Treatment of lumbar instability with pedicular screws

OSMAR AVANZI[1], LIN YU CHIH [2], ROBERT MEVES[3], MARIA FERNANDA SILBER[4]

SUMMARY

The lumbar instability is a common desease in clinical practice. Several authors recommend the use of pedicular screws as a fixation system for posterior arthodesis since they provide better results compared to in situ stabilization. **Objective:** to evaluate the functional and radiographic results in patients assisted by the Spine Group of the Medical Sciences School of Santa Casa of São Paulo, presenting lumbar instability and who underwent posterior vertebral arthrodesis treatment by using melttalic fixation with pedicular screws. **Methods:** Data from medical records of the Service of Medical Files (S.A.M.E) of the Irmandade da Santa Casa de Misericórdia de São Paulo and evaluation through single radiographs (front, lateral, and oblique sections) for image studies besides a pre- and postoperative functional evaluation, with minimal follow-up of two years. **Results:** From November 1995 to June 2000 ten patients with degenerative lumbar unstableness (48%), five patients with isthmic spondylolisthesis (23%) and six with degenerative lumbar stenosis (29%) were evaluated. As for functional evaluation, excellent and good results were obtained in 76%. Complications included superficial infection, pseudoarthrosis, and inappropriate positioning of screws (19%). **Conclusions:** The authors conclude that this fixation method is effective with arthrodesis fusion seen in 95% of patients.

keywords: Lumbosacral region, Joint instability, Bone screws.

INTRODUCTION

Lumbar unstableness é often seen in clinical practice and corresponds to lumbago or lumbosciatalgia irresponsive to clinical treatment[9]. Nagi et al[12] emphasized that lumbar symptoms are found in 40% of the population during their lifetime and affect patient's quality of life in 20% of them. Lumbar disorders account for approximately 18% of all yearly medical visits, which indicates the socioeconomic importance of this disease[5]. In our country Cecin et al[2] have reported an incidence of 53.4% of lumbago in economically active Brazilian people, sciatica being concomitantly found in 32.6% of them.

Surgical therapy for lumbar unstableness through arthrodesis was introduced in the middle twenties[18] and is widely used today. Lumbar fusions are generally performed in patients with spondylolisthesis or degenerative lumbar disease [13]. The introduction of pedicular screws in 1969[18] aimed to increase postoperative stability and enhance consolidation of arthrodesis[1]. Values ranging from 70 to 90% have been found for the *in-situ* technique in contrast with 72 to 95% for consolidation induced by screws. These values vary with the number of arthrodesis levels and the disease[1,6,13,15,16,17,18,].

Controversies have been described in some studies evaluating the synthesis material, including longer surgical time, greater blood loss during surgery, higher risk of damage to nervous roots during screw insertion, and failure of synthesis material[10,16].

The present study aimed to evaluate the functional and radiological results obtained in patients who had lumbar unstableness and were submitted to posterior vertebral arthrodesis through fixation with pedicular screws, carried out by the Column Group of the Medical Sciences School of the Santa Casa of São Paulo.

METHODS

In the present retrospective study, we evaluated 21 patients submitted to surgical stabilization through posterior arthrodesis as a treatment for lumbar unstableness at the Orthopedics and Traumatology Department of the Medical Sciences Scholl of Santa Casa of São Paulo from November 1995 to July 2000. Third-generation implants were used in these patients, such as Cotrel-Dubousset, Cotrel Dubousset of the Horizon type, pedicular screws AO.

Lumbar unstableness is defined as lumbago with or without concomitant sciatica, which is induced by abnormal motility of lumbar or lumbosacral segments. Patients with spondylolisthesis as well as those with stability loss secondary to decompression as treatment for vertebral canal stenosis were included. In the present study, patients unsuccessfully submitted to conser-

Study carried out: by the Spine Group at the Orthopedics and Traumatology Department of the* Irmandade da Santa Case de Misericórdia de São Paulo *- Medical Sciences School of* Santa Casa *of* São Paulo. *(ISCMSP/FCMSP)

1 - Adjunct Professor, Head of the Spine Group
2 - Assistant of the Spine Group
3 - Instructor and Assistant Professor
4 - Trainee of Training Course

Mail Address:
Rua Dr Cesário Motta Jr, 61. Vila Buarque.
ZIP Code 1221020
São Paulo – SP – Brasil
E-mail: robertmeves@hotmail.com

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vative therapy (antiinflammatory agents, physical therapy, and restriction of daily activities for at least two months) were included as well.

