Spinal Osteotomy in Ankylosing Spondyloarthritis

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A frequent cause of Bechterew's disease, in cases where the patient's stance was not suitably controlled in the acute phases, is the flexed trunk posture, which cannot be corrected by means of manual techniques. This deformity considerably disrupts trunk mechanics and hence that of the head and of the lower limbs. The functional disorder that arises from the lack of vertebral mobility is considerable, but it does not cause as much of a hindrance as the resulting difficulties to look at objects placed at an intermediate distance or height or the concomitant respiratory and digestive problems. Respiration, fundamentally of a diaphragmatic kind given the ankylosis of costovertebral joints, is impeded by the patient's posture, which prevents a normal abdominal displacement.

If the attempts made to avoid the deformity are unsuccessful, once it starts developing no effort should be spared to prevent its progression, even if this requires a specific intervention; the lower the degree of kyphosis and the less organized the ankylosis, the simpler the intervention.

At the beginning, injuries involve capsular fibrosis and calcification of ligamentum flavum as well as the vertebral, common, anterior, and interspinous ligaments; the annulus fibrosus may sometimes be calcified too. Later, however, ankylosis of the intervertebral joints occurs with subsequent ossification of the ligamenta flava and the intervertebral ligaments. In very severe cases the whole spine turns into a bone block.

On some occasions, kyphosis involves the whole spine and therefore it is extremely noticeable on the dorsal side and very apparent in the lumbar region given the disappearance of the lordosis. Some other times, kyphosis starts at the dorsolumbar tract.

Usual treatment consists in a lumbar osteotomy which restores and even increases the patients' normal lordosis thereby esthetically compensating for their dorsal kyphosis, which will never disappear completely. This trend to approach the lumbar region, regardless of whether it contains the most severe deformity, is related to the greater caliber of the vertebral canal and to the fact that the bone marrow proper is no longer present at that level.

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Correction can be performed in one single surgical stage, but in cases of severe deformities it is best to carry out a staged procedure at different levels, not only because the posterior wedge that is excised is increasingly smaller but also because this permits a more relaxed postoperative period

Exaggerated corrections made in less time provoke an overdistention of the soft tissues from the prevertebral area to the cauda equina and can result in a very traumatic postoperative period (postoperative paralytic ileus, acute stomach dilatation, etc.).

SURGICAL TECHNIQUES

In 1945, Smith Petersen[14] published the first five cases and was the first to describe a technique used to osteotomize the spine. According to that technique, after sectioning the spinous process, an osteotomy is made of the fused intervertebral joints which, as a result, are free to move with respect to one another. This osteotomy was performed at different heights depending on the degree of correction desired. Likewise, the amount of bone excised, corresponding to the articular processes and the plates, depended on how large the correction had to be.

The osteotomy required the excision of the ligementa flava, generally ossified, and operative care intended to avoid injuries to the dura mater or the roots; after the osteotomy the correction is performed and the necessary postoperative care administered. Operative ankylosis was achieved by placing small grafts running from the base of the resected spinous processes to the next ones.

In 1946[9], La Chapelle described a case in which he performed a two-stage osteotomy. The first stage comprised a laminectomy at the level of the second lumbar vertebra with the excision of the articular processes of the second and third lumbar vertebrae. In the second stage, carried out fifteen days later through a de Pean-type transverse abdominal incision and extraperitoneally, he exposed the disk located between the second and third lumbar vertebrae and excised its anterior portion; he subsequently placed the patient in the supine position and gradually corrected the deformity. Once the correction had been obtained, he went back to the lateral position and filled the gap between the two vertebral

bodies with tibial bone graft. Immobilization was achieved by means of a brace that encompassed both hips.

In 1947, Briggs, Keats y Schlesinger[3] described a technique they used in five cases, consisting basically in a partial wedge-shaped resection of the spinous process and the articular pedicles. The amount of correction closely corresponded to the size of the wedge, which was removed from the posterior arch of the spine. A wide foraminectomy whereby the articular processes of the lower vertebra were excised prevented the occurrence of any root impingements. These authors performed their osteotomy between the third and the fourth lumbar vertebrae. In some cases, they fixed the spinous processes after the correction by means of a Wilson plate; the ankylosing of the correction was assured using small bone grafts.

