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L5-S1 Spondyloptosis: Surgical Treatment by Two Staged GAINE'S Procedure: A Case Report

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ABSTRACT

INTRODUCTION: Various operation techniques are performed for treatment of lumbosacral spondyloptosis. Gaines procedure is one of such procedures. In which there is circumferential excision of L5. With L4-L5-S1 root decompression, with L4-S1 reduction fixation & fusion. MATERIALS and METHODS: A25-year-old lady with lumbosacral spondyloptosis with incapacitating low back pain & neurological claudication, was treated by the Gaines procedure in 2 stages : In 1st stage in supine, the anterior lumbosacral spine was approached through transperitoneal approach and the body of L5 was first removed to the base of the pedicles; L4-L5 & L5-S1 partial Dissectomy done ;In 2nd stage in prone, after 7 days ,residual pedicles, discs & complete neural arch of L5 removed; L4 & S1partial laminectomy done, L4-L5-S1& sacral nerve roots decompression done , and the body of L4 was reduced onto S1with pedicle screw fixation and intervening 10 mm height TLIF cage & banked autologous cancellous bone grafts from excised body all around(360 degree), further stabilized by transverse connector, all through a midline posterior approach, without complication. Initially rest for 6 wks, followed by gradual rehabilitation with LS brace done. RESULTS: Complaints of the patient have relieved completely after 3 months & now independent in ADL at 6 months. Anterior plus posterior fusion is progressive on sequential xrays. Satisfactory back ROM is achieved & full function is expected at 1 year CONCLUSION: Though Gaines procedure is technically demanding & time consuming procedure, in experienced hands, it definitely fulfils all requirements of curative surgery & yields good outcome for difficult problem of lumbosacral spondyloptosis in young patients.

INTRODUCTION

Spondyloptosis, Grade V spondylolisthesis, is complete dislocation of the L5 vertebral body on the sacrum anteriorly. Spondyloptosis is a combination of lumbosacral spondylolysthesis and lumbosacral kyphosis. Originally described by Neugebauer as a complete tilting of the body of the 5th Lumbar vertebra over the sacrum.[1] Typical clinical symptoms are low back pain and stiffness with hamstring shortening. There is also lumbar hyperlordosis, flexed-hip and-knee walking and toe gait. Radicular pain to the buttocks and thighs is not always present since nerves adapt to tension or compression. Radiation of the pain below the knees or cauda equina syndrome is suggestive of high-grade spondylolisthesis.[2]

The natural history of untreated spondyloptosis is not clear because it is an unusual condition and most studies place it with lower grades of spondylolisthesis. The suggested methods of treatment for spondyloptosis except benign neglect have included fusion in situ.[3-7] and reduction and fusion. [8,9,5,10,11,12] Most authors agree that fusion in situ is a safe and reliable method for treatment of high-grade spondylolisthesis. However, others have suggested that reduction of severe anterior displacement and lumbosacral kyphosis may prevent persistent lumbosacral deformity.[13,14 ,15]

We report a case of spondyloptosis treated by us using L5 vertebrectomy and L4 onto S1 reduction, fixation, fusion and decompression in 2 stages (Gaine's procedure)

Case report: A 25-year-old lady with lumbosacral spondyloptosis with incapacitating low back pain & neurological claudication & so bedridden for 4 months. On examination there was no sensory or motor deficit, reflexes were normal & root tension sign was positive with tight hamstring. No bladder bowel involvement.

On imaging Grade 5 anterior lysthesis of L5 over S1 was present with instability on lateral flexion-extension views (Figure 1), with cauda equina compression on MRI (Figure 2). Aortic-vena cava tree angiography is must for pre operative planning (Figure 3)

Figure 1:- Lateral extension view showing grade 5 anterolysthesis of L5 over S1

Figure 2:- T2 weighted sagittal MRI showing L5 over S1 lysthesis grade 5 with cauda equine compression

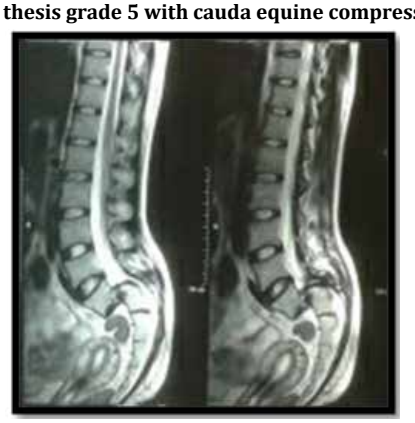
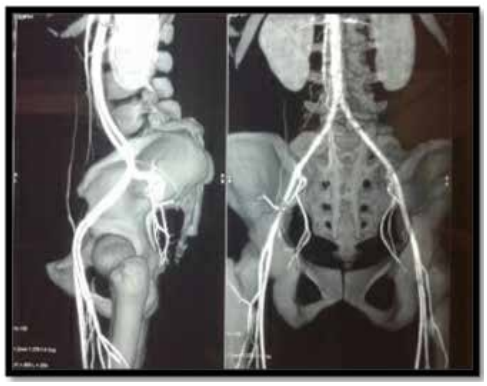


Figure 3:- Aortic-vena cava tree angiography of the same patient



The Surgical procedure was performed in two stages by two separate anesthetic procedures. In the first stage under general anesthesia, supine position with head low, via transperitoneal approach L4 –S1 anterior spine was exposed taking care of the bifurcation of the aorta & vena cava at that level with its branches. Then the body of L5 was incompletely excised to the base of the pedicles followed by L4-L5 & L5-S1 partial dissectomy and removal of caudal cartilage end plate of the L4 vertebra (Figure 4).

