ABSTRACT

Objective: To determine that minimally invasive transforaminal lumbar fusion has fewer complications of chronic lumbar instability compared with traditional open techniques. Methods: Retrospective, observational study of 132 patients with grade I and II lumbar spondylolisthesis with advanced disc degeneration. Forty-five patients operated by minimally invasive transforaminal lumbar interbody fusion (MI-LIF), 45 patients operated by posterior lumbar interbody fusion (PLIF) and 42 patients operated by open transforaminal lumbar interbody fusion (TLIF). Results: Four patients had incidental durotomy, two in the TLIF group and two in the PLIF group. There were no cases of incidental durotomy in the minimally invasive transforaminal access group. No patient in the study presented an inadequate screw position, the lowest mean bleeding occurred in the group of minimally invasive instrumentation and one and two levels. There were 6.6% of infections for PLIF group and none in the other two groups. Conclusions: Arthrodesis techniques are not free of complications, however, the frequency is lower with minimally invasive techniques. Nonetheless, it requires training and does not dispense the need for a learning curve for the spine surgeon compared to open lumbar fusion techniques.

Keywords: Spondylolisthesis, Intervertebral disc degeneration, Decompression surgical; Arthrodesis.

RESUMO

Objetivo: Determinar que a artrodesis lumbar transforaminal minimamente invasiva tem menos complicações de instabilidade lombar crônica em comparação com técnicas abertas tradicionais. Métodos: Estudo retrospectivo observacional em 132 pacientes com espondilolistese lombar de grau I e II com degeneração avançada de disco. Quarenta e cinco pacientes operados por artrodesis lombar intersomática transforaminal minimamente invasiva (MI-LIF, minimally invasive transforaminal lumbar interbody fusion), 45 pacientes operados por artrodesis lombar intersomática por via posterior (PLIF, posterior lumbar interbody fusion) e 42 pacientes operados por artrodesis intersomática lombar transforaminal (TLIF, transforaminal lumbar interbody fusion) aberta. Resultados: Quatro pacientes tiveram durotomia acidental, dois do grupo TLIF e dois do grupo PLIF. Não houve casos de durotomo acidental no grupo acesso transforaminal minimamente invasivo. Nenhum paciente estudado apresentou posição inadequada do parafuso, o menor sangramento médio ocorreu no grupo de instrumentação minimamente invasiva em um e dois níveis. Houve 6.6% de infecções no grupo PLIF e nenhuma nos outros dois grupos. Conclusões: As técnicas de artrodeses não são isentas de complicações, no entanto, a frequência é menor com as técnicas minimamente invasivas. Contudo, requer treinamento e não dispensa a necessidade de uma curva de aprendizado para o cirurgião de coluna, em comparação com técnicas de fusão lombar abertas.

Descritores: Espondilolistese, Degeneração do disco intervertebral; Descompressão cirúrgica; Artrodese.

INTRODUCTION

Spinal instability is the loss of the spine’s ability to maintain the relationship between the vertebrae under physiological strain and to avoid injury to the spinal cord and the nerve roots. Chronic instability is a consequence of progressive deformity that can cause neurological deterioration.
Theoretical approaches that respect more the nature of the posterior ligament complex, such as the open transforaminal and minimally invasive approaches, have fewer complications, since the access route through the lumbar muscle masses dissected only fascias and exposes neural elements like the meninges and the nerve roots to less risk. However, in the management of intervertebral discs, they imply a greater demand during transpedicular fixation.

**METHOD**

This is an observational, retrospective, cross-sectional, and analytical study. The study was evaluated and approved by the Institutional Review Board of the Hospital Central Norte de Petróleos Mexicanos. There are no conflicts of an ethical nature according to the Declaration of Helsinki or in terms of internal hospital regulations, and the study protocol was explained in detail to the patients included in the study, who signed the informed consent form at the beginning of the study. The Hospital Central Norte project number is 2789-B.

We studied 132 patients who underwent surgery during the eight-year period from January, 2006 to February, 2014. They were divided into three groups by route of surgical access: Group A) Minimally Invasive Transforaminal Lumbar Interbody Fusion (MI-TLIF) with 45 patients (34.09%), Group B) Posterior Lumbar Interbody Fusion (PLIF) with 45 patients (34.09%), and Group C) Open Transforaminal Lumbar Interbody Fusion (TLIF) with 42 patients (31.81%) (Table 2). The minimally invasive transforaminal approach (MI-TLIF) group in this study.

Of the total 132 patients who underwent surgery, 41% were female and 59% were male (Table 1). Patients from 20 to 80 years of age were included, with an average age of 55.5 years (ranging from 26-76 years, standard deviation 11.2 years) (Table 2). The minimally invasive transforaminal approach had an average age of 54.9 years (ranging from 30-79 years of age, standard deviation 9.6 years). The open transforaminal group had an average age of 50.7 years (ranging from 30-77 years of age, standard deviation 10.6 years) (Table 2). The minimally invasive transforaminal approach (MI-TLIF) group in this study.

