



Does kyphotic configuration on upright lateral radiograph correlate with instability in patients with degenerative lumbar spondylolisthesis?



Xi Chen¹, Qing-shuang Zhou¹, Liang Xu, Zhong-hui Chen, Ze-zhang Zhu, Song Li, Yong Qiu, Xu Sun*

Department of Spine Surgery, Drum Tower Hospital Clinical College of Nanjing Medical University, Nanjing, China

ARTICLE INFO

Keywords:

Degenerative lumbar spondylolisthesis
Kyphotic configuration
Lumbar instability

ABSTRACT

Objective: To investigate the segmental instability of degenerative lumbar spondylolisthesis (DLS) with a kyphotic configuration at the involved segment, and to determine the most useful diagnostic modalities in the evaluation of instability.

Patients and methods: This study reviewed a consecutive series of patients with L_{4/5} DLS between July 2010 and May 2016. The enrolled patients were divided into two groups based on preoperative neutral radiographs: the kyphotic group (Group K) and non-kyphotic group (Group NK). Translational and angular motion was determined by comparing upright lateral radiograph (U) with a supine sagittal MR image(S) (Combined, US) or flexion/extension radiographs (FE).

Results: There were 26 and 201 patients in Groups K and NK, respectively. In comparison to Group NK, Group K demonstrated significantly higher translational motion (12.4% vs. 7.0%, $P < 0.001$) on US analysis, but significantly lower translational motion (4.2% vs. 6.4%, $P < 0.001$) on FE analysis. Angular motion was detected to be significantly lower in US versus FE in Group NK (1.2° vs. 7.8°, $P < 0.001$), while of no difference in Group K ($P > 0.05$). In Group K, “instability” was recognized in 84.6% of patients using US versus 11.5% patients using FE ($P < 0.001$); While in Group NK, no significant difference was observed in the incidence of “instability” between FE and US (31.3% vs. 27.8%, $P = 0.444$). Overall, Group K had a significantly higher incidence of instability than Group NK (84.6% vs. 31.3%, $P < 0.001$).

Conclusion: DLS with a kyphotic configuration is a distinct subgroup associated with segmental instability. The modality of US is shown to be superior to traditional FE in measuring translational motion and identifying instability for DLS patients with a kyphotic configuration.

1. Introduction

The combination of disc degeneration, facet joint hypertrophy, ligament thickening and segmental instability in degenerative lumbar spondylolisthesis (DLS) often results in back pain and neurogenic claudication, which frequently requires surgical intervention [1,2]. Although there are multiple modalities of surgical treatment for symptomatic DLS, including decompression, fusion with or without instrumentation, and interbody fusion, controversy persists for determining the optimal surgical option for DLS in certain clinical scenarios [3]. According to recent surveys on surgical intervention for DLS, segmental instability is a key factor in determining the treatment algorithm, which is largely based on concerns about iatrogenic

destabilization of the olisthetic segment leading to poor long-term results [4–6].

From a radiographic view, segmental instability of DLS is defined as either the abnormal alignment of spinal segments or, in a broader definition, excessive mobility and angulation at the olisthetic segment [7]. Because degenerative changes of the disc and facet joint may hinder angular motion, abnormal angulation is a poor method to reveal segmental instability [2]. Therefore, the criterion of instability is commonly set as a translational motion > 3 mm and/or $> 8\%$ of the width of the above adjacent vertebra [2,8]. Various positions of patients have been measured to estimate the instability on roentgenography, among which lateral dynamic flexion and extension radiography (FE) is typically used to evaluate intersegmental hypermobility [9]. Additionally, a

* Corresponding author at: Department of Spine Surgery, Drum Tower Hospital Clinical College of Nanjing Medical University, Zhongshan Road 321, Nanjing 210008, China.

E-mail address: drsunxu@163.com (X. Sun).

¹ Xi Chen and Qing-shuang Zhou are co-first authors.

<https://doi.org/10.1016/j.clineuro.2018.07.020>

Received 19 June 2018; Received in revised form 21 July 2018; Accepted 28 July 2018

Available online 30 July 2018

0303-8467/ © 2018 Elsevier B.V. All rights reserved.

combination of upright lateral X-ray and supine MR images has been reported to yield results at least comparable to those of FE in evaluating instability of DLS, which is an easily available, alternative diagnostic modality to FE [8].

However, controversy remains as to whether disc degeneration or facet joint arthrosis is the initiating cause of DLS. Moreover, disc degeneration is a common pathway in pathology of DLS, which results in decreases in disc height [10]. In terms of slip configuration at the olisthetic level, two distinct subtypes separated by slip angle and kyphotic and non-kyphotic angulation were identified in clinical practice. A kyphotic configuration is primarily characterized by a kyphotic slip angle on a neutral lateral radiograph and a posterior disc height higher than the anterior disc height, whereas a non-kyphotic slip angle has a lordotic slip angle with a higher anterior disc height [5].

Recently, increased concern has arisen regarding the subset of DLS patients with a kyphotic configuration [11]. This kyphotic subset and those with decreased segmental lordosis need to be identified as a separate group of DLS, as discussed in recent classification schemes of DLS [11,12]. However, there remains a paucity of data on the stability of DLS patients with different slip configurations. Furthermore, the modalities that can provide a more accurate assessment of stability in DLS with different slip configurations are unclear. Therefore, the current study was performed to determine the segmental stability and motion characteristics of kyphotic versus non-kyphotic spondylolisthesis through FE and US modalities and to determine whether US or FE is better able to identify instability.

