Femoral shaft fractures in children: traction and casting versus elastic stable intramedullary nailing

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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
The use of skeletal traction and spica casting (TXN/CST) versus elastic stable intramedullary nailing (ESIN) for the treatment of paediatric femoral shaft fractures.

Type of intervention
Treatment.

Economic study type
Cost-effectiveness analysis.

Study population
The study population comprised children with femoral shaft fractures who had at least one-year follow-up of their fractures.

Setting
The setting was secondary care (a children's hospital). The economic analysis was conducted in Cincinnati (OH), USA.

Dates to which data relate
The effectiveness and resource data were collected between January 1995 and April 1998. The price year was 1999.

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

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

Study sample
No power calculations to determine the sample size were reported. All children with femoral fractures admitted at the authors' institution between January 1995 and April 1998 were investigated. Patients with pathologic fractures, incomplete data (clinical, radiographic and costs), and less than 1-year follow-up were excluded (n=10). Sixty-eight patients, representing 71 femoral fractures, were included in the study. There were 42 patients in the ESIN group and 26 patients in the TXN/CST group.

Study design
The study was a retrospective cohort study, which was conducted in a single centre. The duration of follow-up was one year. The patient charts were reviewed and an independent blinded reviewer reviewed 34 of them to ensure accuracy. Parent satisfaction and scar acceptance were evaluated through telephone interviews. The parents of 16 TXN/CST patients (62%) and 27 ESIN patients (64%) were successfully contacted.

**Analysis of effectiveness**
All of the patients included in the study were generally accounted for in the analysis. The exception was parent satisfaction and scar acceptance (i.e. outcomes assessed through telephone interviews). The primary health outcomes used in the analysis were the number of days to radiographic healing, minor and major complications, the number of patients in varus or valgus, and the relative flexion and extension at the final follow-up. In addition, parent satisfaction was assessed through telephone interviews and was compared between the two groups.

The characteristics of the two groups of patients differed slightly. For example, the average age at the time of injury was 8 years 7 months in the ESIN group versus 6 years 9 months in the TXN/CST group. The average weight of the ESIN group was 32.1 kg versus 26.3 kg in the TXN/CST group. The proportion of males in the ESIN group was 76% versus 62% in the TXN/CST group. Oblique fracture patterns were most common in the TXN/CST group (48%), followed by transverse fractures (28%). Transverse fracture patterns were most common in the ESIN group (41%), followed by oblique fractures (26%).

**Effectiveness results**
The average TXN/CST patient spent more than 5 days in the hospital for every one inpatient day for the ESIN group (23.6 versus 4.7 days).

There was no statistically significant difference between the TXN/CST and ESIN groups in either the minor or major complication rates. The minor complication rate was 34% in the TXN/CST group versus 17% ESIN group, (p=0.15). The major complication rates were 10% (TXN/CST) and 5% (ESIN), respectively, (p=0.39).

There was no difference between the two groups in terms of the number of days to radiographic healing. The average was 84 days for TXN/CST versus 91 days for ESIN, (p=0.41).

There was no difference between the two groups in terms of the number of patients in varus or valgus, (p=0.68), and relative flexion or extension, (p=0.3).

The scar compliance was statistically higher in the ESIN group (93%) than in the TXN/CST group (63%). The odds ratio (OR) was 7.5 (95% confidence interval, CI: 1.1 - 65.9; p=0.04).

Parent satisfaction was statistically higher in the ESIN group (96%) than in the TXN/CST group (6%). The OR was 390 (95% CI: 17.6 - 54,599; p<0.001).

**Clinical conclusions**
ESIN treatment achieved equivalent clinical outcomes for the patient, was better tolerated and had a higher rate of parent satisfaction.

**Measure of benefits used in the economic analysis**
The authors did not derive a measure of health benefit. Since the authors concluded that the clinical outcomes were comparable, the study was effectively a cost-minimisation analysis.

