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A novel paraspinal surgical approach for lumbar lateral extraforaminal root entrapment

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Abstract We describe a new surgical route that we call the “crest approach” for treating extraforaminal disc herniation in the lumbar spine. This approach is useful only for the levels above L5–S1. It permits perfect root decompression without any bony resection that would contribute to instability. Muscle retraction and devascularization are reduced. Risk of nerve root lesions is minimal since the herniation is removed before root mobilization. Fifteen patients have been treated using this procedure. In all 15, pain and/or neu-

rologic deficits remitted rapidly with no postoperative complications. In conclusion, the crest approach provides highly satisfactory operating conditions by simplifying exposure and greatly limiting the risk of complications. In our relatively limited experience using this procedure, only satisfactory results have been observed.

Key words Crest approach · Paraspinal approach · Lateral disc herniation · Lumbar spine · Discectomy

Introduction

Lateral extraforaminal root entrapment is a rare feature of degenerative lumbar disc disease. With the advent of MRI and CT, our understanding of this lesion has progressively improved.

Lateral surgical approaches, the employment of which sometimes proves difficult, have long been described for such lesions. After several years of applying one of these approaches, we have introduced certain modifications that depend upon the anatomic specificities of the lumbar level involved.

Historically, the first lateral surgical technique was described by Watkins in 1953 for foraminal lesions of the levels L4–L5 and L5–S1 [8]. This procedure called for retraction of a thin flake of ilium with the entire attached sacrospinalis muscle group.

In 1960 Wiltse introduced a lateral exposure that splits the multifidus and the longissimus through a cleavage plane that can be clearly seen on CT and MRI [9]. This route is well suited for the L4–L5 level.

Other lateral approaches have appeared in the literature, notably that reported by Ray [7], differing from Watkins' method by the splitting of the muscles. Bone from the iliac crest blocking passage is removed to the extent necessary.

In 1991 Kunogi and Hasue published an extensive review of foraminal root entrapment and its treatment according to the intra- or extraforaminal nature of the lesion [3]. This review contained a description of lateral fenestration, an effective exposure for cases of far lateral herniated discs. However, they used this method only for the L4–L5 level. It was because of certain anatomic differences in the levels above L4–L5 that we developed a modified version of their procedure that passes laterally to the pars interarticularis and that we refer to as the “crest approach”.

The anatomic specificities of the upper lumbar spine, referred to above, result from the conjunction of two phenomena. First, the transverse diameter of the spinal canal decreases from S1 to L1. This progressive decrease in the distance between the medial wall of the pedicles from L1 to S1 means that each of the lumbar pedicles is more me-

Fig. 1 L1, L2 and L3. The lateral crest of the pars interarticularis lies on the sagittal plane that passes along the medial edge of the pedicle, the projection of which appears in dotted lines in the figure. The foramina have no "roof" at these levels

Fig. 2 L4 and L5. The lateral crest of the pars articularis lies in a sagittal plane passing through the medial portion of the pedicle. At L5-S1, this plane passes through the lateral portion of the pedicle, constituting a bony "roof" over the foramina

dially situated than the subjacent one. The second tendency concerns the lateral curve of the pars interarticularis. This lateral edge or crest of the pars interarticularis lies much more medially in the upper part of the lumbar column than the lower. The distance between the crests of the pars interarticularis progressively diminishes from L5 to L1 and this progressive diminution is more pronounced that the diminution in the distance between the pedicles as one proceeds upward from S1, in such a manner that, at levels L1-L2, L2-L3 and L3-L4, the projection of the pars interarticularis is medial to the alignment of the pedicles (Fig. 1). Consequently, the "foramen" has no bony roof at these levels and access to a root entrapped by a herniated disc does not require the resection of bone that is called for in certain procedures for exposing the lower lumbar column.

At the L4-L5 level, the projection of the pars interarticularis is superimposable with the medial border of the pedicle while, at level L5-S1, the crest of the pars interarticularis projects upon the middle of the pedicle (Fig. 2).

Materials and methods

The crest approach

For the crest approach (Fig. 3), the patient is placed in a kneeling position or in a frame allowing the abdomen to hang freely. In order to avoid difficulties in determining the exact level involved, an image intensifier may be left in place laterally and mobilized there if necessary.

