	Comparator	Outcome	Findings
						<p>Summary</p> <p>Based on the results of this meta-analysis, <u>heparin saline is not superior to normal saline in reducing CVCs occlusion.</u></p> <p>But in the <u>short term, the use of heparin saline is slightly superior to normal saline for flushing catheters (from a statistical point of view).</u></p>
Robertson-Malt et al., 2014 ⁵	High quality	Low quality	Arterial lines (patient, catheter, lumen and line access)	Heparin v normal saline	Patency at <30 days & >30 days	<p>A total of seven studies (606 participants) met the inclusion criteria and measured the <u>primary outcome of interest (Patency).</u></p> <p>All studies were at unclear to high risk of bias. Given the high degree of clinical and statistical heterogeneity of the included studies, no meta-analysis was completed.</p> <p>The <u>results from individual studies that compared heparin at a dose of 1 to 2 IU/mL under continuous pressure were imprecise and do not provide definitive evidence of a difference.</u></p> <p>The observed difference with a dose of heparin increased to 4 IU/ mL came from only one study of 30 participants, and the quality of the reported data was poor.</p> <p>Similarly, consistency in assessment and reporting of <u>adverse events such as haematoma, insertion site infection and limb ischaemia</u> was poor.</p> <p>Further research with well-defined primary and secondary outcome measures using a stratified sampling process that accommodates for the different heparin doses commonly used in clinical practice is needed to confirm the trends seen in research results now reported in the literature.</p> <p>Summary</p> <p>The available evidence is of poor quality because of risk of bias and does not provide sufficient information to support the effects of adding heparin (1 to 2 IU/mL) to a maintenance solution (pressurized to deliver 3 mL of flush solution per hour) of 0.9% normal saline in maintaining the patency and functionality of arterial catheters.</p>

Conclusions

Evidence suggests that heparin may have little or no effect on catheter occlusion however, given the low quality of the evidence this is an uncertain conclusion. Poor quality evidence suggests that 0.9% normal saline is as effective as heparin 1 to 2 U/mL in maintaining the patency and functionality of arterial catheters when positioned in the radial artery.

References

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