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GRAND ROUNDS

The management of high-grade spondylolisthesis and co-existent late-onset idiopathic scoliosis

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Abstract

Introduction It is relatively common for a scoliosis deformity to be associated with a lumbar spondylolisthesis in adolescents (up to 48 % of spondylolistheses). In the literature two types of curve have been described: 'sciatic' or 'olisthetic'. However, there is no consensus in the literature on how best to treat these deformities. Some authors advocate a single surgical intervention, where both deformities are corrected; whereas, others advocate treating them as separate entities. In this situation, it has been shown that the scoliosis will correct with treatment of the spondylolisthesis.

Materials and methods We present a 12-year-old girl who had a concomitant high-grade spondylolisthesis and scoliosis. Her main complaints were those of low back pain and an L5 radiculopathy. We took the decision to treat the spondylolisthesis surgically, but observe the scoliosis, rather than correcting them both surgically at the same sitting.

Results Although the immediately post-operative radiographs showed persistence of the scoliosis, 1-year follow-up demonstrated full resolution of the deformity. This young lady also had relief of her low back pain and leg pain following the surgery.

Conclusion There are no standard guidelines and therefore, we discuss the management of this difficult problem, exemplifying a case of a young girl who had high-grade spondylolisthesis along with a clinically non-flexible scoliosis treated at our institution. We demonstrate that it is safe to observe the scoliosis, even in high-grade spondylolistheses.

Keywords High-grade spondylolisthesis · Adolescent idiopathic scoliosis · Co-existent

Case presentation

A 12-year-old girl presented to our outpatient department with complaints of progressive low back pain and left-sided L5 radiculopathy. On inspection, she needed to flex her knees and hips to maintain her sagittal balance. It was also noted that she tended to lean to her right in the coronal plane, which partially corrected when she sat up on the examination couch. The neurological examination was normal, although the straight leg raise test was positive at 50° for radicular pain on the left side. Hip and knee examinations were normal.

Standing whole spine radiographs (Fig. 1) demonstrated a grade IV spondylolisthesis (95 %) at L5/S1 associated

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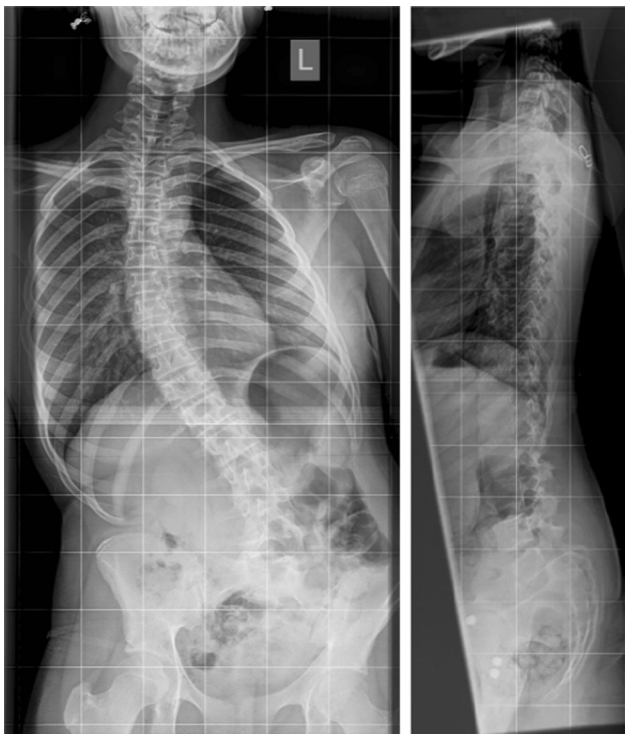

Fig. 1 AP and lateral radiograph demonstrating spondylolisthesis and scoliosis

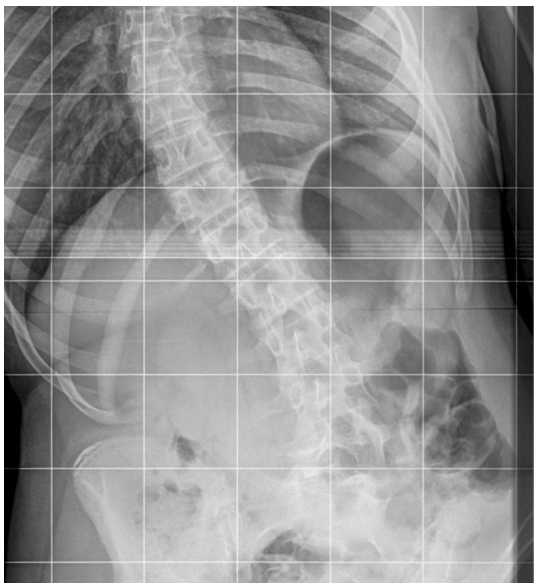

Fig. 2 AP lumbar spine magnified to show rotation of L5 pedicles

with a rigid thoracolumbar scoliosis and retroverted pelvis. There was significant coronal (10 cm) and sagittal imbalance. The scoliotic curve had two components: a lumbar curve which extended from L2 to S1 measuring 44°, and the second compensatory thoracic curve measuring 36° from T6 to L1. The curve did not correct on clinical examination. There was significant rotation of the pedicles in the L5 vertebra, whereas the rest of the lumbar and thoracic spine did not show any rotation (Fig. 2).