Some of the three types of techniques described above have been used by surgeons who subsequently describe the cases they operate. One of these is Herbert[7], who sometimes uses the technique described by Briggs. When after the posterior osteotomy he cannot achieve the desired correction, he supplements his posterior osteotomy with the La Chapelle anterior osteotomy. Later, Herbert[8] systematized the anterior osteotomy technique for the different levels at which it may have to be performed. In 1951, Law[10], who basically followed the Smith-Petersen technique, published a considerable series of cases. He is probably the surgeon who has operated on most patients with this condition.

Other authors have presented isolated cases and made some technical remarks. Among them, Nunziata[12] (1948), two cases; Ottolenghi1[3] (1949), one case; Thompson[15] (1950), five cases; Argüelles[1] (1950), one case; De Marchi[6] (1951), one case; Delitala and Pais[5] (1952), two cases; Botelheiro[2] (1952), one case.

RISKS DURING AND IMMEDIATELY AFTER SURGERY

Anesthesia and patient ventilation might prove challenging when the deformity is severe, especially is the hip is excessively flexed. In these cases it is advisable to place the patient in a lateral position, as suggested by Crawford Adams[4].

Injuries to the dura, the cauda equina and the roots, easily avoidable with a good surgical technique, have not been reported. In addition to a careful laminectomy, it is important to make sure that the posterior wedge corresponds exactly to the desired degree of correction and that the apex matches the posterior border of the corresponding vertebral space.

When hyperflexing the trunk after the osteotomy, care must be taken not to include the neck in the upper lever arm, which means that hyperextension should be carried out by applying the force from both shoulders or from the sternal manubrium. If this force is mistakenly applied from the head, there is a risk of fracturing the spine, which is what probably happened in one of the cases reported by Law[11].

Decubitus positions are dangerous for these patients. In one of the cases reported by Crawford Adam[4] the patient died after 10 weeks; the patient had a bedsore that spread to the anterior region, giving rise to a paravertebral abscess.

CASE REPORT

Francisco N.S., 35 years of age. He is ectomorphic with pale complexion. His mucosa is pale and suffers from chronic bronchitis. Two years ago he started having pain in the lumbosacral region, which at the same time began to bend forward. The patient also noted that this bending also occurred at the level of his dorsal region, but felt no pain there. A year and a half ago, his knee started causing him discomfort and gradually increased significantly in size. His right knee was punctured four times and on each occasion large amounts of a yellowish fluid were extracted. Three months ago his right knee started swelling. Since then, his trunk has continued flexing but he has not been able to do anything about it. No fever was observed during this period, but his general health status has been deteriorating progressively.

Clinically the patient presented with large radius kyphosis involving the whole of his dorsal and lumbar spine. His chest was depressed and the lower costal arches are in contact with the iliac crest. When he stood, a left-sided scoliosis could be observed, with his trunk bending to the right. When we saw him, the patient had his hips and knees flexed 15°. He presented with knees protruding and full of fluid (Fig. 1. A).

The muscles of the vertebral canals, of the thigh and of the leg were atrophic. He could not move his trunk or his cervical region. He would move his head often in order to preserve the occipito-atloid and atlo-axoid mobility. Radiographically, a disappearance of lumbar lordosis could be observed as well as kyphosis, which was most noticeable at the intervertebral spaces between D_{12} and L_1, L_2.

The vertebral disk between L_1 and L_2 seems to be unduly calcified. Several bridges had been formed by ligamentous ossification between D_{10} D_{11} D_{12} L_1 and L_2, L_3. The sacroiliac joints were ankylosed and the vertebrae appeared decalcified (Fig. 2. A). Sedimentation rate was extremely high, with a Katz score of 80. The blood calcium and phosphorus levels were 91 and 29.75 millimeters respectively. The yellowish-gold fluid extracted from the knee was sterile; a few red blood cells were found during the blood count. Of the remaining cells, 45% were neutrophils, 52% lymphocytes and 3% endothelial cells.

The procedure was performed on 18 January 1952 with general anesthesia, pentothal, ether and blood transfusion, drop by drop, up to a total 600 c.c. intraoperatively. The patient was positioned in prone decubitus with his head outside the table.

