

Surgeon Management of Osteoporosis in Instrumented Spine Surgery: AOSpine Latin America Survey

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Abstract

Study Design: Survey study.

Objective: To determine the impact of osteoporosis (OP) in instrumented spine surgery among Latin American spine surgeons.

Methods: An electronic survey on aspects of instrumented spine surgery and OP was sent electronically to all members of AOSpine Latin America (AOSLA): 16 multiple-choice questions included incidence and type of complications experienced, strategies to avoid intraoperative complications, on prevention of complications and OP assessment and treatment prior to surgery.

Results: A total of 349 spine surgeons from a universe of 377 surgeons (230 orthopedic surgeons and 147 neurosurgeons), associated members of AOSLA answered the survey. About 80% recalled complications directly related to OP and 71% had revised instrumentation because of OP-related complications. Techniques for prevention of intraoperative complications varied; 65% extended instrumentation to additional segments, 63% performed vertebral body cement injection alone or associated with instrumentation. Preoperative screening was used by 19% but increased to 75% if patients had risk factors. A limit value of bone mineral density for delaying surgery was not established for 66.4% of respondents. Consultation for OP management was requested by 81%, mostly to endocrinology (56.3%). Interestingly, 19% personally managed their patient's OP.

Conclusion: This study provides a global perspective on how Latin American spine surgeons manage patients with OP undergoing instrumented spine surgery. Most have faced complications associated with OP and have had to resolve them surgically. Spine surgeons frequently participate partially in managing patients with OP. Most refer patients with OP for treatment to the endocrinology.

Keywords

spine surgery, osteoporosis, complications, AOSpine, survey, osteoporosis

Introduction

In Latin America osteoporosis (OP) is a public health problem with a huge economic impact demanding considerable resources for the diagnosis, prevention of complications, and treatment. With an increase in life expectancy, the population with OP is also rising.¹ Only 20% of patients with a fragility fractures receive medication to treat their osteoporosis.²⁻⁴

OP affecting the spine is a problem that spine surgeons must frequently face and is associated to significant complications. Spine fractures are one of the more disabling problems and are associated with pain, may lead to spine deformities and produce significant impact in quality of life.⁵ There are 3 different aspects that spine surgeons need to evaluate in an osteoporotic patient. The first is to evaluate patients

with images and laboratory to establish the diagnosis of OP.⁶ Second is to treat patients with lifestyle recommendations and with medications to improve bone mineral density (BMD).^{7,8} Third is management of complications related to OP that may occur during spine surgery.

Prevention is the most important principle in the management of OP and should always be considered in the

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management of patients older than 50 years. In adult patients undergoing elective spine surgery, the surgeon must recognize OP in order to minimize the risk of a poor surgical outcome.^{9,10}

Referral to an endocrinologist is recommended when OP is detected. A multidisciplinary approach is required in patients with OP that undergo spine surgery. Preoperative planning considering the OP factor is very important for a good surgical outcome.

There are no guidelines for the spine surgeon to manage patients with OP, in spite of the fact that they are a growing population.¹¹

OP presents a challenge for the spine surgeon as it may result in several surgical complications. The most frequent of these are related with failure of instrumentation and fracture at an adjacent level following instrumented surgery, frequently leading to new deformity in the form of proximal junction kyphosis (PJK) or proximal junction failure (PJF).^{1,12,13}

We carried out an electronic survey among LA spine surgeons enquiring about their experience with complications associated to OP in instrumented spine surgery. The survey consisted in 16 questions focused on their appreciation on the prevalence of OP in patients subject to instrumented spine surgery, associated complications, and management strategies in this scenario.

The AOSpine LA (AOSLA) spine surgeon's database was used as the study universe. AOSpine is the leading spine surgeon community internationally and is particularly strong in LA, incorporating a majority of orthopedic and many neurosurgeons with a primary dedication to spine surgery. As such, it is representative of an ample universe of LA spine surgeons.

Methods

In November 2016, an electronic survey (Survey Monkey) was sent to all members of AOSLA. The survey was only sent out to the e-mail address a single time. The survey included 16 simple questions with either yes/no or multiple-choice answers. Also included were professional activity and orthopedic or neurosurgery specialty.

The survey consisted of 16 questions presented in Table 1.

We used the AOSpine database. The survey data was compiled in Excel spreadsheet files. The study sample was described by calculating the frequencies and percentages for categorical variables.

Results

The survey resulted in a participation of 92% with 349 spine surgeons from a universe of 377 (230 orthopedic surgeons and 147 neurosurgeons) who are associated members of AOSLA.

A majority (62%) of responders were orthopedic surgeons, which is representative of spine surgery in LA. Approximately 40% of the spine surgeons had more than 15 years of experience.