An MRI was obtained and this was negative for spinal dysraphism, but there was compression of the L5 nerve roots as they exited through their foramen. The olisthesis was noted to partially reduce to grade III on MRI, indicating that it was a mobile luxation.

Unfortunately, this young lady complained of progressive symptoms whilst waiting for surgery, deteriorating to the point where she became wheel-chair bound from her pain and gait instability.

Historical review of the condition, epidemiology, diagnosis, pathology, differential diagnosis

High-grade spondylolisthesis in the paediatric age group has been associated with scoliosis in several case reports [1–4], with up to 48 % of spondylolistheses of any type developing some sort of scoliosis deformity [2]. The most common pattern of curve is lumbar, which is usually flexible. There are case reports in the literature, which debate the optimal management of these deformities when the two occur concomitantly in a single patient [5–7]. There are those who recommend treating each disorder on an individual basis [5, 6], and others who subscribe to the view that they should be treated together as one pathology [7]. The difference in opinion becomes greater when the spondylolisthesis is high-grade, and is associated with a scoliosis, which appears to be rigid.

The concomitant association of scoliosis with spondylolisthesis has been a matter of great debate. The traditional view attributes the development of scoliosis, secondary to the presence of spondylolisthesis, to one of the following reasons:

First it can be “sciatic” in nature, where the entrapment of the L5 nerve root leads to severe radiculopathy, which in turn leads to altered posture in order to relieve the tension on the nerve root [7, 9, 10]. This altered posture leads to a compensatory curve in the spine, which translates into a ‘sciatic’ or ‘antalgic’ scoliosis. Typically these curves are flexible and have no significant rotation.

On the other hand, the rotational or ‘olisthetic’ curves arise from rotation of the vertebral body because of the differential slip of the vertebral body over an asymmetric pars defect [8, 10]. In these cases, theoretically, the origin of the scoliosis is intrinsically linked to the development of the lysis and spondylolisthesis. Therefore, taking care of the primary cause, should lead to spontaneous improvement of the scoliosis. However, if the scoliosis is idiopathic and is simply co-existent with the spondylolisthesis, they are therefore technically separate pathologies, and the two

need to be treated separately either in a single procedure, or as staged surgical procedures.

Part of the non-flexibility of the curve could be attributed to the low back pain and lumbar radiculopathy. However, identification of the aetiology of the curve in the thoracic spine is more challenging. This could be either compensatory, pain related or idiopathic. In this case, the curve did not correct on the operating table under anaesthesia underlining the above difficulty in labelling the aetiology. (Unfortunately no intra-operative bending films were saved and so we cannot present these.)

The case presented highlights this predicament for a spinal surgeon in choosing the optimal management of these two conditions which are co-existing together.

Rationale for treatment and literature review

In the recent review published by Crostelli et al. [7], they advocated that a scoliosis associated with a spondylolisthesis should be treated together. It was based on the observation that they are often separate entities, where the spondylolisthesis has little influence on the aetiology of the scoliosis. This was found to be particularly true in especially large curves in the thoracic and thoracolumbar area. Goldstein et al. [11] have also presented an in-depth 'guideline' on how to manage these deformities, suggesting that thoracic curves can be observed, but lumbosacral scoliosis needs correcting at the time of surgical correction of the spondylolisthesis.

The management of the presented case does differ from this point of view. The intention of the senior author in the presented case was to avoid an additional procedure, if possible, given the dissimilar opinions in the literature. The approach to this case is supported in the literature by recent case reports [5, 6].

Zhou et al. [5] presented a case report where they did not require additional surgery for scoliosis when managing this in combination with a high-grade spondylolisthesis. In their follow-up period the scoliosis resolved spontaneously. However, there was a slight difference with our case in that the high-grade spondylolisthesis was not symptomatic in their report and so they were able to simply observe it.

Pneumaticos et al. [6] also reported spontaneous resolution of a scoliosis in a patient with a spondylolisthesis. Their management differed from that of Zhou et al. [5] in that they treated the spondylolisthesis surgically, without correcting the scoliosis, following which the latter resolved during their follow-up period. Based on these two observations, we felt that on balance, staging the procedure was a safer option, and could prevent the need for major surgery to correct the scoliosis correction. If the scoliosis did not resolve in the long-term, then it was still possible to perform this surgery at a later date.

There is also some controversy surrounding the treatment of isolated spondylolisthesis with regard to reduction or fusion in situ. There is some evidence to suggest that fusion rates are higher, and therefore outcomes improved, with reduction of the deformity [12, 13]. There is also the logical argument that if the scoliosis is secondary to the spondylolisthesis, then this will need to be corrected for the scoliosis to resolve.