2. Materials and methods

2.1. Patients

After obtaining institutional review board approval, we retrospectively reviewed the records of patients with symptomatic DLS who underwent surgical intervention at our center between July 2010 and May 2016. Patients enrolled in this study had to meet the following inclusion criteria: (1) mono-segment L_{4/5} DLS; (2) low-grade lumbar spondylolisthesis (Meyerding's grade I-II); and (3) a complete set of radiological examinations, including upright neutral, flexion/extension radiographs, and supine MR images. Patients were excluded for any of the following criteria: (1) lumbar scoliosis greater than 10°; (2) isthmic spondylolisthesis; (3) spondylolisthesis at any other level in the lumbar spine; and (4) prior history of spinal trauma, surgery or infection.

2.2. Baseline characteristics evolution

Baseline characteristics included patients factors (age, gender, BMI, and work status), basic radiographic parameters on X films or MR images (slip percentage, slip angle, anterior and posterior disc height), and patient-reported outcomes [13]. The Oswestry disability index (ODI) scale and the visual analogue scale (VAS) of leg pain and back pain were used to evaluate patient-reported outcomes [11,14].

2.3. Radiographic evaluation

All parameters were measured twice by a single spine surgeon, and the mean values were used for the analysis. Slip distance was measured as the interval between two extended lines of the posterior aspects of the L4 and L5 vertebral bodies [15]. The slip percentage (SP) was measured as ratio of the slip distance to the length of the upper endplate of L₅. The anterior disc height (ADH) was measured as the distance between the most anterior point of the upper and lower end plates, whereas the posterior disc height (PDH) was measured as the distance between the most posterior point of the upper and lower end plates [10,16]. To control the magnification bias in the radiographs, we calculated the ratio of the disc height to the length of the upper endplate of the L₄. The slip angle (SA) was measured as the angle between the

lower L₄ endplate and upper L₅ endplate. For the angulation measurement, positive values denoted lordosis, whereas negative values indicated kyphosis.

2.4. Measurement and definition of instability

All supine MR images, and upright lateral, flexion/extension radiographs were obtained by the same team of technologists in our hospital as the routine workup for evaluating DLS. As described in previous studies, two common methods were used to evaluate the potential instability: (1) FE radiographs and (2) an upright lumbar lateral radiograph (U) with a supine sagittal MR image (S) (combined, US) [8]. The translational motion was measured as the sagittal translation distance of the slipped vertebra from either F to E or U to S, and the percentage of the translation distance to the above adjacent vertebra was used for the final analysis [8]. Angular motion was also measured as the difference of the intervertebral angles from E to F or S to U [14]. A translational motion > 8% and/or > 3 mm was identified as instability [8,15,17].

2.5. Study groups

The enrolled patients were divided into two groups, the kyphotic group (Group K) and the non-kyphotic group (Group NK), based on the slip configuration on the preoperative neutral radiographs. Group K included patients with a preoperative intradiscal kyphotic configuration, which was defined as a condition in which the anterior disc height was less than the posterior disc height at the olisthetic level in the upright neutral position [5]. Group NK included patients with a non-kyphotic configuration.

2.6. Statistical analysis

Two primary analyses were conducted. First, baseline characteristics were compared between Group K and Group NK. Second, the segmental mobility and ability to identify the instability using US were compared with FE. All data were analyzed using SPSS version 17.0 (SPSS, Chicago, IL, USA). The paired *t*-test was used to analyze the intra-group differences determined by FE and US. The independent samples *t*-test or Chi-square tests were used to analyze the differences between Group K and Group NK. A *P* value < 0.05 was considered statistically significant.

3. Results

3.1. Baseline characteristics analysis

A total of 227 consecutive patients (45 males and 182 females) were included in this study. The average age was 59.6 ± 10.4 years (range: 41–75 years). Twenty-six (11.5%) patients were assigned to Group K. No difference was observed in age, gender, BMI and work status between Group K and Group NK (Table 1).

As revealed in the preoperative neutral radiographs, Group K was characterized by a prominently intradiscal kyphotic angulation ($-3.1^\circ \pm 2.3^\circ$ vs. $7.9^\circ \pm 4.7^\circ$, $P < 0.05$), collapse of the anterior disc space (0.18 ± 0.09 vs. 0.28 ± 0.10 , $P < 0.05$) and more listhesis ($22.8\% \pm 4.1\%$ vs. $19.6\% \pm 3.7\%$, $P < 0.05$). For patient-reported outcomes, Group K had worse preoperative back pain (7.4 ± 1.6 vs. 5.1 ± 1.3 , $P < 0.01$) and ODI scores (47.2 ± 9.3 vs. 43.0 ± 8.1 , $P = 0.040$), but no difference was observed for VAS leg pain (Table 1).

3.2. Evaluation of motion using FE or US

The measurements of SP and SA with various views are summarized in Table 2. In Group K, the transitional motion determined by US was significantly higher than that determined by FE ($P < 0.05$), whereas in

Download English Version:

<https://daneshyari.com/en/article/8681625>

Download Persian Version:

<https://daneshyari.com/article/8681625>

[Daneshyari.com](https://daneshyari.com)