Incidence and Type of Complications Experienced

A high number of responders (79.6%) recalled having had to manage complications directly related to OP. In keeping with

Table 1. Questionnaire on Complications Associated With Osteoporosis in Instrumented Spine Surgery.

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1. Time of professional activity in spine surgery.
 2. Specialty: neurosurgeon or orthopedic surgeon.
 3. Have you experienced surgical complications in instrumented spine fusion which are directly attributable to osteoporosis?
 4. Have you had to reoperate a patient with an instrumented spine fusion because of complications which are directly attributable to osteoporosis?
 5. Which postoperative complications related to osteoporosis have you faced?
 6. Have you faced intraoperative complications due to osteoporosis in an instrumented spine fusion?
 7. Have you had to modify your surgical plan because of osteoporosis in an instrumented spine fusion?
 8. Have you used additional surgical techniques to prevent complications associated with osteoporosis?
 9. How frequently do you evaluate bone mineral density (BMD) in patients with spine pathology?
 10. Which diagnostic tool do you employ to evaluate BMD in patient undergoing spine surgery?
 11. Have you defined limits in the dual-energy X-ray absorptiometry (DEXA) scan to postpone or cancel a scheduled instrumented spine surgery?
 12. Do you order laboratory tests to confirm a suspected osteoporosis?
 13. If you refer a patient with osteoporosis or osteopenia, to which specialist do you direct your referral?
 14. If you personally treat your patient with osteoporosis, which medications do you prescribe?
 15. In patients with instrumented spine surgery and osteoporosis, how frequently do you believe bad surgical results are directly related to osteoporosis?
 16. Do you consider noninstrumented fusion in any of your patients as an option because of osteoporosis?
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the above, 71.6% of responders referred having to revise spine instrumentation because of OP-related complications.

When enquired on their experience dealing with late complications associated with OP, surgeons recalled an elevated incidence of all those mentioned in the survey: proximal junction kyphosis (PJK), instrumented vertebral fracture and pseudarthrosis (44.4%, 39.2%, and 38.6% respectively).

Intraoperative complications from OP were reported by 63% of surgeons. Also, this resulted in unplanned modification of the surgery in 67.4% of the respondents.

Strategies Used by Surgeons to Prevent Intraoperative Complications

Techniques employed for prevention of intraoperative complications varied; a majority (65.3%) extended instrumentation to incorporate additional segments and/or performed vertebral body cement injection (63.8%). Less frequently used were the addition of anterior support (32.8%) and resorting to hybrid instrumentation techniques incorporating laminar-hook fixation (27.3%). Other options were the use of fenestrated screws designed for instrumentation in OP vertebrae (41.4%) and a

variation of screw insertion aimed at improving fixation on OP bone (51.2%).

In spite of the frequency of complications encountered, only 21% of surgeons believed that OP was the main cause for a final poor surgical result.

A total of 50.5% of surgeons resorted to perform an uninstrumented fusion for some of their OP patients, to prevent complications (implant loosening, fracture, etc).

Prevention and Treatment Prior to Surgery

Only 19.6% of respondents practiced screening for OP prior to surgery. However, for patients with risk factors preoperative evaluation of BMD was frequent (75.5%). The preferred exam to evaluate the BMD was dual-energy X-ray absorptiometry (DEXA) selected by 86% of the responders. A limit value of BMD in the DEXA for delaying surgery was not established for a majority of cases (66.4%). Additional laboratory investigations were frequent if OP was either suspected or confirmed. Serum calcium levels was requested in 67% of cases and vitamin D levels in 59% of this subpopulation. Less frequently requested were phosphemia and thyroid hormones.

Additional consultation for OP management was requested for a majority of cases (81%), mostly directed to endocrinologist (56.3%). Less frequent were referrals to rheumatologist, geriatrician, and gynecologist (19%, 4%, and 1%). Interestingly, 19% (62/327) of responding surgeons elected to personally manage their OP patients.

Clearly, in spite of any specialty consultation, most surgeons directly participate to some degree in managing their patient's OP, as 268 responders resorted to some form of pharmacological treatment for this condition. For this group, calcium, vitamin D, and diphosphonates use was prevalent (74.3%, 73.1%, and 73.1% respectively). Teriparatide and denosumab were used in 29% and 16% respectively. Raloxifen was infrequently employed (9.3%) in this population.

