Lumbar osteotomy for correction of thoracolumbar kyphotic deformity in ankylosing spondylitis: a structured review of three methods of treatment

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Authors' objectives
To assess the quality of reported articles concerning lumbar osteotomy for correction of thoracolumbar kyphotic deformity of the spine resulting from ankylosing spondylitis and to compare the outcomes of opening wedge osteotomy, polysegmental wedge osteotomy, and closed wedge osteotomy.

Searching
MEDLINE was searched for reports published in English, French or German between 1966 and 1998. Reference lists of all publications were screened.

Study selection
Study designs of evaluations included in the review
Reports concerning lumbar osteotomies with the following criteria were included in the review: at least four patients treated by the same method; included details of patients age and sex, level of correction, radiographic degrees of correctness; and reported complications and subjective patient outcomes. Reports with at least ten patients and sufficient clinical information were analysed for demographic data.

Specific interventions included in the review
Anterior opening wedge osteotomy according to Smith-Petersen referred to as opening wedge osteotomy (OWO), polysegmental lumbar posterior wedge osteotomy referred to as polysegmental wedge osteotomy (PWO) and monosegmental posterior closing wedge osteotomy referred to as closed wedge osteotomy (CWO) were included.

Participants included in the review
Patients with thoracolumbar kyphotic deformity (TLKD) of the spine resulting from ankylosing spondylitis (AS) were included. Mean age at time of operation was 41 years (range 19 to 70 years), with overall male: female ratio 7.5:1.

Outcomes assessed in the review
The following "technical" outcomes were assessed: pre and post operative assessment; mortality; degree of post-operative correction; degree of correction at follow-up; loss of correction; superficial infection; deep infection; re-operation; pseudoarthrosis; neuropraxia; retrograde ejaculation; paralysis; and implant failure. Results were graded as good (fusion and consolidation, loss of correction up to ten degrees and no implant failure), fair (pseudoarthrosis or loss of correction greater than ten degrees, neuropraxia, deep infection, or re-operation or implant failure) or poor (no correction achieved, recurrent deformation, paralysis, vascular complications or fatal complications).

How were decisions on the relevance of primary studies made?
The authors do not state how the papers were selected for the review, or how many of the the reviewers performed the selection.

Assessment of study quality
The authors do not state that they assessed validity.

Data extraction
The following data were extracted: first author; number of patients overall and by surgical technique; methods used for pre-operative assessment; post-operative treatment; outcome measures (radiographic degree of correction, level of surgical procedure, age and sex); and number experiencing each specified complication. The authors do not state how
data were extracted for the review, or how many of the reviewers performed the data extraction.

**Methods of synthesis**

How were the studies combined?

Results were summed across studies separately for the three surgical techniques.

How were differences between studies investigated?

Outcomes from individual studies were presented in tables. No formal statistical test for heterogeneity was undertaken.

**Results of the review**

Forty-one reports were included (N = 856 patients). Of these, 16 studies were analysed for technical outcomes (523 patients) and 14 reports including 589 patients met the criteria for demographic analysis.

OWO was performed in 450 patients (29 reports), PWO was performed in 249 patients (5 reports) and CWO was performed in 156 patients (8 reports). One report included patients undergoing either OWO or CWO.

Because of insufficient clinical data in most reports, statistical analysis of the technical outcome of the three techniques was not feasible.

Technical outcomes. Of these, 9 reports (224 patients) dealt with OWO, 4 reports (248 patients) dealt with PWO and 4 reports (51 patients) dealt with CWO.

Few authors described their pre-operative assessment. Post-operatively, all authors advocated a plaster thoracolumbar sacral orthosis (TLSO) immobilisation with one leg included. Duration of immobilisation ranged from two to four months in CWO and six weeks to fifteen months in OWO and PWO.

Peri-operative mortality: overall 4% (34/856) mostly (76%) caused by post-operative pulmonary and intestinal problems, cardiac failure, and sepsicaemia. Peri-operative mortality by technique: OWO 5.8% (26/450); PWO 2.4% (6/249); CWO 1.3% (2/156). 0.94% (8/856) died from vascular complications.

Comparison of neurological complications and comparison of good vs poor post-operative outcomes for different surgical technique.

OWO (9 reports, 224 patients): neuropraxia 8.5%; paralysis 3.1%; results good 73%; results poor 27%.

PWO (4 reports, 247 patients): neuropraxia 11.3%; paralysis 2.0%; results good 69%; results poor 31%.

CWO (4 reports, 51 patients): neuropraxia 7.8%; paralysis 0%; results good 78%; results poor 22%.

Degree of surgical correction (330 patients): average post-operative correction achieved in the lumbar spine ranged from 37 to 40 degree for the three techniques. Loss of correction was mainly reported in OWO (mean 3.9 degrees) and PWO (mean 6.0 degrees). Only one CWO report gave data on loss (2.7 degrees).

Many complications have been reported including dural lacerations, transient nerve root dysfunction (reported equally in all surgical techniques), permanent neurological complications, transient and permanent retrograde ejaculation (after OWO in 7 patients), implant breakage and loosening of the rod-screw connection (OWO: 3.6%; PWO 6.5%; CWO 3.8%); screw breakdown of the pedicle during correction has been reported in PWO patient with osteopotic bone; re-operation in 7 patients (OWO 3.1%; PWO 9.7%; CWO 5.9%); and deep and superficial infection rates up to 43% were reported in some series.

**Authors’ conclusions**

Lumbar osteotomy for correction of TLKD resulting from AS is a major surgery. The indications for these lumbar osteotomies as well as the degree of correction in the lumbar spine has not been established. Furthermore, there is a
need for a generally accepted clinical score that encompasses accurate pre-operative and post-operative assessment of 
the spinal deformity. The results of this review suggest that the data from the literature are not suitable for decision 
making with regard to surgical correction of TLKD resulting from AS.

CRD commentary
The aims and inclusion criteria were specified. Only studies adequately reporting specified information were included. 
Relevant details from individual studies were presented in tabular format. The discussion includes appraisal of the 
limitations of the evidence available from the primary studies.

Limiting included studies to published reports identified in one database may have omitted some relevant studies. 
Keywords were not reported. Publication bias may have arisen from the application of language restrictions. Methods 
used to select primary studies and extract data were not described. No validity assessment was undertaken. It is not clear 
how representative the results are of all such operations being performed. Duration of follow-up was not reported.

The authors’ conclusions were supported by the evidence presented.

Implications of the review for practice and research
Practice: The authors state that the data are not suitable for decision-making with regard to which surgical treatment is 
preferable.

Research: The authors state that there is a need for a generally accepted clinical score that encompasses accurate 
measurements needed for the pre-operative and post-operative assessment of the spinal deformity in patients with 
thoracolumbar kyphotic deformity of the spine resulting from ankylosing spondylitis.

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This is a critical abstract of a systematic review that meets the criteria for inclusion on DARE. Each critical abstract
contains a brief summary of the review methods, results and conclusions followed by a detailed critical assessment on the reliability of the review and the conclusions drawn.