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Original Research Article

GENERAL ANAESTHESIA VS SPINAL ANAESTHESIA FOR SINGLE LEVEL TRANSFORAMINAL LUMBAR INTERBODY FUSION – A RETROSPECTIVE OBSERVATIONAL STUDY OF 40 CASES.

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Abstract:

General anaesthesia vs Spinal anaesthesia for single level transforaminal lumbar interbody fusion – a retrospective observational study of 40 cases.

Objective: To assess the peri-operative outcomes of single level transforaminal lumbar interbody fusion under Spinal anaesthesia vs General anaesthesia.

Methods: first 20 cases each of single level dynamic L4-L5/ L5-S1 instability between age of 20 to 70 years who got operated by a single senior spine surgeon with transforaminal lumbar interbody fusion under spinal anaesthesia and under general anaesthesia between October 2020 to October 2022 were included in the study. All patients failed to respond to the conservative treatment for at-least 6 weeks. Routine steps for spinal anaesthesia and general anaesthesia were adhered. Total operating Room (OR) time, 3-hour post-anaesthesia care unit (PACU) numeric rating scale (NRS) pain score, post-operative rescue analgesic medication, and time to first ambulation and peri-operative adverse events were compiled and assessed. Appropriate statistical analysis was applied.

Results: Clinically the two groups were homogeneous in characteristics. Total OR time was found to be lesser for patients who underwent TLIF under SA, with a mean OR time of 195.5 +/- 10.11 minutes versus 214.6 +/- 21.3 minutes for patients who underwent TLIF under GA ($p < 0.0001$), a reduction of 9 %. The total procedure time was comparable in two groups. Post operative nausea and vomiting was found to be significantly higher in GA group. The mean NRS pain score during the first 3 hours in the PACU was different as patients who received SA reported a lower pain score compared with those who received GA (2.5 +/- 2.2 vs 4.6 +/- 1.5; $p = 0.001$). No significant difference was observed in rescue analgesic received by the two groups. Patients who received SA had a shorter time to first ambulation compared with those who received GA (403 +/- 211 minutes vs 922 +/- 430 minutes; $p < 0.0001$).

Conclusion: Spinal anaesthesia is safe and effective for performing single level lower lumbar interbody fusion with advantages of reduced perioperative time, early ambulation and lesser complications and cost effective.

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1. Introduction:

With recent advances in techniques of spine surgery weightage is also being given for early post operative recovery.
Hence regional anaesthesia is frequently used in orthopaedic surgery and as part of ERAS protocols in other specialties (1) (2), but it has not been widely accepted in lumbar spine surgery. The preference for GA for lumbar spine surgery does not appear to be due to scientific or clinical evidence of superiority but, rather, to either surgeon preference and, potentially, lack of exposure to SA, or anaesthesiologist preference for GA because of a secured airway prior to placement of the patient in the prone position. Multiple studies evaluating GA versus SA in lumbar laminectomy and discectomy have found that SA is cost effective with lesser analgesic use, shorter anaesthesia and surgery time, reduced blood loss, and less postoperative adverse effects (3).
TLIF is a common procedure in spine to treat unstable lumbar segments which is traditionally performed under general anaesthesia. Recently some studies with awake spinal fusions have come-up with good outcomes and lesser complications (4). There are very few studies comparing the mode of anaesthesia and its advantages for TLIF procedure.
Hence this study was conducted to compare the peri-operative outcomes of single level transforaminal lumbar interbody fusion under Spinal anaesthesia vs under General anaesthesia by the same team at same set-up.

2. Material Methods:

After approval from the ethical committee and the hospital administration data of all the patients who underwent TLIF surgery between October 2020 to October 2022 was obtained. Patients with ASA I and II aged 20 to 60 years with no addictions, no morbid obesity, absence of history of seizure or intracranial hypertension, coagulopathy, infection at site of needling, hypovolemia, severe spinal stenosis, myelographic demonstration of arachnoiditis, claustrophobia, or severe respiratory problems were included in the study. Two groups containing 20 patients each were made based on mode of anaesthesia for TLIF, SA group and GA group respectively. Thus total 40 patients formed the sample size. Standard peri-operative protocol for general and spinal anaesthesia was applied for all the cases.