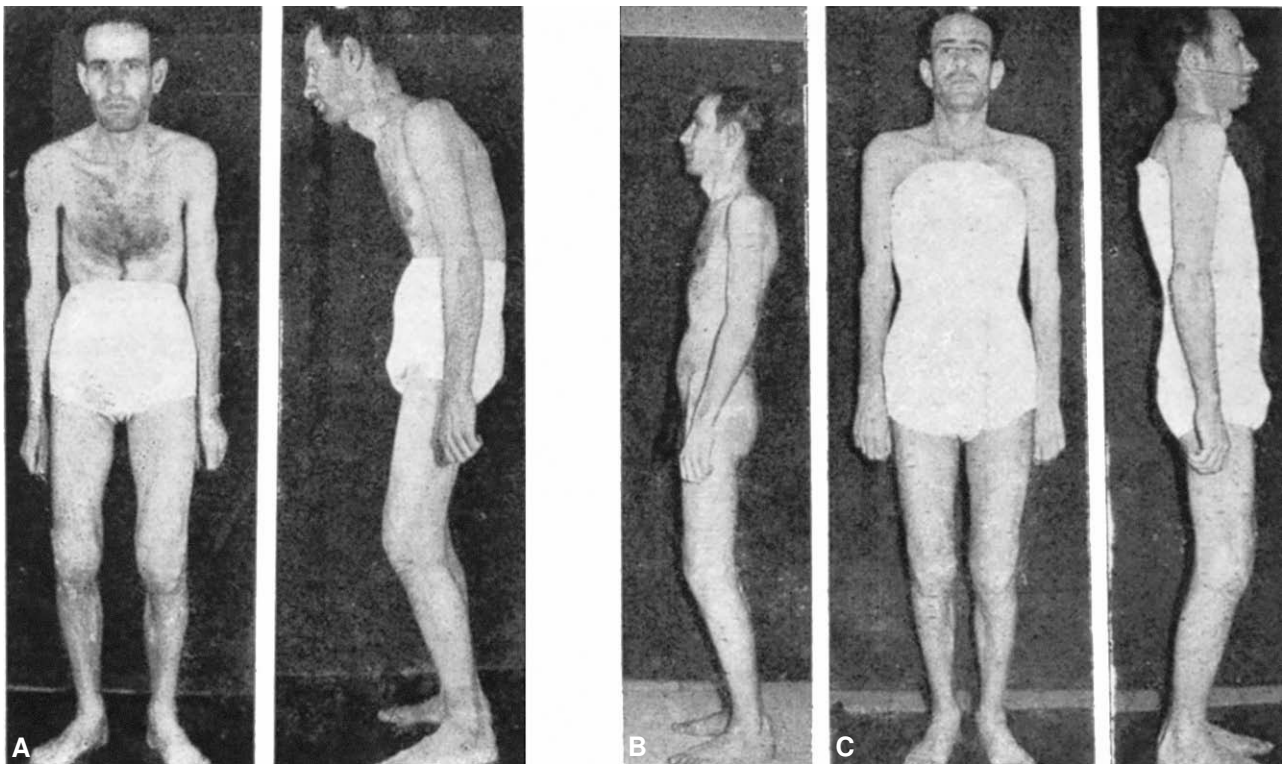

Fig. 1. *(A) Pre-op photograph. (B) Post-op result. (C) Ambulatory brace.*

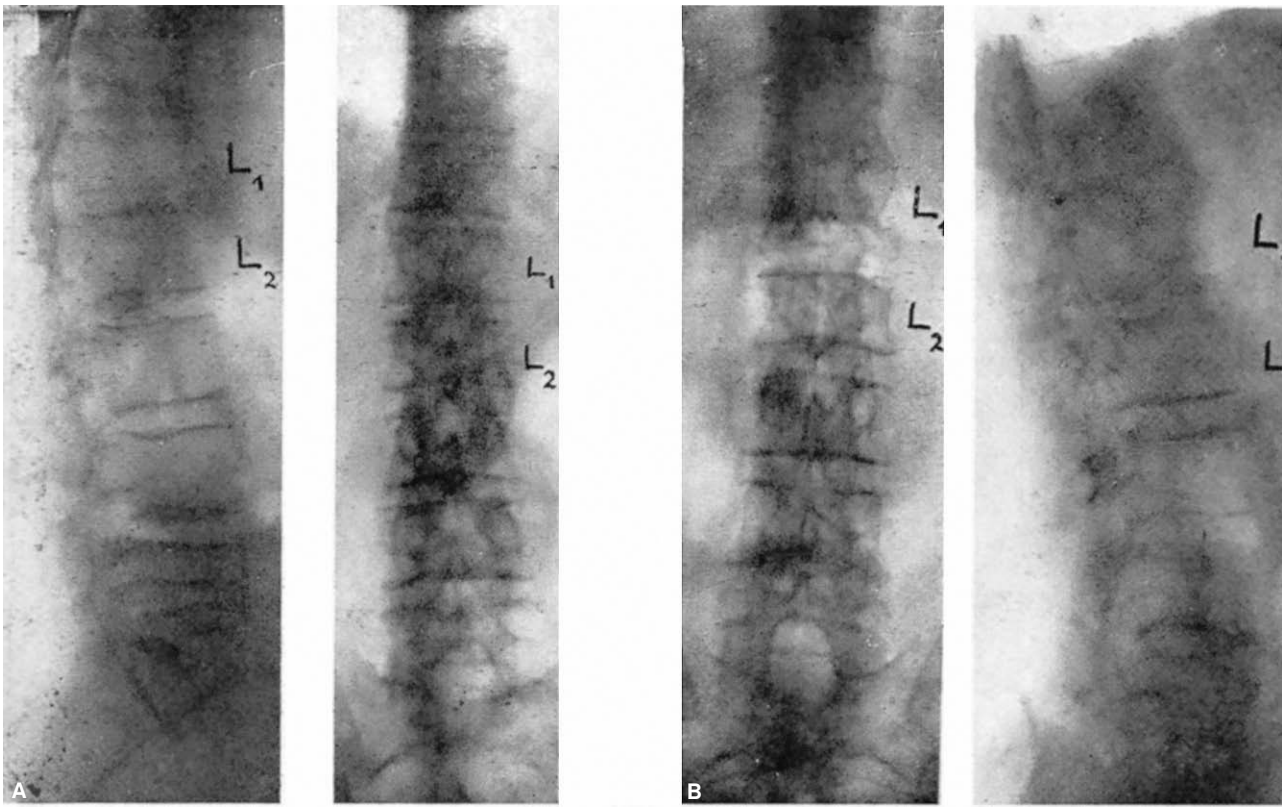

Fig. 2. *(A) Pre-op x-ray. Kyphosis between D12, L1, L2; calcified disk between L1 and L2. (B) Post-op result: kyphosis between L1 and L2 has been corrected.*

A longitudinal incision was performed from D_{12} to L_3. The aponeurosis was penetrated and the musculature of the spinous processes and of the laminae was subperiostically detached until the intervertebral joints were clearly visible. A cutter is used to resect about half of the L_1 and L_2 spinous processes, with the section being made obliquely so that the base of the wedge is posterior. The interspinous ligament is extracted together with the base of the spinous processes so that he dura mater is exposed. The ligamenta flava are ossified so they cannot be excised with the scissors. Once the dura mater has been protected, with a chisel directed from the enter towards the sides, the lower border of the L_1 laminae and the upper border of the L_2 laminae are sectioned, with the osteotomy also comprising the base of the articular processes, especially those of the lower vertebra. When this osteotomy is carried out, care must be taken to remove more bone on the left side so that the existing scoliosis can be corrected at the same time as the kyphosis. We will subsequently have to make a ligature, but before that we must bore a hole into each of the L_1 and L_2 spinous processes and a wire is passed through them. Then an assistant must lift the anterior portion of the patient's trunk while we put direct pressure on the area of osteosynthesis, visually controlling the straightening of the kyphosis, which is achieved after a clicking sound is heard that results from the gentle but sustained pressure employed. The spinous processes are then brought together thus completing the required correction. A knot is tied with the wire that keeps the two processes together and small grafts obtained from the spinous processes and the resected laminae are plated at the docking site in the osteosynthesis area.

