Isolated closed diaphyseal fractures of the femur in children: comparison of effectiveness and cost of several treatment methods

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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**
Hip spica cast, for the treatment of isolated closed diaphyseal fractures of the femur in children.

**Type of intervention**
Treatment.

**Economic study type**
Cost-effectiveness analysis.

**Study population**
Children aged between 4 and 16 with isolated closed femur fractures.

**Setting**
Hospital. The economic study was carried out in Minnesota, USA.

**Dates to which data relate**
Effectiveness and resource use data related to the period from January 1986 to December 1992. The price date was not stated.

**Source of effectiveness data**
Evidence for final outcomes was based on a single study.

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

**Study sample**
During the study period, 88 children presented with a femur fracture at the study hospital. Of these, 30 patients had an isolated closed diaphyseal femoral fracture, and were eligible for inclusion in the study sample. There were 7 in the hip spica group (mean age 7.5 years, none female), 6 in the cast with pin group (mean age 6.1 years, none female), 6 in the traction group (mean age 10.2 years, one female), 6 in the external fixation group (mean age 10.1 years, one female), and 5 in the intramedullary nail group (mean age 15.3 years, two female). Patients were allocated to treatment options on the basis of fracture type, displacement, over-riding, comminution, social and demographic characteristics and surgeon preference. Power calculations were not used to determine sample size.
Study design
The study was of a prospective case series design. Mean time to final radiographic follow-up examination was 12.25 months (range: 2.3 - 28.4) with no drop outs. Parents of 20 (67%) patients were successfully followed up by telephone interview, an average of 46.5 months post injury.

Analysis of effectiveness
The analysis was based on the whole patient sample. Primary health outcomes were time taken to union and the frequency of complications. Parents' satisfaction with the procedure and their reporting of long term complications was assessed by telephone interview. Groups were not demonstrated to be comparable in terms of clinical or demographic characteristics at the time of analysis.

Effectiveness results
The number of days to union were 66 (range: 44 - 92) in the hip spica group, 61 (range: 44 - 67) in the cast with pin group, 59 (range: 42 - 83) in the traction group, 102 (range: 77 - 165) in the external fixation group and 75 (range: 59 - 88) in the intramedullary nail group. Complications, which were relatively minor and easily corrected, included loss of reduction, cast problems, pin tract drainage, and refracture following discontinuation of primary treatment. There were 5 complications in the hip spica group, 5 in the cast with pin group, 5 in the traction group, 2 in the external fixation group and 1 in the nail group. At the follow up telephone interview, 1 child was reported to have stiffness (traction group), 2 children were reported to have pain (hip spica group and the traction group), 2 had a limp (hip spica group and intramedullary nail group), and 1 child in the intramedullary nail group had activities limited by the injury. 18 (90%) of the 20 parents interviewed were satisfied with the outcome of treatment.

Clinical conclusions
Treatment results were excellent and there was minimal morbidity for all treatment methods. Hip spica cast, with or without a pin, had the shortest time to union but had more complications. Patients treated with an intramedullary nail had fewest complications. Skeletal traction resulted in the longest hospital stays and external fixation was most appropriate for patients unlikely to tolerate casting and at risk of avascular necrosis from femoral nailing.

Measure of benefits used in the economic analysis
Estimates of effectiveness were not converted to a single measure of health benefit.

Direct costs
Costs were analysed from the perspective of the hospital and included hospital charges and physician fees. Hospital charges were taken from computerised records and include average room costs, operating room fees, anaesthesia charges, implant fees, and radiologic charges. Selective costs and quantities were reported separately. The cost of informal care, although acknowledged by the authors in a narrative fashion, was not included in the analysis. The price date was not stated.

Statistical analysis of costs
The average cost and associated range was reported.

Indirect Costs
Not included in the analysis.

Currency
US dollars ($).
Sensitivity analysis
A sensitivity analysis was not performed.

Estimated benefits used in the economic analysis
Not applicable.

Cost results
The total per patient costs were:

- Hip spica group, $5,490 (range: $3,139 - $8,131),
- Cast with pin group, $6,529 (range: $3,510 - $10,332),
- Traction group, $16,273 (range: $9,612 - $28,533),
- External fixation group, $16,394 (range: $11,524 - $20,585),
- Intramedullary nail group, $16,056 (range: $12,420 - $21,314).

Synthesis of costs and benefits
A synthesis of costs and benefits was not performed.

Authors' conclusions
Hip spica casting and casting with a pin were less costly but had a greater incidence of angulation malunion and leg length discrepancy. They were less suitable for older, larger children and girls. Inhospital traction was expensive with a long hospitalisation, but produced good outcomes. External fixation and intramedullary fixation had similar costs to traction and avoided long hospitalisation, but intramedullary fixation was associated with a risk of femoral head necrosis and morbidity due to hardware removal. "Each fracture, child, family and financial considerations should be evaluated for each fracture in order to choose the optimal treatment method."

CRD COMMENTARY - Selection of comparators
The comparators were chosen to represent usual clinical practices. You, the user of the database, should decide if these are widely used technologies in your own setting.

Validity of estimate of measure of effectiveness
The authors used strict eligibility criteria to determine the study sample in order to ensure homogeneity. However, the resulting sample was too small to detect any statistically significant differences in clinical outcomes or in costs. This problem was exacerbated by the non-random method of treatment allocation adopted in the study, which diminished the comparability of the groups. Since the patient groups were not demonstrated to be comparable, the effectiveness of the treatments may be attributable to confounding factors, related to characteristics of the particular patients, rather than to the treatments per se.

Validity of estimate of costs
The authors acknowledged that lower costs for hip spica and cast with pin methods due to short hospitalisation are counterbalanced by the need for care in the home following discharge, but did not estimate the costs of community or informal care. The small sample size means that differences in cost results may not be attributable to differences in treatments.

Other issues
Given the uncertainties in the data relating to the study sample size, the authors' conclusions are not justified.
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