GA Protocol

In the GA group, intravenous midazolam 1mg and intravenous glycopyrrolate (0.01 mg) was administered as premedication. After preoxygenation with 100% oxygen, patient was induced with intravenous fentanyl (2mcg/kg) and intravenous propofol (1–2 mg/kg). Endotracheal intubation was performed via direct laryngoscopy using intravenous atracurium (0.5 mg/kg). GA was maintained on controlled mechanical ventilation with intravenous atracurium (0.1mg/kg), intravenous diclofenac (1mg/kg), isoflurane (MAC 1.2), oxygen 50% and nitrous oxide 50%. Patients were positioned prone with adequate padding of pressure areas. At the completion of the procedure, the patient was repositioned supine, and the anaesthetic was discontinued. After adequate reversal of nondepolarizing muscle relaxant, patient was

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extubated. Patients were transferred to recovery once they were awake, breathing spontaneously, and following commands.

SA Protocol

In the SA group, intravenous midazolam 1mg and intravenous glycopyrrolate 0.01 mg was administered as premedication. Spinal anaesthesia was performed under all aseptic precaution in sitting position after application of subcutaneous 2% lidocaine (1 to 2 mL). A 25G spinal needle was introduced between L3- L4 vertebral space and isobaric bupivacaine (0.5%, 2.5 mL) was slowly injected in the subarachnoid space. The patient was then positioned prone, with adequate padding of pressure areas. At the completion of the procedure, the patient was repositioned supine.

All patients received standardized perioperative multimodal analgesia (an oral acetaminophen regimen of 1000 mg every 6 hours that was started in the preoperative holding area) and nausea and vomiting prophylaxis (ondansetron 4 mg intravenously prior to emergence). Patients were mobilized once the spinal block wore off. incision/percutaneous screw track to provide long-acting local anaesthesia.

For each patient, data were collected from the medical record system including the total OR time (from patient entering the OR to patient leaving the OR, which included administration of the SA for the SA group), total procedure time (from skin incision to placement of the surgical dressing), time to leave the OR (from placement of the surgical dressing to the patient leaving the OR), intraoperative adverse events, intraoperative estimated blood loss (EBL), postoperative adverse events, and postoperative length of stay. We also collected intraoperative hemodynamic parameters including the mean heart rate (HR), oxygen saturation (SpO2) and mean arterial blood pressure (MABP) at every 5 minutes interval. We recorded analgesic requirement along with numeric rating scale (NRS) pain scores (0–10) during the first 3 hours in the PACU. We used intravenous tramadol (50 mg) as rescue analgesic medicine. The time to first ambulation was also collected, calculated from the time patients left the OR to the first ambulation.

Statistical Analysis:

Descriptive demographic statistics were calculated, using the mean as a measure of central tendency and the standard deviation as a measure of dispersion. The chi-square test was used to compare categorical variables and comparisons of continuous variables were made using the Student t-test. All tests were performed at a significance level of 0.05. All analyses were performed using IBM SPSS Statistics version 24 (IBM Corp.).

3. Results:

The demographic variables among the two groups were comparable with statistically no significant difference (P> 0.05) (Table - 1).

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Table - 1

Variable	SA group (N = 20)	GA group (N = 20)	P value
Age (years)	61.3 +/- 9.2	63.1 +/- 8.6	0.236
Sex (M/F)	9/11	8/12	0.751
BMI	30.5 +/- 5.1	31 +/- 5.8	0.322
ASA (I/II)	10/10	11/09	0.465
Mean Pre-op HR (bpm)	73 +/- 10.1	76.6 +/- 10.4	0.218
Mean pre-op MABP (mm Hg)	109 +/- 16	99.9 +/- 11.3	0.076

The patients in SA group ranged in age between 31 to 69 years with mean age of 61.3 +/- 9.2 years while in GA group ranged between 42 to 72 years with mean age of 63.1 +/- 8.6 years. Of 20 patients in SA group, 9 were male and 11 were female while in GA group 8 were male and 12 were female. The mean BMI was 30 +/- 5.1 in SA group and 31 +/- 5.8 in GA group. SA group had 10 patients each of ASA I and II. In GA group 11 patients were ASA I and 9 patients were ASA II. No patient required conversion from SA to GA. There were no intra-operative adverse events. One patient in SA group required post operative foleys catheterisation for urinary retention. 5 patients, 1 from SA group and 4 from GA group had post-operative nausea and vomiting which was treated accordingly.

The time from entering the OR to start of the surgery between the two groups was comparable (Table - 2). The time lapsed in the SA group was lesser with mean of 33 +/- 6.6 minutes than in the GA group 39 +/- 8.3 minutes but statistically insignificant. There was no significant difference in the surgical time in between the two groups with average time of 158.3 +/- 15.1 minutes in SA group and 163.1 +/- 8.9 minutes in GA group. The time from completion of surgery to exit from OR was lesser in SA group as compared to GA group. It was 4.2 +/- 2.2 minutes in SA group and 12.5 +/- 1.9 minutes in GA group, the difference was statistically significant (P< 0.005). The mean overall OR time was thus significantly more in GA group than in SA group and was 195.5 +/- 10.11 and 214.6 +/- 21.3 respectively. Blood loss in both the groups was comparable and statistically insignificant. No significant difference was observed in the intra-operative haemodynamic parameters in the two groups.