Discussion

OP is prevalent in the adult population and degenerative disease of the spine is rising in frequency. Spinal pathology may require surgery and frequently involves instrumentation.¹⁴ If the spine is affected by OP, there is a higher risk of complications including fixation failure and adjacent level fractures when compared with a spine with a normal bone density.^{5,14}

Hence, in instrumented spine surgery is important to detect and treat OP, ideally before surgery if it is possible. When treating OP before surgery is not possible, it is important to be prepared to manage the potential intraoperative complications and to consider methods to improve screw fixation in osteoporotic bone.^{1,15,16}

There are guidelines for detection and treatment of OP, but not for patients with OP that are candidates for spine surgery.

The preferred currently available method to evaluate BMD in patients undergoing spinal surgery is DEXA. Computed tomography (CT) scans can be used as screening for OP by

measuring Hounsfield units in the vertebral body. This may be useful, considering that this exam is used frequently in the preoperative study.¹

An interesting finding of our survey was the elevated number of surgeons (63%) reporting having experienced intraoperative complications from OP. Also, we find unplanned modification of the surgery in 67.4% of the surgeons. This is always a hazardous situation in spine surgery and raises a red flag on the importance of identifying OP preoperatively, adequately managing the condition and planning in advance strategies for problem solving in case of facing this complication during surgery.

When a spine surgeon performs an instrumented surgery in a patient with OP, there is a significant risk of intraoperative complications and fixation failure.¹⁷ Various techniques are employed for prevention of intraoperative complications in this population.^{13,16} Based on our study a majority (65.3%) extended instrumentation to incorporate additional segments and/or performed vertebral body cement injection (63.8%). Less frequently used were the addition of anterior support (32.8%) and resorting to hybrid instrumentation techniques incorporating laminar-hook fixation (27.3%). An interesting result was the frequent use (41.4%) of fenestrated screws designed for cement injection. The above data suggests that surgeons usually resort more than one strategy to manage the risk of fixation failure associated with OP during surgery with 2 or more options being used in an individual patient. This highlights that there is no solid evidence of the effectiveness of the different available methods.¹³

In patients with OP, prevention is the most important part of management.

Only 19.6% of respondents practiced screening for OP prior to surgery. This is a low number considering the high incidence of OP in the population older than 60 years. However, for patients with risk factors preoperative evaluation of BMD was frequent (75.5%). The preferred exam to evaluate BMD was DEXA selected by 86% of the responders. A low percentage considered x-rays or CT scan as an option. There is no standardized limit value of BMD in the DEXA for delaying surgery. Additional laboratory investigations are available to evaluate the etiology and the severity in OP patients. However, there is no defined algorithm or guidelines to give you a priority to request the exams that support the choice of investigations or their order for this patient population.

Spine surgeons frequently have a role in managing patients with OP. Common recommendations for patients with OP are exercise, adequate intake of calcium and vitamin D, avoid cigarette smoking and limit alcohol intake. Secondary causes of OP (associated with rheumatological disease, hypogonadism, malabsorptive disorders, and metabolic diseases) must be ruled out.⁶

A low level of serum vitamin D is common, presenting in 40% to 90% of the adult population.

Pharmacological treatment frequently includes bisphosphonates, because scientific evidence of their efficacy.^{1,7,8,11,15} However, their effects on spine fusion are unclear.¹⁸

It is reasonable that the spine surgeon refers the patient to the endocrinologist before surgery to optimize treatment. Our study shows that the consultation for OP management was requested for a majority of cases (81%), mostly directed to endocrinologist (56.3%).

Conclusion

The reported incidence of OP-associated complications, both intraoperatively and of having had to revise instrumented spine surgery in LA spine surgeons is very high.

OP in spine surgery is a frequent problem associated with severe complications that should be considered in the treatment of this kind of patients, especially when they need an instrumented fusion.

The prevalence of OP in the spine surgery population that needs to be treated is unknown. There is no established guideline on which patients require screening for OP or if the patient should be treated before surgery.

There are many different options to manage complications during the surgery, but there is no consensus on which is the best.

Most of Latin American spine surgeons report having faced complications associated to osteoporosis, including having had to revise spine instrumentation because of OP-related complications.

When confronting an intraoperative complication from OP, Latin American spine surgeons most frequently resort to extension of instrumentation to incorporate additional segments and perform vertebral body cement injection.

Our survey found that spine surgeons usually participate in managing patients with OP. However, in the majority of cases they refer patients with OP to improve evaluation and treatment to the endocrinology or rheumatologist.

This study determines the global perspective about how Latin American spine surgeon manage patients with osteoporosis. Among Latin American spine surgeons, there are different options for evaluating patients to make a diagnosis of OP, on treatments to improve the mineral bone density and finally on managing surgical complications.

Currently there is no guideline to orient the spine surgeon on how to study or treat patients with OP undergoing instrumented spine surgery.

Reviewing the current published data, the available evidence is weak and limited. Data based on high-quality trials is required to obtain better recommendations for this patient population.

Authors' Note

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