The skin is incised medially over the spinous processes. The incision is longer than usual (7 cm) to allow lateral enlargement. Muscles are separated from the spinous processes and laterally from the articular processes on the side of herniation. Muscle attachments to the transverse processes are left in place. Two Taylor's retractors are placed at the lateral edge of the articular processes of the upper and lower vertebrae, respectively. Often at this stage moderate arterial bleeding may occur around the articular processes, requiring careful hemostasis before proceeding. At these levels, the intertransverse ligament, which appears as a thin white film inserted onto the articular capsule, is released with a blunt retractor starting from the superior aspect of the articular pillar near the junction with the pars interarticularis crest at the caudal end of the space defined by the crest medially, the articular process overlying the impinged nerve root above and the lower articular process of the same vertebra below. Maintaining instruments flush with the bone along the lateral edge of the crest, the foramen is penetrated without excessive lateral detachment of muscles. In some cases, a thin scalpel is needed to sever very resistant attachments of the intertransverse ligament to the articular processes.

By starting from the lower part of the space, one attains the herniation first, reducing the risk of root lesions. It is not recommended to proceed downward from the upper part of the space with the intention of following the root to its impingement. Not only is localization of the root unnecessary in most cases, but one must also keep in mind that the root may be pushed upward by the herniated disc, where it could sustain scalpel injury if the ligament were opened from above.

Fig. 3 The herniation is situated slightly lateral to the crest in the lower half of the space between the two transverse processes. By remaining flush with the crest and following it downward, one comes upon the herniation

Other problems that may be encountered during the procedure are potential difficulties in differentiating the root from a nonextruded herniation and the possibility of tearing the intermediate artery during root mobilization, in which case bipolar electrocautery is required.

In extruded herniation, decompression manoeuvres are very simple. Once the free fragment is removed, the root is easily mobilized. If the herniation is not extruded, the thin surrounding membrane is opened with a blunt retractor and discectomy is performed. The same approach allows resection of bulging disc or thickened annuli.

At the L4–L5 level, this technique may be more difficult to apply because of the existence of the foraminal roof and the proximity of the iliac crest, which inhibit a satisfactory lateral approach. In cases involving this level, lateral fenestration as described by Kunogi and Hasue [3] may be a useful alternative.

After discectomy, if doubt about decompression remains, we employ an intracanal approach to ensure optimal results. It may be simpler to decompress the root from the inside than to attempt decompression from an external approach, which can contribute to loss of spinal stability.

The intraforaminal liberty of the root is verified using a curved probe before closing the wound on drainage. Patients are allowed to walk the following day and discharged on day 3.

Summary of cases

Thirteen men and two women, with a mean age of 52 years (range 43–67 years) have been operated using this technique. In all cases, preoperative symptoms included radicular pain lasting for more than 60 days. Sensory deficit was present preoperatively in three cases and motor deficit in one. Levels involved were L2–L3 in four cases, L3–L4 in eight and L4–L5 in three. There were eight cases of herniation on the left side and seven on the right.

CT was considered to provide enough diagnostic detail in six cases. In the nine others, MRI was performed in order to confirm the diagnosis of purely extraforaminal herniation.

Results

In 12 cases, extrusion of the herniation, which had been visualized by preoperative imaging, was confirmed during surgery. In the other three cases, the annulus had to be opened in order to remove the herniation. Herniectomy alone was performed in ten cases, while discectomy was associated in five.

No postoperative complication was noted in any case. Pain disappeared immediately after surgery in five cases. In the other ten, pain receded slowly during the first 3 postoperative days.

Sensory and motor deficits recovered completely within 1 month of the procedure.

Discussion

Far lateral lumbar disc herniations occur with a reported incidence ranging from 2.6% to 11.7% [5] of all lumbar herniations. According to Osborn, elimination of misdiagnosis could raise the incidence to as high as one-third of cases of herniated lumbar discs [6]. Even today, far lateral

lumbar disc herniations may still be overlooked on CT or MRI, but the misdiagnosis rate should drop as more and more clinicians become aware of their existence. The fact that such lesions remain unknown to some might explain the differences in the incidence rates reported by the authors cited by Maroon. An incidence of 10% would seem to be a reasonable estimate [1].

The absence of bony structures surrounding a root entrapped by lateral herniation appears to render spontaneous pain relief more frequent at these particular lumbar levels. Consequently, the percentage of annular rupture and fragment extrusion in the cases for which surgery seems to be indicated is relatively high. This, in turn, contributes to the facility of the operations that are actually performed.

