Complications and cost associated with parenteral nutrition delivered to hospitalized patients through either subclavian or peripherally-inserted central catheters


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
The use of peripherally-inserted central venous catheters (PICCs), utilising a cephalic or basilic venous approach, for the delivery of total parenteral nutrition (TPN) was studied.

Type of intervention
Treatment.

Economic study type
Cost-effectiveness analysis.

Study population
The study population comprised patients aged 18 years and older who required TPN and who had a visible basilic, median cubital, or cephalic vein suitable for cannulation. Exclusion criteria were lack of visible venous access, musculoskeletal and peripheral nervous system pathology affecting extremities where PICCs would normally be placed, and an absolute neutrophil count of less than 500. Patients who had undergone bone marrow or organ transplantation, or who had suspected bacteraemia at the time of catheter insertion, were also excluded.

Setting
The setting was secondary care. The economic study was carried out in the USA, although a more precise location was not stated.

Dates to which data relate
The effectiveness and resource use data related to the time of the study, which was not stated. The price year was also not stated.

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

Link between effectiveness and cost data
The costing was undertaken prospectively on the same patient sample as that used in the effectiveness study.

Study sample
A power calculation indicated that a sample size of 102 patients would be required to detect a difference of 15% in the primary end-point of complications requiring catheter removal, with a power of 80%. It was not stated whether the power calculation was performed during the planning stage of the study or retrospectively. Potential study patients were
recruited after their independent health care providers made the decision to start TPN. The authors did not discuss the suitability of the study sample for the clinical study question. The study sample consisted of 102 patients, 51 randomised to PICC and 51 to centrally-inserted subclavian catheter. It was not stated whether any patients refused to participate or were excluded from the study sample.

Study design
The study was a multi-centred, randomised controlled trial that was carried out in two hospitals (a university teaching hospital and a Veteran’s Administration hospital). The patients were block-randomised according to a schedule generated by the SAS function RANUNI and following a published algorithm (see Other Publications of Related Interest). There appears to have been no loss to follow-up. The study does not appear to have been blinded.

Analysis of effectiveness
The method of analysis was not stated, but all 102 patients appear to have been included in the analysis. The primary end-point was the development of complications that required catheter removal. Chest radiographs were used to identify catheter tip location. The two study groups were said to be similar in age, gender and medical diagnosis, although tests for statistical significance were not reported.

Effectiveness results
The duration of complication-free catheter survival was greater for the subclavian approach, (p<0.05).

PICCs were associated with a greater prevalence of thrombophlebitis than the subclavian approach, 15.4% versus 2.0%, (p<0.0001).

There was no significant difference in the rates of catheter infection between the two study groups.

Clinical conclusions
PICCs are associated with lower rates of complication-free survival than the standard subclavian approach.

Measure of benefits used in the economic analysis
No summary health benefit was used in the economic analysis. Hence, a cost-consequences analysis was performed.

Direct costs
The resource quantities and the costs were not reported separately. The study included hospital costs. The costs used in the analysis were for the insertion kits, the radiographs used to confirm catheter placement, dressing changes, the diagnosis and treatment of catheter complications, and for the health professional’s time taken to insert the catheter. The cost data were taken from the University of Iowa’s Office of Outcomes and Resource Management at the beginning of the study, and these were then applied to resource use collected in the study. Discounting was not necessary since the costs were incurred during less than one year. The study reported the average costs pertaining to the date of the study. These averages were not adjusted for inflation. The costs of venous ultrasound studies were omitted as they were protocol-driven, unless the attending physician specifically requested the test as part of routine care.

Statistical analysis of costs
The authors reported the mean cost per day and standard deviation. These descriptive statistics were suited to normally distributed data, but costs are typically right-skewed, cannot be negative and are therefore non-normal. The Wilcoxon rank-sum test was used to compare mean costs to determine the statistical significance in a two-sided test, where a p-value of less than 0.05 was considered significant. The Wilcoxon rank-sum test is suitable for non-normal data, but it assumes that the data are symmetrical about the median, which may not hold with cost data. There was no power calculation for the costs.
Indirect Costs
The indirect costs were not included in the analysis. This was consistent with the perspective adopted.

Currency
US dollars ($). No conversions were undertaken.

Sensitivity analysis
No sensitivity analyses were carried out.

Estimated benefits used in the economic analysis
See the 'Effectiveness Results' section.

Cost results
The total direct cost of PICCs was $10,756.49. This translates to a mean cost of $22.32 (+/- 2.85) per day of catheter use.

The total direct cost of subclavian catheters was $8,636.40. This translates to a mean cost of $16.20 (+/- 2.96) per day of catheter use.

PICCs were found to be significantly more expensive than subclavian catheters, (p=0.03).

Synthesis of costs and benefits
Not relevant.

Authors' conclusions
Peripheral-inserted central catheters (PICCs) were associated with a lower rate of complication-free survival, greater difficulty in insertion and higher rates of thrombophlebitis. The authors concluded that PICCs are not a cost-effective alternative to subclavian catheters in the population studied.

CRD COMMENTARY - Selection of comparators
The authors chose the comparator on the basis that it was the most commonly used method of delivering TPN in their setting. You should decide whether subclavian catheters are widely used to administer TPN in your own setting.

Validity of estimate of measure of effectiveness
The basis of the analysis was a randomised controlled trial, which was suitable for the study question. There was little discussion of whether the study population was typical of patients requiring TPN in the USA. You, therefore, should decide whether the patient characteristics are typical of those requiring TPN in your own setting. The study groups were said to be comparable at analysis, although statistical tests for differences were not reported. Kaplan-Meier survival curves were used to compare complication-free survival, which was appropriate for the data in question, but no data were given on the covariates considered.

Validity of estimate of measure of benefit
The authors did not derive a summary measure of health benefit. The analysis was therefore categorised as a cost-consequences study.
Validity of estimate of costs
All the categories of cost relevant to the perspective considered were included in the analysis. The costs of venous ultrasound studies were omitted, as they were protocol-driven, unless the attending physician specifically requested it as part of routine care for a patient. The costs and the quantities were not reported separately. Resource use was obtained from a single study. The statistical analysis of the quantities was performed using a chi-squared test. The unit costs were obtained from a university database, although their precise nature was not reported. A sensitivity analysis of the prices was not conducted. Discounting and currency conversions were not required. The date to which the prices related was not reported.

Other issues
The authors made appropriate comparisons of their findings with those from other studies. The issue of generalisability to other settings was not addressed. The authors did not present their results selectively. They also did not extend their conclusions beyond the scope of the study. The authors asserted that a larger dataset would be required to generalise their results to the general population of patients who receive central venous catheterisation.

Implications of the study
The authors recommended that further research, to determine which patient sub-groups may be more suited to PICCs and to identify methods to reduce the rate of PICC-associated complications, should be undertaken.

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Other publications of related interest

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