

Scoring systems to suggest surgical intervention in degenerative spondylolisthesis - a retrospective study

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Objective

Find out if scoring systems can be utilized to suggest surgical interventions on degenerative spondylolisthesis in lumbar spine (DSLS) by performing a retrospective study.

Introduction

Degenerative spondylolisthesis is a common spinal pathology where one vertebral body slips forward over the vertebral body below due to aging processes that weaken the spine¹. Slippage can induce radiculopathy which leads to symptoms such as back pain, sciatica or even loss of bladder function.^{3 6}

The primary surgical intervention available to DSLS patients is a decompression surgery, where segments of vertebra are removed to relieve pressure on nerves. Further interventions such as posterior fusions (PF) where posterior segments of the spine are fused together to prevent further slippage. The creation of minimally invasive lumbar interbody fusions (LIF) such as TLIF's and PLIF's are a part of a spinal surgeons arsenal to treat DSLS.^{1 5 2}



Despite these advancements, there is no agreed system or guidelines to help surgeons in select which interventions are best to treat DSLS cases. The aim of this study was to find which scoring systems are available to suggest surgical interventions for DSLS cases and assess their potential for clinical use.

Method

Two potential scoring systems were identified through an initial review of the literature; the degenerative spondylolisthesis instability classification⁷ (DSIC) and the University of California San Francisco Degenerative Spondylolisthesis⁴ (UCSF DS) classification system. Both scoring systems use a combination of clinical and radiological information to categorize DSLS cases - both are able to suggest interventions ranging from decompression alone to decompression with PF and LIF

DSIC SCORING SYSTEM⁷

Parameter	Type 1 - Stable Decompression Alone	Type 2 - Potentially Unstable Decompression + PF	Type 3 - Unstable Decompression +PF+LIF
Low Back Pain	None or Very Mild	Primary/Secondary Complaint	Primary/Secondary Complaint
Disc Angle	Lordotic Disc Angle or <3mm of translation	Neutral Disc Angle or 3-5 mm of translation	Kyphotic Disc Angle or >5mm of translation
Joint Effusion	No Facet Joint Effusion	Facet Joint Effusion without joint distraction	Large facet joint effusion
Rehabilitation	Grossly narrowed disc height	Reduced Disc Height	Normal to slightly reduced disc height

UCSF DS SCORING SYSTEM⁴

Parameter	Decompression Alone	Decompression + PF	Decompression +PF+LIF
Primary Clinical Presentation	Primarily Leg Pain	Both Leg and Back Pain	Primarily Back Pain
Disc Angle	Lordotic Disc Angle or <3mm of translation	Neutral Disc Angle or 3-5 mm of translation	Kyphotic Disc Angle or >5mm of translation
Joint Effusion	No Facet Joint Effusion	Facet Joint Effusion without joint distraction	Large facet joint effusion
Rehabilitation	Grossly narrowed disc height	Reduced Disc Height	Normal to slightly reduced disc height

89 DSLS cases affecting the L4/L5 vertebra were collated from the Cardiff Spinal Surgery Database. Both scoring systems were retrospectively applied to these cases and suggested interventions were compared with the actual intervention used. Statistical analysis was performed to produce results.

Results

F1 scores (harmonic mean of precision and accuracy) were calculated for each system. UCSF DS pulled ahead of DSIC with an F1 score of 0.438 against 0.371. However a score of 0.438 is relatively low so further investigation was done by comparing suggested and actual surgeries.

We calculated the following for each scoring system in each case:

- Underestimations - Where suggested surgeries were less invasive than the actual surgery
- Overestimations - Where suggested surgeries were more invasive than the actual surgery
- Exact Matches - Where suggested surgeries were the same as the actual surgery

Scoring System	Underestimations	Overestimations	Exact Match
DSIC	23.6%	39.3%	37.1%
UCSF DS	41.6%	14.6%	43.8%

UCSF DS displays a high percentage of underestimations and exact matches. In the dataset we assume all surgeries had completely successful outcomes. This would indicate that the scoring system is suggesting less invasive surgeries that could be just as effective as the one performed.

Conclusions

Of the two scoring systems UCSF DS displayed the most potential as a scoring system to suggest surgical interventions in DSLS. It displayed the highest F1 score of the two tested scoring systems.

Furthermore, it tended to suggest less invasive surgical interventions in the dataset, which, given assumptions in the dataset, would mean UCSF DS could improve patient outcomes with less invasive interventions and save the NHS money on operations.

Further study is indicated to prove the efficacy of these scoring systems, this study shows there is significant potential for these scoring systems to be used in practise to improve patient outcomes and reduce NHS costs.

Improvements and Limitations

- As this was a retrospective study, we cannot look at the direct efficacy of these scoring system. Further study with prospective surgeries would be required
- The lack of QoL scoring pre and post operatively limited our ability to assess if a surgery in the dataset could be improved therefore it was assumed all surgeries had 100% success and improvement of patient QoL
- Potential improvements to the scoring systems were identified during the study, such as adding further clinical factors (i.e

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