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Original Research Article

Retrospective study of minimally invasive surgery verses open laminectomy or laminectomy with diskectomy

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ABSTRACT

Background: Minimally invasive spine surgeries (MIS) are often considered superior to their open counterparts in view of smaller incisions, reduced blood loss, less post-operative pain and less hospital stay. In this study, we compared the clinical outcome of MIS and open procedure of lumbar laminectomy/discectomy. The objective of this study was to compare clinical outcome between the MIS and open procedure of lumbar laminectomy/discectomy.
Methods: This was a retrospective study conducted at Government medical college, Kottayam, Kerala, India where we studied the patients who underwent MIS and open laminectomy/laminectomy with discectomy during the period January 2018 to January 2020.
Results: We studied a total of 200 patients, among which 60% were males with a mean age of 50.58 years and 40% were females with a mean age of 53.59 years, 45.5% had L5 S1 IVDP, 30% had L4/5 IVDP, and 24.5% had L4/5 lumbar canal stenosis, 75.5% underwent laminectomy with discectomy and the rest (24.5%) underwent laminectomy with foraminotomy, 60% underwent open surgery and 40% underwent MIS.
Conclusions: MIS was superior to its open analog in terms of intra operative blood loss as well as hospital stay. But open surgeries required less operation time, less C arm exposure, had better pain control and functional outcome and less recurrence in our study.

Keywords: Minimally invasive laminectomy/diskectomy, Open laminectomy/diskectomy, Comparison

INTRODUCTION

Minimally invasive spine surgeries (MISS) are becoming increasingly favoured as alternatives to open spine procedures because of the reduced blood loss, postoperative pain, and recovery time. Studies have shown mixed results regarding the efficacy and safety of minimally invasive procedures compared to the traditional, open counterparts. In the study by Righesso et al the hospital stay was longer in open surgery group, whereas operative time and immediate postoperative pain were greater in MISS group.[1] However, the overall functional outcome as assessed by ODI (Oswestry diasability index) was similar in the 2 groups.[2]

In India, a huge human resource is utilized for labour involving various activities which involve bending and twisting of the spine.

Therefore, more disc degeneration and disc herniation can be expected compared to the western world. The treatment facilities and expertise among the doctors are also different from the western world.[3-5] There is only limited data comparing the outcome of minimally invasive procedures compared to the open counterparts, especially from the Indian subcontinent.

The objective of this study was to compare clinical outcome between the MISS and open procedure of lumbar

laminectomy/discectomy from a tertiary centre in Kerala, India.

METHODS

This retrospective observational study was conducted in the department of neurosurgery, Govt. Medical College, Kottayam.

Patients who had undergone MISS and open laminectomy/laminectomy with discectomy in this centre during the period January 2018 to January 2020 were included in the study.

Sample size and sampling

The study by Righesso et al was considered as the parent study.[1] The main parameter taken was surgical time. Sample size (N) was calculated by the formula,

$$N = \frac{(Z_{1-\frac{\alpha}{2}} + Z_{1-\beta})^2 (\sigma_1{}^2 + \sigma_2{}^2)}{(\mu_1 - \mu_2)^2}$$

where $(Z_{1-\frac{\alpha}{2}} + Z_{1-\beta})^2$ was 7.84, α (type 1 error) was 0.05 and β (type 2 error) was 20%. σ_1 is standard deviation of first group and σ_2 is standard deviation in second group, (μ_1-μ_2) is the difference between the mean of 2 groups.

On substituting the values,

$$N = \frac{7.84(15.5^2 + 21.9^2)}{(82.6 - 63.7)^2}$$

So, the minimum sample size in each group should be 16. We selected consecutive cases that underwent surgery from January 2018 to January 2020. Patients who were suffering from a rapidly evolving pathology (e.g. tumor) and traumatic pathologies, patients transferred to other hospitals before surgery or whose follow-up could not be assured, and patients less than 18 years of age were excluded from the study. A detailed Performa was used to collect the required data from the patient. Their records were analyzed and post-operative follow up assessment of pain and disability were studied.

The post-operative values were recorded at the final follow-up (after 3 months) for each study, and these included the visual analog scale (VAS) for back pain as well as radiation of pain to lower limbs and the ODI. VAS scores were scaled across studies to be 0-5 to allow for comparison. Estimated intra-operative blood loss was also recorded. The number of C arm fired to localize the level was also recorded. The average hospital stay was noted in our study. We focused on these outcome measures because they were the most prevalent across the studies analyzed.

Statistical analysis

Data assessment was done using SPSS software and Microsoft excel. Descriptive statistics were ascertained for the included studies. Means standard deviations and proportions were calculated for all outcomes of interest. The change in score was analyzed and significance was tested using Pearson Chi square test, ANOVA and linear association.

RESULTS

We studied a total of 200 patients, among which 60% were males with a mean age of 50.58 years and 40% were females with a mean age of 53.59 years, 45.5% had L5 S1 IVDP, 30% had L4/5 IVDP, and 24.5% had L4/5 lumbar canal stenosis, 75.5% underwent laminectomy with discectomy and the rest (24.5%) underwent laminectomy with foraminotomy, 60% underwent open surgery and 40% underwent MIS.

