Cost-effectiveness analysis of anesthetic agents during peripheral intravenous cannulation in the pediatric emergency department

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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.

CRD summary
This study examined the cost-effectiveness of eight anaesthetic treatments intended to manage pain during peripheral intravenous cannulation in the paediatric emergency department. The authors concluded that needle-free jet injection of lidocaine and the injection of buffered lidocaine were the most cost-effective options. Despite some limitations, the methodology was valid and the authors’ conclusions appear to be appropriate.

Type of economic evaluation
Cost-effectiveness analysis

Study objective
This study compared eight anaesthetic treatments for managing pain during peripheral intravenous cannulation, in the paediatric emergency department, for children aged between three and 18 years.

Interventions
The interventions were: needle-free jet injection of lidocaine (NJILD); buffered lidocaine (1%) injection; lidocaine iontophoresis; nitrous oxide inhalation; heated lidocaine and tetracaine patch; sonophoresis with lidocaine cream (4%); lidocaine cream (4%); and a eutectic mixture of local anaesthetics (EMLA, lidocaine 2.5% and prilocaine 2.5%) cream. These were compared with no anaesthetic.

Location/setting
USA/tertiary care (paediatric emergency department).

Methods
Analytical approach:
A decision tree model was constructed for the economic analysis. The time horizon and the perspective adopted were not explicitly stated by the authors.

Effectiveness data:
The effectiveness data were obtained from randomised controlled trials (RCTs). The methods used to identify these trials, the inclusion and exclusion criteria, and the sources searched were explicitly reported. The primary clinical outcome was pain during intravenous cannulation, which was measured by the self-reported Visual Analogue Scale (VAS) for pain.

Monetary benefit and utility valuations:
Not relevant.

Measure of benefit:
The reduction in VAS units of 1cm was the measure of benefit.

Cost data:
The economic analysis included the cost of the anaesthetic treatments and the cost of parents' time in the emergency department for peripheral intravenous cannulation. These included the fixed costs of the emergency department, administrative costs, and registered nurse, emergency department technician, and physician costs. Treatment costs were
from the authors’ setting. Time in the emergency department for peripheral intravenous cannulation was estimated by the authors using a prospective cohort of 25 patients in their setting. This time was multiplied by the relevant emergency department costs from the hospital’s accounting system. All the unit costs were reported, but the price year was not and discounting was not relevant. All the costs were reported in US dollars ($).

Analysis of uncertainty:
The issue of uncertainty was addressed in two ways. A series of one-way sensitivity analyses was conducted on the key model inputs, using ranges of values derived from the literature or extreme values from the authors’ setting. A probabilistic sensitivity analysis was undertaken to investigate the uncertainty around the cost-effectiveness results.

Results
Only the incremental results were presented and all strategies were compared with no anaesthetic.

Compared with no anaesthetic, NJILD had the best incremental cost-effectiveness ratio of $1.89 per reduction of one additional unit on the VAS. NJILD resulted in a 2.05 reduction in VAS pain score at an additional cost of $3.90 compared with no anaesthetic. The next two best options were buffered lidocaine 1% and iontophoresis.

The deterministic and probabilistic sensitivity analyses demonstrated that these results were robust.

Authors’ conclusions
The authors concluded that NJILD and the injection of buffered lidocaine were the most cost-effective options for pain management in peripheral intravenous cannulation in the paediatric emergency department.

CRD commentary
Interventions:
The interventions were clearly reported and the rationale for their selection was explicit. The authors only included anaesthetic interventions that were available in the US setting. You should decide if these are valid comparators in your own setting.

Effectiveness/benefits:
Some details were provided on the trials that supplied the clinical data, but more information would have been useful. The methods, conduct, and inclusion and exclusion criteria for the literature review were reported. The use of published RCTs to derive the clinical data was appropriate given the strengths of their design. The benefit measure, although relevant, was disease specific.

Costs:
The perspective was not explicitly stated, but it appears from the cost analysis that it was that of the hospital provider. The unit costs were obtained from the authors’ setting. The resource quantities were not reported separately from the unit costs, which will hinder the reworking of the analysis for other settings. The price year was not reported, impeding future reflation exercises. The uncertainty around the cost estimates was investigated in the sensitivity analyses.

Analysis and results:
An incremental approach was undertaken, but each of the interventions was compared against no anaesthetic. If the incremental cost-effectiveness ratios had been calculated comparing all the interventions in ascending order of effectiveness, this would have strengthened the results. The issue of uncertainty was thoroughly investigated using a deterministic and a probabilistic approach. The results of the base case and the deterministic analysis were satisfactorily reported, while the results of the probabilistic analysis were only briefly reported. The authors acknowledged several limitations to their study and these mostly related to the sources used to derive the estimates for the model.

Concluding remarks:
Despite some limitations, the methodology was valid and the authors’ conclusions appear to be appropriate.

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