Figure 4:- Sagittal CT scan showing L5 vertebrectomy (First stage Gaine's procedure)

Haemostasis was achieved using bone wax & abgel. After the completion of the procedure lumbosacral corset was applied to the patient. Blood loss during the procedure was 1 unit. Duration of general anaesthesia was 3 hours and that of the surgery was 2 hours.

The second stage of this procedure was performed 7 days after the first stage. Under general anaesthesia, in prone position on bolster via midline posterior approach L4 & S1 pedicle screw inserted & fixed one side using temporary rod. Complete removal of residual pedicles of L5 and complete neural arch of L5 & L4-L5 & L5-S1 disc removed. L4 & S1 vertebre partial laminectomy and bilateral L4-L5-S1 & sacral nerve roots decompression was done. The body of L4 was gradually reduced onto S1 with pedicle screw fixation and intervening 10 mm height lordotic TLIF cage. The removed bone & banked autologous cancellous bone grafts from excised body packed for anterior & postero-lateral fusion all around (360 degree) between L4 & S1.The construct was further stabilized by transverse connector. Thorough haemostasis achieved by using bipolar & abgel. (Figure 5) Blood loss during this procedure was 1 unit and duration of general anaesthesia was 3 hours and that of surgery was 2 hours.

Figure 5:- Lateral skiagram showing post second stage Gaine's procedure

After the surgery post operative protection with lumbosacral corset for 6 wks was given with bed rest and followed by gradual range of motion exercises of back. Patient noticed temporary meralgia on left side during post operative period which was brief. Complaints of severe back pain & claudication were completely relieved after 3 months and patient is now independent in activities of daily living at 5 months. Anterior plus posterior fusion is progressive on sequential x-rays (Figure 6) and full function is expected at 1 year.

Figure 6:- Post operative follow up at 5 months showing fusion

Satisfactory back range of motion has been achieved after 6 months of follow up.

DISSCUSSION

Spondyloptosis defines the condition where the L5 vertebral body has completely dislocated from the sacrum anteriorly, and descended into the pelvis. [8] The etio-pathogenesis of this disease is unclear. A few cases caused by traumatic acute spondylolysis have been reported in the literature. [10, 12] Developmental spondylolyses have some type of dysplasia in the posterior elements such as spina bifida of the S1 and S2 segments and frequently the L4 and L5 segments, unsegmented lumbosacral articular facets, hypoplastic L5-S1 facets and elongated isthmus.[8] The presence of these dysplasias raises the question about whether these changes are congenital as described by Newman. 12 In our case it appears to be dysplastic type.

The natural history of untreated spondyloptosis is not clear because it is an unusual condition and most studies place it with high-grade (grades III and IV) spondylolisthesis. Patients with spondyloptosis have back pain, radicular pain, motor and sensory deficits in the lower extremities, and symptoms resembling intermittent claudication or a cauda equina syndrome [8,16,9,17,10,6,14,18,12,19.] The physical examination may show flattening of the buttocks, loss of trunk height, tight hamstrings, and an associated structural scoliosis [8,16,9,17,10,6,11,18,19,7.] Urinary incontinence has not been often reported in wide series of severe spondylolisthesis [16,14] except the series reported by Smith and Bohlman [20.] Smith and Bohlman [7] reported that [4] of their [11] cases with severe spondylolisthesis had urinary incontinence, and there was evidence of return of function in all four patients six weeks to 2 years after surgery. In the patient presented here, the prominent symptom was urinary incontinence, and sphincter function was normal after 6 months of surgery.

Treatment of patients with spondyloptosis is a challenge. The goal of treatment is to relieve the pain and the neurological deficit, to prevent progression of deformity and to provide a long-term stabilization by solid fusion 16,6. The suggested methods of treatment for spondyloptosis except benign neglect have included fusion in situ with or without decompression [3,4,5,6,7,] and reduction and fusion (posterolateral and/or anterior, single-, double- or triple-staged) [8,9,10,11,12.] Most authors agree that fusion in situ methods are safe and reliable for treatment of high-grade spondylolisthesis. However, the deformity may progress after fusion in-situ [14,15.] Reduction methods may yield better rates of fusion, of relief of pain, of correction of deformity, and of improved appearance than in situ arthrodesis, but they are lengthy, technically challenging, and have a considerable rate of complications [8,9,17]. In addition, the deformity may also progress after reduction and fusion methods [4,11.] Various methods have been described for both in situ arthrodesis, and reduction and fusion in spondyloptosis. One of the popular reduction methods is the Gaines procedure. In this procedure, the anterior lumbosacral spine is approached and the body of L5 is first removed to the base of the pedicles; the loose neural arch and the pedicles of L5 are then removed, and the body of L4 is reduced onto S1 and stabilized by transpedicular instrumentation through a midline posterior approach [10,11]. In the Lehmer series 11 using this method, 25% of the patients required reoperation because of delayed union of fusion or breakage of implant. In small series, good results were reported by various methods requiring long-term closed reduction, combined anterior and posterior approaches, and long term orthosis usage [8,5,21].