The wound is closed and a plaster bed is created in the area of correction; the patient is placed on that bed. When placing the patient on the bed, care must be taken to place a few pillows in order to reinforce the plaster bed. The post-op period can cause significant discomfort during the first two days given the prevailing abdominal paralysis, but this abates from the third day onward.

Eleven days post-op the patient Developer a small bedsore in the shoulder area and shortly afterwards another one in the operative region, which forced us to get the patient up from bed twenty days after surgery with a full-breadth brace. Standing up helped the healing of these bedsores; there were no further postoperative complications.

The patient is highly satisfied with the result. Figure 2B shows his status three months post-op. He had to wear an ambulatory brace (Fig. 1 C) as a cautionary measure related to his postoperative evolution. When still in hospital, he experimented with not wearing his cast for a few days and had no trouble whatsoever so he became very happy with the result since he realized that not only his kyphosis but also his scoliosis had been corrected.

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Commentary

In this paper, the author provides a gratifying account of a rather uncommon problem in our daily practice. Fifty-five years on, the article, written in a plain but forceful style, remains extremely pertinent for the treatment of ankylopoietic spondyloarthritis despite the fact that some progress has been made in a few technical details. Reading this study can prove instructive for any surgeon, whether devoted to vertebral conditions or not, as a criterial update.