In all cases, plain radiographs (front, lateral, and oblique sections) of the lumbosacral column were taken and a questionnaire was applied to evaluate the clinical criteria described by Fischgrund et al[4] after a mean follow-up of 4 years (follow-up range: 2 to 6 years). The initial clinical picture and radiographs of these patients were collected from their medical records of the Service of Medical Files (SAME) of Santa Casa of São Paulo. The vertebral canal stenosis was evaluated through more detailed radiographs, including myelography, myelotomography, or magnetic resonance imaging, in patients with radiculopathy or neurogenic claudication.

Median approach was used with the patient in ventral decubitus and under general anesthesia. Autologous spongy bone grafts were inserted near the transverse process for posterolateral arthrodesis in all patients and those with stenosis were submitted to radicular decompression through foraminotomy and laminectomy corresponding to the affected roots. Radiography or radioscopy of the lumbosacral column (front and lateral sections) was used during surgery to guide insertion of pedicular screws. Radiographic evaluation (oblique sections) of arthrodesis consolidation was performed six months after surgery when integration of the graft could be visualized in the region of the transverse process of the vertebra [1,7,15,18]. Pseudarthrosis (lack of consolidation) was diagnosed in cases where integration was not seen.

All patients were instructed to use the Putti jacket for at least six months following surgery.

The functional evaluation of results was carried out according to the criteria described by Fischgrund et al[4]: excellent - asymptomatic patients with no limitation of daily activities; good - sporadic pain - lumbago or radiculopathy - with sporadic use of analgesic agents and no restriction of daily activities; regular - intermittent pain or radiculopathy with regular use of analgesic agents, restriction of daily activities, and clinical improvement following surgery, as compared to preoperative status; poor - frequent pain and/or radiculopathy with continuous use of analgesic agents and major restrictions of daily activities (with no improvement following surgery).

Out of 21 patients of this series, 10 patients (48%) had degenerative spondylolisthesis, 5 (23.4%) had isthmic spondylolisthesis, and 6 (28.6% had degenerative lumbar stenosis (Table 1). As for gender, 11 (51.0%) male and 10 (49.0%) female patients were included. The mean age at the time of surgery was 53 years (age range: 21 - 79 years).

Patients with spondylolisthesis were classified according to Meyerding criteria for vertebral slippage. Out of 15 patients, 3 had grade I slippage, 11 patients had grade II slippage, and one patient had grade III spondylolisthesis.

As for clinical picture 6 patients (28.6%) had lumbago, 15 (71.4%) had lumbosciatalgia, totalling 21 patients; however, two of the patients with lumbago and four of the patients with radicular symptoms had clinical evidence of neurogenic claudication consistent with stenosis as well (Table 2). Physical examination showed decreased muscular force in five patients (23.8%), sensitivity deficit in 10 patients (47.6%), and abnormal deep tendon reflexes in the legs in three patients (14.2%).

L5-S1 (19.0%) and L4-L5 arthrodesis was performed in four (19.0%) and six (28.5%) patients, respectively; two-level arthrodesis was carried out in six patents, including L4-L5 and L5-S1 (28.5%), and three-level or multilevel arthrodesis was performed in five patients (24.0%) involving decompressions followed by stabilization (Graph 1).

As for the synthesis material pedicular screw AO was used in one patient (4.7%), the Cotrel-Dubousset Horizon instrumentation was used in one patient (4.7%), and Cotrel-Dubousset instrumentation was used in 19 patients (90.6%).

RESULTS

Arthrodesis consolidation was seen in 20 patients (95%).

Patients	Number	%
Degenerative Spondylolisthesis	10	48,0
Isthmic Spondilolisthesis	5	23,4
Lumbar stenosis	6	28,6
Total	21	100,0

LS = spondilolisthesis
Source: S.A.M.E - ISCMSP

***TABLE 1 -** Etiological Diagnosis*

Patients	Number	%
Lumbago	6	28,6
Lumbago/Sciatica	15	71,4
Claudication	6	26,6

Source: SAME – ISCMSP

***TABLE 2 -** Preoperative Clinical Picture*

As for clinical picture 14 patients (66.7%) were asymptomatic, 5 (23.8%) had lumbago, and 2 (9.5%) complained of lumbago associated to sporadic sciatica (Case 1) - Figures A, B, C, D, E, F).