The results were collected for transoperative bleeding and the most frequent complications, which were incidental durotomy, poor screw placement, and the incidence of infection from the immediate postoperative period to two weeks following surgery.

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The average total surgical time for the three groups was 230 minutes (SD: 58.9684 minutes). This is an observational, retrospective, cross-sectional, and analytical study. The study was evaluated and approved by the Institutional Review Board of the Hospital Central Norte de Petróleos Mexicanos. There are no conflicts of an ethical nature according to the Declaration of Helsinki or in terms of internal hospital regulations, and the study protocol was explained in detail to the patients included in the study, who signed the informed consent form at the beginning of the study. The Hospital Central Norte project number is 2789-B.

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**RESULTS**

The average bleeding (Table 4) of the patients instrumented at one level was 543.3 ml, with an average of 136.6 ml in the MI-TLIF group, an average of 1050 ml in the PLIF group, and an average of 443.3 ml in the TLIF group. The patients instrumented at two levels presented average bleeding of 624.6 ml, with an average of 196.6 ml in the MI-TLIF access group, and average of 1231 ml in the PLIF group, and an average of 446.2 ml for the TLIF approach (Figure 2).

Of the 132 patients who underwent spinal instrumentation surgery, only 5.3% (7 patients) presented complications. Incidental durotomy occurred in two patients (4.4%) in the posterior approach arthrodesis (PLIF) group and in two patients (4.76%) in the open transforaminal approach (TLIF) group. There were no cases of incidental durotomy in the minimally invasive transforaminal approach (MI-TLIF) group in this study.

Infections occurred in 2.27% of the patients (3 patients), all of them operated via posterior lumbar access (6.6% of the 45 patients in this group) and there were no infections resulting from the other access methods (99.33%, 129 patients). The statistical significance was p = 0.23 at a confidence interval of 95%. None of the patients in the study presented improper screw placement (Table 5, Figure 3).

**DISCUSSION**

In this work, we analyze the open transforaminal approach developed by Harms and Jeszensky, which is a variant of the posterior lumbar approach described by Croward in 1953 (apud...
Yan et al. and Mura et al., as well as the minimally invasive transfemoral approach, which offers a suitable access for 360 degree fusion at the lumbar level in cases of degenerative instability, initially reported by Foley and Gupta in 2001 with a posterior approach and later with transfemoral approach, as described by Isaacs et al. and Schwender et al.

The objectives of intervertebral fusion at the lumbar level are to achieve lumbar segmental stability, to decompress the nerve structures, and to reconstruct the height of the intervertebral space in the translational and rotational planes. In our working sample, transpedicular instrumentation was performed at one (42.2%) and two (57.5%) lumbosacral levels for advanced disc degeneration and Meyerding grade I and II spondylolisthesis.

Minimally invasive techniques have emerged with a lower frequency of complications. In our study, there were 7 patients (5.3%) with complications secondary to the surgical approach: 3 posterior access infections (6.6%), 2 open transfemoral approach durotomies (TLIF= 4.4%), and two more in the posterior access group (PLIF= 4.76%), with no complications in the minimally invasive technique group (MI-TLIF= 0%) and a statistical significance of p < 0.23.

A reduction in the relative risk (RM) of infection was calculated for the minimally invasive (MI-TLIF, p<0.20) and open transfemoral (TLIF, p<0.23) approaches, of incidental durotomy for the minimally invasive transfemoral (MI-TLIF, p<0.14) approach, and of poor screw placement (p= 0). There were increases in the relative risks of infection and incidental durotomy in the posterior approach by factors of 1.56 and 2.00, respectively.

Minimally invasive techniques have reduced transoperative bleeding to a minimum. A study conducted by Schwender of 120 patients who underwent minimally invasive transfemoral access surgeries reported average bleeding of 140 ml (ranging from 50-450 ml) with an average surgical time of 240 minutes (ranging from 110-30 minutes). In our study, we had an average bleeding of 156.6 ml (ranging from 50-330 ml) for minimally invasive transfemoral (MI-TLIF) arthrodesis, as compared to the open techniques. The classic transfemoral route had an average bleed of 445.2 ml (ranging from 300-1600 ml, with an average surgical time of 235 minutes), while the posterior approach (PLIF) had an average bleed of 1077.7 ml (ranging from 100-5600), with a statistical significance of p= 0 (confidence interval of 95%).

The minimally invasive transfemoral approach had fewer complications and less bleeding, both statistically significant, as compared to the open transfemoral and posterior approaches.

CONCLUSION

Minimally invasive transfemoral lumbar interbody fusion (MI-TLIF) resulted in a statistically significant lower bleeding volume as compared to the open transfemoral (TLIF) and posterior (PLIF) interbody fusion techniques.

Performing minimally invasive techniques requires training and does not eliminate the need for a learning curve for the spine surgeon, as compared to open lumbar fusion techniques, which are more accessible and technically less demanding. Although minimally invasive lumbar arthrodesis techniques are more expensive, their risk-benefit seems to be more favorable.

All the authors declare that there are no potential conflicts of interest regarding this article.
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REFERENCES