However, it has been shown that sagittal alignment does not improve significantly following reduction [14] and therefore, this would go against the rationale that improving one deformity helps to correct the other. It has also been shown that only partial reduction is necessary for good clinical outcomes [15]. The overriding concern for those who prefer to fuse in situ is the risk of neurological injury [12] although there are no comparative clinical trials to assess the relative risk. We decided to correct the deformity because it was mobile and therefore technically possible, although we did not achieve anatomical reduction.

Overall, although the scoliosis described is a progressive, double curve with large Cobb angles and significant L5 pedicular rotation, we were not in favour of simultaneously addressing both conditions in our young lady. We are of the opinion that the curve resolved due to the rotational correction and reduction of the L5 vertebral body, along with the subsequent pain resolution. However, until we can conclusively decipher the intricate relationship between these two complex pathologies, and their behaviour, we were hopeful that we could avoid major scoliosis correction with this management.

Procedure

The patient was positioned prone utilising a standard midline approach. Posterior decompression at L5/S1 was performed, and the L5 nerve roots were explored far laterally to ensure adequate release. Posterior instrumentation utilising pedicle screws bilaterally from L4–S1 was performed. Unfortunately, the L5 pedicle on the left side was found to be hypoplastic and therefore was not instrumented because of the risk of screw cut-out.

L5/S1 discectomy was performed, approaching the disc space bilaterally. Following this, sacral dome osteotomy was performed and the TLIF was completed. Reduction of the spondylolisthesis was attempted and the instrumentation held this reduced at a grade 1 olisthesis. Further reduction to neutral position put strain on the screws risking cut-out, and the L5 nerve roots were considered to be stretched and so further reduction was not considered

Fig. 3 Standing AP and lateral radiographs obtained immediately following surgery showing persistence of the scoliosis

safe and a grade 1 deformity was accepted. The construct was further augmented with S2 screws intra-operatively to ensure maintenance of the reduction.

Outcome, follow-up

Post-operatively the patient was ambulatory on day 2 without any leg pain; however, the scoliosis and coronal imbalance persisted (Fig. 3). The immediate post-operative radiographs demonstrated persistence of the lumbar scoliosis (measuring 37°), with the thoracic curve measuring 29°, and a coronal deviation of 8.3 cm. The possibility of the scoliosis actually acting as a separate entity, and thus requiring further treatment, was discussed with the family at this stage.

The patient was seen at 6 weeks in clinic when the X-ray showed significant resolution of the scoliosis along with restitution of coronal balance. The lumbar curve was 14° and thoracic curve was 21°.

The patient was further followed at 7 months post-operatively at which time she was attending school and had no leg pain and back pain. The final radiograph (Fig. 4) showed complete resolution of the scoliosis and good fusion across the L5/S1 disc space. No complications were noted in the follow-up period.

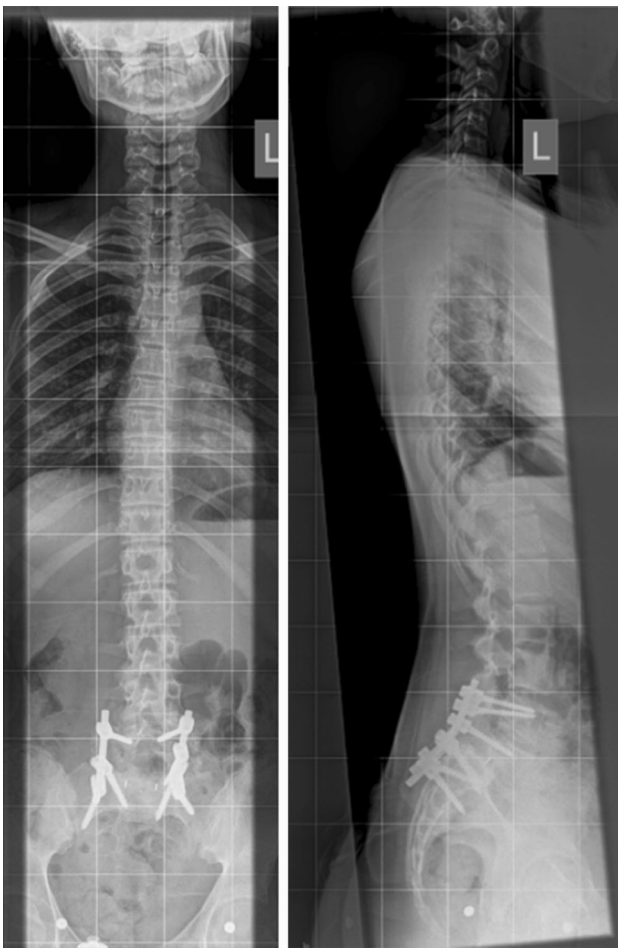

Fig. 4 Standing AP and lateral radiographs showing resolution of the scoliosis

Conflict of interest None.

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