Increasing recognition of this pathology has led to the development of newer, more suitable routes of surgical exposure. The initial technique, consisting of midline hemilaminectomy with ipsilateral facet joint destruction, has been abandoned because of the high rate of postoperative instability [4].

A variety of approaches have been designed to avoid an overly extensive detachment of muscles from articular and transverse processes. All of these methods involve the splitting of muscles. Watkins' [8] approach passes lateral to the sacrospinalis muscle group, that described by Ray [7] proceeds between the iliocostalis and the quadratus lumborum, while Wiltse's [9] procedure advances between the multifidus and longissimus muscles.

For many years, we used Wiltse's route. Certain drawbacks of that procedure led us to conceive the "crest approach". First, as Wiltse himself noted in his description in 1988, it is necessary to coagulate some lateral transverse fibres in order to dissociate the multifidus from the longissimus. This coagulation is not easy to carry out and, although the small amount of bleeding is of little consequence when performing arthrodesis, in cases of lateral discectomy it may lead to deterioration of operating conditions. Furthermore, the median muscle mass forms a kind of "canopy", which may hinder exposure.

However, thanks to the experience of far lateral herniation at these particular lumbar levels gained over many years using Wiltse's approach, it became evident to us that the extensive denudation of the transverse processes called for in older midline procedures would be avoidable, since herniation always occurred adjacent to the pars interarticularis crest. Being thus able to dispense with the inconvenience of the older medial approaches meant that there was no longer any advantage in the use of lateral approaches with problematic passage through muscle groups.

In our experience, it is not necessary to see the root nor its artery through the crest approach, because one comes upon the herniation immediately by beginning at the lower part of the space defined by the crest on the medial side and the upper and lower articular processes of the same vertebra above and below. The use of microdis-

section as proposed by Maroon [5], is therefore not necessary. The pattern of progressive rather than immediate amelioration of pain observed in these patients is consistent with our previous experience when using other paraspinous approaches in cases of lateral herniation in which the root ganglion was compressed. This has also been observed by Darden et al. [2].

We never use this approach at level L5–S1, since the iliac would hinder retraction of the muscles. At this level, we use an ordinary foraminotomy with posterolateral spinal fusion.

Conclusion

Foraminal disc herniation remains a relatively uncommon disorder of problematic diagnosis and treatment. Drawbacks involved in exposing the surgical field often increase technical difficulties in such operations. The approach described above simplifies the procedure and gives good results.

References

1. Abdullah AF, Wolber PGH, Warfield JR, Gunadi IK (1988) Surgical management of extreme lateral lumbar disc herniations: review of 138 cases. *Neurosurgery* 22:648–653
2. Darden BV, Wade JF, Alexander R, Wood KE, Rhyne AL, Hicks JR (1995) Far lateral disc herniations treated by microscopic fragment excision: technique and results. *Spine* 20:1500–1505
3. Kunogi J, Hasue M (1991) Diagnosis and operative treatment of intraforaminal and extraforaminal nerve root compression. *Spine* 11:1312–1320
4. Lee CK (1983) Lumbar spinal instability (olisthesis) after extensive posterior spinal decompression. *Spine* 8:429–433
5. Maroon JC, Kopitnik TA, Schulhof LA, Abba A, Wilberger JE (1990) Diagnosis and microsurgical approach to far-lateral disc herniation in the lumbar spine. *J Neurosurg* 72:378–382
6. Osborn AG, Hood RS, Sherry RG et al (1988) CT/MR spectrum of far lateral and anterior lumbosacral disk herniations. *AJNR* 9:775–778
7. Ray CD (1987) The paralateral approach to decompression for lateral stenosis and far lateral lesions of the lumbar spine. In: Watkins RG, Collis JS (eds) *Lumbar discectomy and laminectomy*. Aspen, Rockville, pp 217–227
8. Watkins MB (1953) Posterolateral fusion of the lumbar and lumbosacral spine. *J Bone Joint Surg [Am]* 35:1014–1018
9. Wiltse LL, Bateman JG, Hutchinson RH, Nelson WE (1960) The paraspinous sacrospinalis-splitting approach to the lumbar spine. *J Bone Joint Surg [Am]* 50:919–921