Efficacy of normal saline solution versus heparin solution for maintaining patency of peripheral intravenous catheters in children

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Record Status
This is a critical abstract of an economic evaluation that meets the criteria for inclusion on NHS EED. Each abstract contains a brief summary of the methods, the results and conclusions followed by a detailed critical assessment on the reliability of the study and the conclusions drawn.

Health technology
Using saline solution flush in maintaining patency of peripheral intermittent intravenous infusion devices (PIID) in paediatric emergency department (ED) patients requiring IV heparin lock placement.

Type of intervention
Treatment.

Economic study type
Cost-effectiveness analysis.

Study population
The study consisted of ED paediatric patients requiring IV heparin lock placement.

Setting
Children's hospital. The economic study was carried out in the USA.

Dates to which data relate
No dates were reported but correspondence with the author indicates that effectiveness and resource use data relate to 1996. The price year was also 1996.

Source of effectiveness data
Effectiveness data were derived from a single study.

Link between effectiveness and cost data
Costing was retrospectively performed on the same patient sample as that used in the effectiveness analysis.

Study sample
Power calculations conducted were not specified in the determination of sample size (correspondence with the author indicates that power calculations were carried out). The study recruited 150 subjects with a mean age of 5.5 years (range: 1 - 22, with only four subjects older than 18). Patients were randomised to the control group (n=77) to receive 3 ml of a 10 units heparin/ml normal saline solution IV flush, or to the treatment group (n=73) to receive 3 ml of normal saline solution only for IV flush. 22-gauge catheters were used in 82% of patients and 24-gauge catheters were used in the remaining 18%. All ED patients requiring heparin lock placement were included in the sample. Diagnoses included a wide range of typical paediatric emergency visits, including sepsis, trauma, rehydration, and antibiotic therapy.
Study design
This was a prospective, randomised, double blind controlled trial, carried out in a single hospital. Patients were assigned to groups by a computer-generated randomisation table. For the heparin lock placement in the ED the study had mean and median durations of 2.89 (range: 0.5 - 24 hours) and 2.5 hours, respectively. The study was set to follow the routine hospital procedure for flushing.

Analysis of effectiveness
The principle used in the analysis of effectiveness was intention to treat. The clinical outcome measures were IV complications including phlebitis, erythema, warmness, tenderness, resistance to flushing, blood return, and use of tourniquet to check blood return. The patient groups were reported to be comparable in terms of demographics.

Effectiveness results
The number of cases for each type of IV complication for the control group and the treatment group, respectively, were as follows:

- phlebitis, 1 and 0;
- erythema, 0 and 0;
- warmness, 1 (the same case) and 0;
- tenderness, 1 (the same case) and 0;
- resistance to flushing, 2 and 4;
- blood return, 59 and 60;
- and use of tourniquet to check blood return, 33 and 35.

The final statistical verdict was that there was no significant difference between the study groups in terms of occurrence of IV complications.

Clinical conclusions
The results suggest that normal saline solution may be an effective alternative to heparin flush in the maintenance of patency in peripheral intermittent IV access devices in the paediatric ED population.

Measure of benefits used in the economic analysis
No summary benefit measure was identified in the economic analysis, and as such, a cost-consequences approach was adopted.

Direct costs
Costs were appropriately not discounted due to short period of follow-up. Quantities were reported separately from the costs. Cost components were reported separately. The cost analysis covered the costs of solutions and nursing time. The patient's perspective was adopted in the cost analysis. Nursing time data were based on previous time studies used to determine "nursing care acuities". Cost data were based on historical financial data on nursing salaries and patient charges for solutions, derived from the study institution. The date of the price data was not explicitly specified, but correspondence with the author has indicated that it was 1996.

Statistical analysis of costs
No statistical analysis was undertaken.
Indirect Costs
Indirect costs were not included but would not be appropriate for the study population and the chosen perspective.

Currency
US dollars ($).

Sensitivity analysis
No sensitivity analysis was undertaken.

Estimated benefits used in the economic analysis
Not applicable due to the cost-consequences approach adopted. The reader is referred to the effectiveness results reported above.

Cost results
The annual total cost for the procedure using heparinised saline was $48,866 versus $19,272 for the normal saline, yielding an annual saving of $27,594.

Synthesis of costs and benefits
Costs and benefits were not combined since the use of normal saline was a (weakly) dominant strategy (achieving the same level of efficacy with lower costs).

Authors’ conclusions
The use of saline solution flush in maintaining patency of PIID was as effective as heparin flush while achieving considerable annual savings.

CRD COMMENTARY - Selection of comparators
A justification was given for the choice of the comparator (the use of heparin flush). It was regarded as a widely used solution in the context in question. You, as a database user, should consider whether this is a widely used health technology in your own setting.

Validity of estimate of measure of benefit
The effectiveness results are likely to be internally valid given the randomised double-blind design adopted in the study. It would have been more helpful to provide details about the baseline characteristics of the study sample by groups. Also, it is not clear whether the sample size provided sufficient power to the study (although this has been confirmed through correspondence with the author). The study was a cost-consequences analysis but this is likely to be the most appropriate approach at the clinician-patient level of analysis adopted in the study.

Validity of estimate of costs
Although the economic analysis was not the main focus of investigation the results are useful to decision-makers. Good features are that quantities were reported separately from the costs and adequate details of the methods of cost estimation were given. However, the retrospective nature of the cost analysis plus the use of charge data tend to limit the generalisability of the findings to other settings. Although the economic analysis is provisional, it provides good evidence for the economic benefits of the intervention although future studies in this area would benefit from a more rigorous approach.
Other issues
The authors' conclusions offer good efficacy evidence in favour of the intervention and strong prospects of economic savings, suggesting dominance, which should be of interest to decision-makers. The economic analysis, although not exhaustive, was a stated objective of the study and offers provisional economic support for the intervention. Future studies would benefit from more detailed economic analyses using appropriate statistical and sensitivity analyses. Appropriate comparisons, however, were made with other studies.

Note: the NHS Centre for Reviews and Dissemination is grateful for useful feedback from the author in clarifying various points and issues concerning this abstract.

Implications of the study
As a result of this study, a change to saline solution IV flushes for these devices was implemented in the study hospital.

Source of funding
None stated.

Bibliographic details

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Other publications of related interest


Indexing Status
Subject indexing assigned by NLM

MeSH
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