These sophisticated treatment methods for spondyloptosis help in reducing the tension on sacral roots, correction of slip angle greatly reduces the bending moment and tensile stresses that work against the postero-lateral graft. When the normal biomechanics are restored by the correction of the deformity, it may be possible to fuse fewer lumbosacral segments and reduce adjacent segment degeneration and also correct the overall appearance of the spine in adolescents. [10,24]

The rate of neurological complication with reduction has been reported to be as high as 20-31% 8,9. These are multiple nerve root lesions, especially L5 root deficits, due to marked stretching of the cauda equina. The incidence of bowel, bladder, or sexual dysfunction is high [17.] These procedures are actually lengthening procedures and the lumbosacral roots may be tethered by anatomically correcting the translational deformity [13]. In addition to the risk of neurological deficit, there may be some loss of correction by the end of the treatment in reduction methods [4,11].

Various methods have also been described for fusion in situ in spondyloptosis. Decompression may or may not be performed while anterior and/or posterior fusion may be performed. Grzegorzewski and Kumar [20] have reported [21] patients with grade III, IV and V spondylolisthesis treated by in situ posterolateral arthrodesis from L4 to S1 and immobilization in a pantoloon cast for four months. All patients had reported improvement after the operation. Radiographic findings showed progression of the slip in five patients, but progression was not associated with symptoms. Bohlman and Cook 3 described a one-stage posterior approach applicable to the completely dislocated lumbosacral joint which includes posterior neural decompression, bilateral posterolateral fusion, and interbody fusion using a fibular strut. In this technique, after a wide fifth lumbar and first sacral, and if necessary, fourth lumbar laminectomy and a wide fifth lumbar andfirst sacral foraminotomy, the dura is gently freed from the postero-superior prominence of the first sacral vertebral body, and the sacral prominence is osteotomized to decompress the dura anteriorly. Next, a posterior interbody fusion is performed with bilateral fibular strut grafts inserted into bilateral holes drilled into the L5 and S1 bodies. In 1990, Smith and Bohlman [7] have reported [11] cases with Grade III-V spondylolisthesis treated by the same procedure, of which six were of spondyloptosis. They reported that a solid fusion was obtained in all patients, and all had major or complete neurological recovery in between two to twelve years of followup. None of their patients had complications or major changes in the position of the vertebrae, despite early mobilization two or three days after surgery, and osseous union was achieved in all of them. In 1938, Speed [22] reported on a case with severe spondylolisthesis that he treated successfully with an arthrodesis performed through a trans-abdominal approach using a single tibial bone strut that was placed in much the same position as the fibular graft that Bohlman et al inserted. Recently, Bozkus and Dickman [23] reported a similar technique with posterior interbody cage insertion and pedicle screw fixation and reduction of deformity for treatment of a case with high-grade spondylolisthesis. Fusion in situ may be performed with or without decompression in spondyloptosis. Fusion in situ without decompression may cause postoperative neurological deficits, especially in the presence of preoperative deficits. L5 nerve root deficits are too frequent as in the reduction methods, presumably caused by intrathecal bleeding from decortications trauma or progression of the deformity during positioning [17,18,19]. Extended L5 foraminotomy may be necessary to prevent this complication. The sacral roots may be draped over a posterior prominence of the first sacral vertebra, and a laminectomy and resection of some bone from the posterior part of the first sacral vertebral body may be necessary to relieve the neural compression completely [7]. Fusion in situ may be performed via only a posterior approach without anterior fusion in spondyloptosis. However, spondylolisthesis is a slip without angulation, but spondyloptosis is a more serious problem with a lumbosacral kyphosis superimposed on a slip which on its own would not be so serious, and it is generally accepted that a kyphosis in other parts of the spine requires an anterior fusion for a successful result [4].

Boachie-Adjei et al. proposed a compromised technique of partial reduction of the lumbosacral kyphosis, decompression of the nerve roots, postero-lateral fusion, and pedicle screw transvertebral fixation of the lumbosacral junction. This technique has the advantage of providing three column fixation by the lumbosacral transfixation, yet it is performed through a single posterior approach. It also allows interbody grafting to be done if necessary without a formal anterior procedure.[25]

CONCLUSION

Though Gaines procedure is technically demanding & time consuming procedure, in experienced hands with thorough pre operative planning & its surgical execution, it definitely fulfils all requirements of curative surgery & yields good outcome for difficult problem of lumbosacral spondyloptosis in young patients.

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