Anterior release and fusion in pediatric spinal deformity: a comparison of early outcome and cost of thoracoscopic and open thoracotomy approaches


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
Thoracoscopic anterior spinal release and fusion for scoliosis or kyphosis.

Type of intervention
Treatment.

Economic study type
Cost-effectiveness analysis.

Study population
Male and female patients undergoing either thoracoscopic anterior spinal release and fusion for scoliosis or kyphosis, or open thoracotomy.

Setting
Hospital. The economic study was carried out in San Diego, California, USA.

Dates to which data relate
The main effectiveness data were obtained from a single study conducted between 1993 and 1994. Resource and cost data were taken from 1993-94 sources. The price year was not stated.

Source of effectiveness data
The estimates for percent curve correction, blood loss and complication rates, operative time, and length of hospital stay were obtained from a single study.

Link between effectiveness and cost data
The costing was undertaken on the same patient sample as that used in the effectiveness analysis. The analysis was undertaken prospectively on the intervention group and retrospectively on the control group.

Study sample
Fourteen consecutive patients in whom the anterior thoracic spinal surgery was performed thoracoscopically and 18 consecutive patients undergoing open thoracotomy were included in the analysis. The ratio of male-to-female patients was 9.5 and 10.8 for the endoscopic and open groups, respectively. The average age of the patients treated with thoracoscopy was 14 (+/- 4.4) years and for patients treated with thoracotomy was 11.3 (+/- 4.5) years. 8 out of 14 patients in the thoracoscopic group had neuromuscular disorders and 5 out of 18 in the thoracotomy group. The preoperative kyphosis was 98 degrees (+/- 28) in the thoracoscopic group and 77 degrees (+/- 19) in the open group.
Preoperative scoliosis values were 84 degrees (+/- 23) and 73 degrees (+/- 18) in the thoracoscopy and thoracotomy groups, respectively. Power calculations to determine the sample size were not undertaken.

**Study design**
Non-randomised trial with historical controls. The duration of the follow-up was not clearly reported but it is likely to correspond to the length of stay.

**Analysis of effectiveness**
The analysis of effectiveness was based on treatment completers only. The primary health outcomes were percent curve correction, blood loss and complication rates, operative time and length of hospital stay.

**Effectiveness results**
The kyphosis correction was performed for 9 patients in the thoracoscopic group and 5 patients in the open thoracotomy group with average percent correction of 88% and 94%, respectively. Scoliosis correction was performed in 7 patients treated with thoracoscopy with an average percent correction of 56% compared with 60% for the 10 patients treated with the thoracotomy approach. The estimated blood loss was 235 (+/- 212) mL and 270 (+/- 154) mL with thoracoscopy and open thoracotomy, respectively, (P=0.6). The operative time was 191 (+/- 39) and 128 (+/- 39) minutes with thoracoscopic and open thoracotomy procedures, respectively (P<0.0001). The number of intensive care unit (ICU) days was 2.0 (+/- 3.1) days with thoracoscopy and 1.2 (+/- 3.5) days with open thoracotomy. The special care unit (SCU) days were 1.8 (+/- 1.4) days and 2.1 (+/-1.6) days with thoracoscopy and open thoracotomy procedures, respectively. The complications encountered with the thoracoscopic procedure were 1 upper respiratory infection, 1 wound infection, 1 pleural effusion and 2 prolonged ICU stay (ventilator support). The corresponding figures for open thoracotomy were 1 wound infection, 1 pleural effusion and 1 prolonged ICU stay (ventilator support).

**Clinical conclusions**
The thoracoscopic technique compared favourably with the standard open thoracotomy in pediatric and adolescent patients with spinal deformity. The ability to perform an effective anterior spinal release for scoliosis and kyphosis was confirmed by the similar percent curve correction obtained with both methods. The technique was performed safely with minimal blood loss and few complications. However, thoracoscopy is technically demanding and requires a substantial commitment to training and education.

**Measure of benefits used in the economic analysis**
No summary benefit measure was used in the analysis and as such the benefits are considered to be the same as the outcome measures.