Among all, 65% of the patients had an ODI score between 41-60%, 15% each had 19-40% and 61-80%, 5% had 81-100%. 50% had a VAS of 3 at admission, 35% had VAS of 4, 10% had VAS of 5 and 5% had VAS of 2 at admission. Among those patients who underwent open surgery, the time taken for surgery was 45 min-1.5 hrs in 74.2% and less than 45 min for the rest 25.8%. Among those who underwent MIS, the time required was 1.5-2.5 hrs for 50%, >2.5 hrs for 33.8% and between 45 min-1.5 hrs for the rest 16.2%. This difference in operation time was found to be significant with a p value of 0.00. Among those who underwent open surgery, 57.5% received 2 C arm exposures and 42.5% received 1 C arm exposure. In the MIS group, 58.5% received 3, 23.8% received 2 and 17.5% received 4. This difference was significant with a p value of 0.00. Among those who underwent open surgery, 58.3% had to stay in hospital for 3 days, and the rest 41.7% had to stay for 2 days. Among those who underwent MIS, 66.2% had to stay for 2 days and the rest 33.8% had to stay for 1 day. This difference in hospital stay was found to be statistically significant with a p value of 0.00. Among those who underwent open surgery, 48.3% had blood loss of 50-100 ml, 33.4% had 100-200 ml loss, and 18.3% had <50 ml loss. Among those who underwent MIS, 93.8% had <50 ml blood loss and the rest 6.2% had 50-100 ml loss.

This difference in blood loss was statistically significant with a p value of 0.00.

Among the open surgery group, 86.7% had an ODI of 0-20% at discharge and the rest had 19-40% whereas among the MIS group, 75% had an ODI of 0-20% and 25% had 19-40% at discharge, which was statistically significant with a p value of 0.035. Similarly, among the open surgery group, 68.3% had a VAS of 1 and the rest 31.7% had a VAS of 0 a discharge whereas among the MIS group, 76.2% had a VAS of 1,13.8% had 2 and the rest 10% had 0 at discharge, which was found to be statistically significant.

Both the groups had a significant reduction in ODI as well as VAS at the time of discharge but open surgery group had better control. Among those who underwent open surgery, only 4.2% had recurrence of the disease whereas 12.5% of those who underwent MIS had recurrence which was statistically significant with a p value of 0.028.

DISCUSSION

MIS gained popularity among surgeons as it demonstrated advantages in terms of blood loss and hospital stay but its superiority over open surgery remains a debated topic till now. Several factors have been postulated behind the benefits of MIS, including smaller portals and reduced muscle stripping, which have been shown to reduce blood loss.

Wu et al demonstrated that discectomy via MIS resulted in significantly shorter hospital stay (4.8 days vs 7.3 days) and mean time to return to normal activities (15 days vs 21 days) compared to open discectomy.[5,6] However, they found no significant difference in pain improvement between the two groups.[1] We have the same result as per hospital stay, however our study demonstrated better pain relief in open surgery group. The study by Arts et al. in 2009 and the study by Lau et al in 2010 concluded that there is no significant difference in length of hospital stay or in timing of mobilization in both the groups.[2,3] In 2011, Lee et al demonstrated that there were no differences between MIS and open surgery with regards to duration of surgery, wound complications, or symptomatic recurrence requiring repeat surgery. Patients who underwent MIS had shorter mean length of stay compared to those who had undergone an open discectomy (0.48±0.84 days vs 0.82±0.91 days, p=0.0156).[4] MIS is proposed to be beneficial for overweight or obese patients.

Systematic review of randomized controlled trials (RCTs) involving MIS versus open spine surgery performed using the PubMed database by McClelland et al showed that in lumbar disc herniation, MIS was inferior in providing pain relief and improving quality of life, had >10 times more radiation exposure and more recurrence rates but had shorter hospital stay.[5] These results support the findings in the current study. However, in their analysis, there was no difference in short-term function, long-term function, or 6-month postoperative ODI scores. But in our study, we could demonstrate a significant improvement in the open surgery group.

Our study demonstrated that open surgeries benefit in terms of reduced operating time, better VAS outcome, improved ODI and reduced recurrence rates along with reduced number of C arm firing done to localize the level.[7-9] The experience of the surgeon is the main determinant of the MIS outcome. It may not be surprising that in the hands of a well experienced surgeon, these results can vary.

Whether it's open or MIS, in appropriately selected patients, outcomes with either of the methods should be comparable because the etiology of the patient's symptoms in both instances should be a herniated disc that has been addressed.[10-12]

Limitations

Selection bias was a key obstacle given the range of preoperative outcome measures reported and the baseline differences in the demographics of included studies. Specific approach techniques for each procedure were not accounted for due to variation and lack of description in specific studies. Different surgeons performing the surgeries may have added variability to clinical outcomes. It is unclear whether VAS is comparable from study to study because it is a subjective measure. Oswestry scoring is more standardized and, consequently, presumably more robust. Reported blood loss is highly dependent on surgeons and anesthesia practitioners and, as a result, should be interpreted carefully. Finally, this study only looked at end-point outcome measures, which might have led us to MIS any potential early improvement. A plethora of validated quality of life and back pain scores to evaluate recovery exists, but questions remain as to which measures are appropriate when comparing MIS to open spine procedures.

CONCLUSION

This systematic review suggests that MIS is superior to its open analog in terms of intraoperative blood loss as well as hospital stay. Open surgeries required less operation time, less C arm exposure, had better pain control and functional outcome and less recurrence in our study. While individual studies have demonstrated advantages in favour of MIS over traditional techniques, more highly powered, randomized clinical trials are needed to establish MIS techniques as standardized treatment strategies.

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