Functional results, according to the clinical criteria described by Fischgrund et al[4], were excellent in nine patients (42.9%), good in seven (33.3%), regular in four (19.04%), and poor in one patient (4.7%) (Table 3).

Four patients (19.4%) developed complications: a surperficial infection of surgical wound during the first week following surgery required surgical drainage in one patient; screw malposition was found in two patients who were submitted to a new surgery to better position the screws that were found to be in extrapedicular position (Table 4). The patient who developed pseudarthrosis (5%) had persistent lumbago upon movements and was submitted to

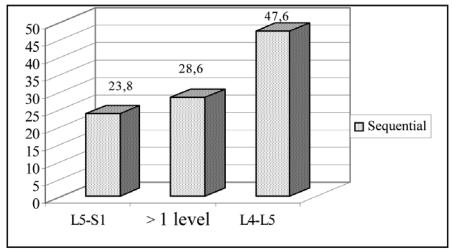
arthrodesis review with grafting and replacement of synthesis material.

DISCUSSION

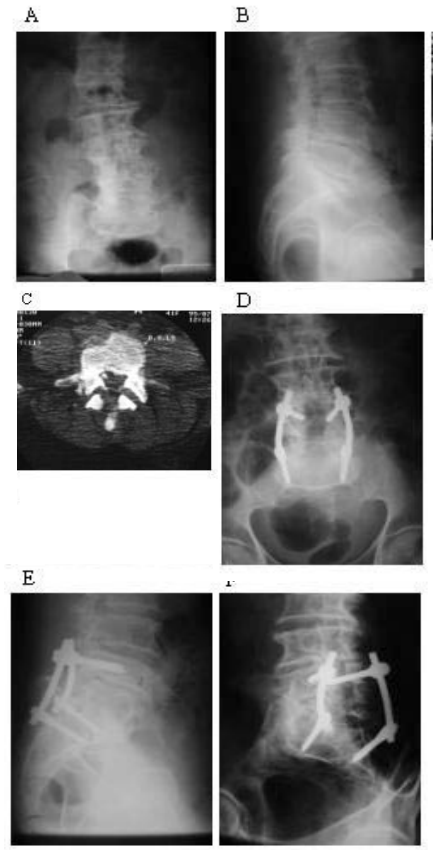
Osteosynthesis with pedicular screws associated with arthrodesis for treatment of lumbar unstableness is recommended by several authors[1,7,8,9,13,16,17,18,19]. The advantages of implants are reported specially because of higher percentage of consolidation and restricted use of postoperative immobilization[8]. Soini et al[16] and Thomasen et al[18] showed a consolidation rate of 95%. Rechtine et al[15] observed an increase of up to three times in arthrodesis consolidation in patients with spondylolisthesis, as compared to patients with no instrumentation.

According to some authors, the great variability of arthrodesis consolidation is related to the number of levels involved and association of decompression and fusion procedure when a multilevel laminectomy is performed, thus contributing to greater lumbar unstableness; however, authors have not always specified the levels involved[7,10,13,15,16,]. Kim et al[7] found 95% of consolidation in 20 patients treated for degenerative spondylolisthesis and pseudarthrosis in one patient submitted to posterolateral arthrodesis associated with L3-S1 decompression.

Lettin AW[9] reported that out of 41 patients with spondylolisthesis submitted to arthrodesis with pedicular screws five (12%) developed pseudarthrosis following wide decompression and inclusion of two or more levels in the arthrodesis. Thomassen et al[18] observed a pseudarthrosis rate of up to 34% when three levels were involved in the treatment for lumbar unstableness through pedicular screws. Rechtine et al[15] observed pseudarthrosis in 33% of 18 patients with degenerative spondylolisthesis and reported that lack of consolidation was found in patients submitted to three-level surgical intervention.