**Direct costs**
Operative (operative room services: video equipment use, disposable endoscopic instruments, thoracoscopic spinal instruments, bronchoscopic intubation and additional operating time) and postoperative hospital charges and costs were included in the analysis. The quantities were reported separately from the prices. The quantity/cost boundary adopted was the hospital. Discounting was not undertaken due to the short period of the study. The price year was not clearly reported. The difference in costs between the two groups is presented as a percentage difference because the hospital considers absolute cost data to be proprietary information.

**Statistical analysis of costs**
Not undertaken.
Not considered.

Currency
US dollars ($).

Sensitivity analysis
No sensitivity analysis was performed.

Estimated benefits used in the economic analysis
The kyphosis correction was performed for 9 patients in the thoracoscopic group and 5 patients in the open thoracotomy group with average percent correction of 88% and 94%, respectively. Scoliosis correction was performed in 7 patients treated with thoracoscopy with an average percent correction of 56% compared with 60% for the 10 patients treated with the thoracotomy approach. The estimated blood loss was 235 (+/- 212) mL and 270 (+/- 154) mL with thoracoscopy and open thoracotomy, respectively, (P=0.6). The operative time was 191 (+/- 39) and 128 (+/- 39) minutes with thoracoscopy and open thoracotomy procedures, respectively (P<0.0001). The number of intensive care unit (ICU) days was 2.0 (+/- 3.1) days with thoracoscopy and 1.2 (+/- 3.5) days with open thoracotomy. The special care unit (SCU) days were 1.8 (+/- 1.4) days and 2.1 (+/-1.6) days with thoracoscopy and open thoracotomy procedures, respectively. The complications encountered with the thoracoscopic procedure were 1 upper respiratory infection, 1 wound infection, 1 pleural effusion and 2 prolonged ICU stay (ventilator support). The corresponding figures for open thoracotomy were 1 wound infection, 1 pleural effusion and 1 prolonged ICU stay (ventilator support).

Cost results
The operative and postoperative charge was $54,910 (+/- $15,546) for the patients treated with thoracoscopy and average charge for the open thoracotomy group was $48,025 (+/- $19,836). The charges related the operating room services were $29,426 and $24,841 for the thoracoscopic and the open thoracotomy procedures, respectively. Average hospital costs per case demonstrated the open procedure to be 29% less costly than the thorascopic procedure (p<0.01).

Synthesis of costs and benefits
Costs and benefits were not combined.

Authors' conclusions
The thoracoscopy technique is a safe and effective alternative to open thoracotomy in the approach to the anterior thoracic spine for the treatment of pediatric and adolescent spinal deformity. However, the technique is significantly more costly to perform because it is more technically demanding for the surgeon.

CRD COMMENTARY - Selection of comparators
The reason for the choice of the comparator is clear. The thoracoscopic approach is a minimally invasive method for the care of spinal disorders. The procedure has become more widely adopted due to recent advances in video capabilities, its reduced invasiveness and the limits it holds in terms of skin and muscle division. Open procedures are the traditional alternative.

Validity of estimate of measure of benefit
No summary benefit measure was used and as such the authors have performed a cost and outcomes analysis. The data have not been used selectively but a full economic evaluation using one benefit measure would assure greater validity in terms of economic evaluation.
Validity of estimate of costs
Resource quantities were reported separately from the prices. Adequate details of methods of quantity/charges estimation were given. Important charge items do not appear to have been omitted. However, as noted by the authors, in July 1994 the software was updated to assign cost more accurately. As such the comparability of the cost data from early in the study (control group) with that from later in the study (intervention group) was limited. A ratio of costs was provided and, by presenting only charges, the generalisability of the results is difficult to assess. The perspective is limited to the hospital and therefore cannot represent a societal or patient perspective.

Other issues
The authors’ conclusions are likely to be justified given the uncertainties in the data. However, as the authors noted, the fact that the two study populations were not identical limits the robustness of the findings. The issue of generalisability to other settings or countries was not addressed. However, appropriate comparisons were made with other studies particularly in terms of results obtained in other studies where the thoracoscopic method was compared with the open thoracotomy approach. The results do not appear to have been presented selectively.

Implications of the study
Further research is required to includelong-term assessment of the efficacy of the thoracoscopic approach in obtaining solid anterior fusion, preferably within the context of a multi-centre controlled trial.

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