**Direct costs**
The perspective adopted was not stated. The average costs were reported. The direct costs were for the hospital (including inpatient and outpatient costs), physician (inpatient and outpatient), radiological examination, physical therapy and facility. The total hospital costs included the costs of the customary room, daily nursing, medication,
operating room, anaesthesia and anaesthesiologist. The hospital costs were obtained through the authors’ institution computerised cost accounting system. The charges were subjected to the hospital’s reimbursement analysis to define cost data. The final cost data would be a percentage of the charges. The physician inpatient costs were calculated using standard International Classification of Disease charge codes. The physician outpatient costs were calculated according to the dates of the clinic encounters. Discounting was unnecessary since all the costs were incurred in one year. The costs and the quantities were not reported separately. Charges for 1999 were used.

**Statistical analysis of costs**
The costs were analysed using Student’s t test.

**Indirect Costs**
No indirect costs were included in the analysis.

**Currency**
US dollars ($).

**Sensitivity analysis**
No sensitivity analysis was carried out.

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

**Cost results**
The total overall cost of treating femoral shaft fractures with ESIN was significantly less expensive ($11,077) than with traditional TXN/CST ($13,490), (p=0.04). A breakdown of the costs follows.

Physician inpatient costs were greater in the ESIN group in terms of the overall surgeon's cost ($1,552 versus $1,106) and the physical therapy costs incurred ($486 versus $134), (p<0.001).

Facility costs were higher in the TXN/CST group ($11,357) than in the ESIN group ($8,139), (p=0.015). This resulted in a slight difference in the overall inpatient costs between the two groups, (p=0.047).

The total outpatient costs were greater in the ESIN group ($608) than in the TXN/CST group ($359), (p=0.04). This resulted from overall higher costs for physical therapy, (p=0.001), radiography (p<0.001), and facility costs, (p<0.001).

**Synthesis of costs and benefits**
Not applicable.

**Authors' conclusions**
Less costs and comparable clinical outcomes make elastic stable intramedullary nailing (ESIN) a better treatment option than traditional skeletal traction and spica casting (TXN/CST) for femoral fracture care in the skeletally immature patient.

**CRD COMMENTARY - Selection of comparators**
The choice of the comparator was clear. The comparator was chosen because it represented a treatment alternative for paediatric femoral fractures. You should consider whether these are widely used technologies in your own setting.
Validity of estimate of measure of effectiveness
The analysis used a retrospective cohort study, which was inappropriate for the study question. There was significant potential for bias, particularly selection bias. There was also significant potential for confounding since a few baseline patient characteristics were not that comparable between the groups. Parent satisfaction was measured retrospectively, suggesting a potential bias in the findings. The sample size was very small, particularly in the TXN/CST group (n=26), which suggested a lack of power calculations.

Validity of estimate of measure of benefit
The authors did not derive a measure of health benefit. As the authors concluded that the clinical outcomes were comparable between the groups, the study was effectively a cost-minimisation analysis.

Validity of estimate of costs
The perspective adopted was not stated, but it is likely to have been that of the health service. It appears that all the categories of costs relevant to the health service perspective were included in the analysis. The authors acknowledged that safe transportation via ambulance, to and from hospital and home, would represent a substantial cost. However, they did not evaluate this. This exclusion may have biased the findings in favour of the TXN/CST intervention. Charges were adjusted to derive cost data using the hospital's reimbursement estimates. Discounting was unnecessary since all the costs were incurred in one year. The costs and the quantities were not reported separately.

Other issues
The generalisability of the results to other settings or countries was not addressed. Adequate comparisons were made with studies dealing with the same topic. The authors highlighted the limitations of their study and do not appear to have reported their results selectively. The authors’ conclusions seemed to reflect the scope of the analysis.

Implications of the study
ESIN of paediatric femoral fractures has become the procedure of choice at the authors’ institution for patients meeting the stated criteria.

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