GRAPH 1 - *Frequency of arthrodesis level (Source: SAME-ISCMSP)*



CASE 1

A and B: *Severe arthrosis and degenerative scoliosis with lumbar pain and neurogenic claudication. -* ***C:*** *Tomographic section showing degenerative lumbar stenosis -* ***D:*** *Anteroposterior radiography showing L3 and S1 pedicular screws three years following surgery. -* ***E:*** *Lateral radiography showing L3 and S1 pedicular screws three years following surgery. -* ***F:*** *Oblique radiography showing arthrodesis consolidation.*

Patients	Number	%
Excellent	9	43,0
Good	7	33,0
Regular	4	19,0
Poor	1	5,0
Total	21	100,0

Source: SAME – ISCMSP

TABLE 3 - *Functional Results according to Fischgrund et al[13]*

The correlation between slippage percentage and slippage effect upon arthrodesis consolidation has been mentioned in literature concerning treatment for spondylolisthesis[1,10,13,16,17,18]. In general, there is a consensus that only great slippage (grades IV and V) would hinder consolidation. Beirne et al.[13] emphasized that the higher rate of consolidation was seen in L5-S1, pseudarthrosis being found in 34% of 25 patients; however, lumbosacral transition was not involved in any case. In our patients, arthrodesis was radiographically consolidated in 95%, a finding consistent with those described by some authors[1,13,16,17,19].

Literature concerning the functional criterium used by authors was reviewed, uniformity being not found [4,8,9,10,16,18]. We adopted the criterium described by Fischgrund et al[4], because their method is simple, feasible, and of easy reproduction in retrospective studies. Kim et al[7] and Zuchermann et al[19] chose to use a scale developed by them, described in their study. Their scale was based upon the criteria associated with patient's daily activities and resulted in a rather extensive and complex questionnaire. Other authors, such as Thomasen et al[18], have used the "Dallas Pain Questionnaire" as clinical evaluation criteria. We consider this questionnaire difficult to apply because it includes detailed information difficult to interpret.

Fischgrund et al[4] evaluated 35 patients with lumbar diseases submitted to fixation with pedicular screws, with excellent and good results in 27 patients (78%) and regular and poor results in 8 patients (22%), results similar to those found in our patients. Other authors showed satisfactory clinical results ranging from 70 to 86%[1,2,6,13,15,16,17,18]. Since the methods of functional evaluation were different, comparison with our results is difficult to make.

The most frequent complications found in literature were malpositioning, implant breakage, instrumental looseness, symptomatic prominence of the implant, symptom recurrence, neurological damage, and infection with a rate ranging from 2% to 50%, according to different au-

thors[1,4,6,10,13,15,16,17,18], as compared to the rate of 19% found in the present study.

In a study carried out in 102 patients with nontraumatic lesions of the lumbar column submitted to surgery with pedicular screws, Bostman et al[14] showed that 108 new surgeries were required with a total of 47% of complications. McGuire et al[11] emphasized the higher incidence of neurological lesions, as compared to *in-situ* fusion, due to malposition of the screw in the lumbar vertebra pedicle. In the present study, implant malposition was found in two patients in whom screws were found to be in extrapedicular position. Neurological lesion was not found in any case.

	Number	%
Pseudarthrosis	1	5,0
Infection	1	5,0
Inappropriate position of the implant	2	10,0
Total	4	19,0

Source: SAME – ISCMSP

TABLE 4 - *Complications*

Delfino and Fuentes[3] described the use of Cotrel-Dubousset in 39 patients, two of which had lumbar unstableness and were submitted to fixation associated with posterior decompression at the L4-L5 level in one patient and at the L5-S1 level in the other one. Consolidation and good clinical results were observed in both patients.

One should remember that there is a correlation between complications associated with pedicular screws and surgeon's learning curve. There is a consensus among different studies[6,16,19] that surgeon's experience in handling instrumentation is of crucial importance for a successful surgical procedure. This is believed to be true for the present study, when one takes into account the time period during which study patients were operated on by this technique.

CONCLUSION

The authors conclude that the use of pedicular screws for arthrodesis fixation in the treatment of lumbar unstableness was efficacious in 76% of patients with 95% of solid arthrodesis. However, the procedure is not free from complications since they occurred in 19% of these patients.

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