Early versus delayed fixation of pelvic ring fractures

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 effects of early versus delayed surgical stabilisation (operative fixation) of pelvic ring fractures were compared.

Type of intervention
Treatment.

Economic study type
Cost-effectiveness analysis.

Study population
Patients with acute pelvic trauma, with fractures of the pelvic ring requiring operative fixation, were selected for inclusion.

Setting
The setting was tertiary care. The economic study was carried out in an academic teaching hospital in Birmingham (AL), USA.

Dates to which data relate
The effectiveness evidence and resource data were obtained from medical records dating from June 1996 to December 2000. The price year was not reported.

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

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

Study sample
From a review of the medical records of the trauma registry, it was determined that 151 patients had sustained fractures of the pelvic ring during the period under analysis. Of these, 99 patients (65.6%) with Tile Types B and C were considered in the analysis. Patients with Type A fractures (34.4%) were excluded, as these injuries rarely undergo definitive fixation when not associated with additional pelvic injuries (i.e. acetabular fractures). The use of power calculations or blinding of the outcome assessment were not stated.

Seventy-one patients (71.7%) were classified in the early pelvic fixation group, as they had received a definitive operative treatment within one week from the time of injury. Twenty-eight patients (28.3%) were classified in the...
delayed pelvic fixation group. Decisions about the timing of fixation were made independently of the means of admission to the hospital. The early and delayed fixation groups were statistically equivalent in terms of gender, race and mean age. In addition, injury characteristics for both groups were reported.

Study design
The study was a retrospective cohort study that was performed in a single centre. The follow-up period was not specifically reported, but it seems to have been the index hospitalisation period.

Analysis of effectiveness
The primary outcomes used in the analysis were:

- the injury severity score (ISS),
- the timing of operative fixation,
- the incidence of pulmonary complications, and
- the length of stay.

Fisher's exact test was used to compare the proportions of patients in the treatment groups by demographic variables (including gender and race) and mechanism of injury. Student's t-test was used to compare the groups in terms of mean age, ISS, intensive care unit (ICU) days, ventilator support days, and hospital length of stay. Multiple linear regression was used to calculate mean values, adjusting for several confounding variables (e.g. ISS, age, gender and race) and mechanism of injury. The risk of pulmonary complications was calculated for both groups and a proportional hazard modelling was used to compute the risk ratios and 95% confidence intervals (CIs).

Effectiveness results
The mean ISS was 18.8 (standard deviation, SD=10.2) in the early fixation group and 23.2 (SD=13.2) in the delayed group, (p=0.0635).

The mean days of ventilator support was 5.4 (SD=6.5) for the early fixation group versus 13.5 (SD=9.0) for the delayed group, (p=0.0569).

The mean ICU days was 6.1 (SD=5.1) for the early fixation group versus 13.3 (SD=9.0) for the delayed group, (p=0.0073).

Nine patients (12.7%) in the early fixation group and 8 (28.6%) in the delayed group suffered pulmonary complications. Thus, the relative risk (RR) for pulmonary complications among the early fixation group was lower than that of the delayed group (RR 0.44, 95% CI: 0.17 - 1.15). This association reached statistical significance after adjustment for ISS (RR 0.49, 95% CI: 0.25 - 0.96). The addition of age and gender variables to the model did not significantly alter the results.

Clinical conclusions
The average ISS was higher in the delayed fixation group than in the early group, and there were no significant differences in the distribution of fracture patterns among the sub-types. In addition, although the groups were similar in terms of mechanism of injury, injury characteristics, and the number of days spent on a ventilator, they differed significantly in the number of days spent in the ICU. Overall, there was a reduced length of hospital stay and a lower risk for pulmonary complications in the early fixation group.

Measure of benefits used in the economic analysis
The authors did not derive a summary measure of benefit. In effect, a cost-consequences analysis was performed.
Direct costs
The perspective taken was that of the hospital. The costs included the cost of hospitalisation itself, although a detailed breakdown of what this entailed was not given. Post-hospitalisation costs, such as sub-acute care or inpatient rehabilitation stays, were not assessed. Discounting was, appropriately, not carried out because of the short-term horizon of the study. The quantities and the costs were not reported separately. The cost source and date were not explicitly stated.

Statistical analysis of costs
The costs were treated stochastically. Student’s t-test was used to calculate p-values. Multiple linear regression was used to calculate mean values for this variable, adjusting for several potential confounding variables such as ISS, age, gender, race, and mechanism of injury.

Indirect Costs
No indirect costs were reported.

Currency
US dollars ($).

Sensitivity analysis
No sensitivity analysis was reported.

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

Cost results
Among patients undergoing early fixation, there was a reduced cost of care ($57,084 versus $158,625; p=0.0317). Adjustment for the ISS had little impact on the results ($60,687 versus $147,939; p=0.0005). This represented a reduction in hospital cost for the early fixation group of 64.0%.

Synthesis of costs and benefits
The costs and benefits were not combined. No incremental analysis was performed.

Authors' conclusions
These results and other research studies support the evidence that patient outcome could be optimised by the timely surgical stabilisation of pelvic ring fractures. There were statistically significant reductions in the incidence of pulmonary complications, the length of hospital stay, and the overall cost of hospitalisation when patients received fracture fixation within one week of injury.

While the nature of the retrospective study design prevented a definitive statement that early fixation directly resulted in these findings, it clearly presented a statistical association between them.

CRD COMMENTARY - Selection of comparators
A justification was given for the comparators. They represented actual practice, as derived from the medical records of an academic teaching hospital. You should judge whether these treatment strategies are relevant to your setting, or whether other comparators from other treatment modalities could also have been relevant.
Validity of estimate of measure of effectiveness
The analysis was based on a retrospective cohort study. This, as the authors stated, cannot give definitive answers about treatment comparisons, but can suggest them. The study sample was representative of the study population. In addition, the patient groups were shown to be comparable at analysis. Appropriate statistical analyses were undertaken to ensure the comparability of the patient groups. No power calculations were reported. The authors undertook some analyses to adjust for confounding. This will aid the internal validity, which is likely to be quite low given the nature of the study design.

Validity of estimate of measure of benefit
The authors did not derive a measure of health benefit. The analysis were therefore categorised as a cost-consequences study.

Validity of estimate of costs
The authors acknowledged that only the costs associated with hospitalisation itself were considered, although it is unclear what was included in this category. The costs excluded, such as sub-acute care and inpatient rehabilitation stays, were not considered. The costs and the quantities were not reported separately, which limits extrapolation exercises to other settings. It is possible that post-hospitalisation costs could alter the overall costs for care and differences between both groups. The source of the costs was not stated. It appears that the costs have been taken from the authors’ setting, and thus may not be representative of other settings. Although the follow-up period was not stated, it appears to have been only the index hospitalisation period. The price year was not reported.

Other issues
The authors made appropriate comparisons of their findings with those from other studies. However, the issue of the generalisability was not addressed and no variables were subjected to a sensitivity analysis of any type. The conclusions reflected the scope of the analysis.

According to the authors, a strength of the study was the large sample size. In addition, the relatively short timeframe ensured that the operating surgeons, who conducted the surgery, and technique varied little over the course of data accumulation. Even when it was impossible to randomise the patients, the authors stated that selection bias was unlikely to be a significant concern.

The authors reflected about additional limitations, such as the problem of missing information for the total cost of the hospitalisation variable. The proportion of missing information was greatest for patients in the delayed fixation group. Thus, a potential information bias may have been introduced.

Implications of the study
The results of this study showed that early timing of surgery was an important consideration when treating patients with fractures of the pelvic ring. Multidisciplinary teams should make every effort to communicate effectively and apply clinical decisions promptly, so that patients outcomes can be optimised.

Further studies are warranted. In particular, there should be prospective, randomised trials with increased follow-up, further variables to identify the groups as similar in terms of critical care needs, and an analysis of outcomes based on specific fixation constructs.

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