Table -2

Variable	SA group	GA group	P value
Time from entering OR to start of surgery, mins	33 +/- 6.6	39 +/- 8.3	<0.101
Surgical time, mins	158.3 +/- 15.1	163.1 +/- 8.9	0.121
Time to leave OR, mins	4.2 +/- 2.2	12.5+/- 1.9	**<0.001**
Total OR time, mins	195.5 +/- 10.11	214.6 +/- 21.3	**0.004**
EBL (ml)	40.2 +/- 10	52 +/- 1.6	0.511
Intra-op MABP (mm Hg)	82.5 +/- 7.6	86.1 +/- 5.8	0.115

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Intra-op HR (bpm)	69 +/- 7.2	73 +/- 4.1	0.012

The Mean 3-hour PACU NRS score was significantly low in SA group i.e. 2.5 +/- 2.2 as compared to 4.6 +/- 1.5 in GA group. There was no statistically significant difference in time of first post-op rescue analgesia in the two groups. The patients who underwent TLIF under SA were ambulated much early when compared to GA group with time to first ambulation 403 +/- 211 minutes vs 922 +/- 430 minutes ($P < 0.001$).

Table - 3

Variable	SA group	GA group	P value
Mean 3 hr PACU NRS score	2.5 +/- 2.2	4.6 +/- 1.5	**< 0.001**
Time of first post-op rescue analgesia, mins	59.2 +/- 17.5	52.1 +/- 11.1	0.016
Time to ambulation, mins	403 +/- 211	922 +/- 430	**<0.001**

4. Discussion:

To authors knowledge there are very limited studies comparing SA and GA in spine surgeries (5) (6). Most of the studies are for procedures like discectomy and laminectomies. Studies for TLIF are rare to find. In past few years regional anaesthesia for spine surgeries is gaining popularity and some centres have started practicing awake spinal fusions. Our study represents a retrospective observational study comparing method of anaesthesia for TLIF. In our study we have tried to reduce potential selection bias by excluding patients who had contra-indications for either GA or SA. Similar to studies in past showing safety and efficacy of spinal anaesthesia in spine laminectomies and discectomies (7), our study also found SA to be safe and effective for TLF with other potential advantages.

In our study, patients who underwent TLIF under SA had significantly reduced total OR time i.e 8% lesser when compared with GA group. This reduction in OR time was observed mainly from end of surgical procedure to shifting out from OR. This is explained by the fact that time for complete reversal from the neuromuscular block, gaining respiratory function, extubation and ability to follow the commands is required I patients operated under GA. On the contrary, patients who underwent surgery under SA were not deeply sedated and hence were fit transfer to PACU immediately post procedure. Our results match with the outcomes of study by G. D Biase et.al (8) except that we did not find any significant difference in surgical time in the two groups.

We did not find any significant difference in the intra-operative haemodynamic parameters in our study between the two groups which contrasts with some previous studies. This can probably be explained by the use of isobaric intrathecal drug for spinal anaesthesia and maintaining adequate depth of anaesthesia during general anaesthesia in our study. (9) (10)

The Mean 3-hour PACU NRS score was significantly low in SA group as compared to GA group but there was no statistically significant difference in the time of first post-op rescue

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analgesia requirement in the two groups. Overall, patients who underwent TLIF under SA experienced less postoperative pain, having a lower mean NRS pain score in the first 3 hours in the PACU compared with patients who underwent TLIF under GA. It can be explained by two mechanisms. First, SA may provide pre-emptive effect in attenuation of pain response by inhibiting afferent nociceptive pathway. Second, the recovery of the sensory loss remains longer than that of motor.

In our study, we also observed that patients who underwent TLIF under SA could be mobilized as early as mean 6.7 hours as compared to mean 15 hours in GA group. This is similar to the outcomes of study by G. D Biase et.al. a possible explanation to this could be that early recovery from motor block and delayed recovery from sensory block in SA probably allows the patient a pain free ambulation.

Significantly higher number of patients had nausea and vomiting in GA group in our study which is comparable to results of metanalysis by A D Cassai et.al (11) this could be attributed to the use of inhalational agent and opioids with the administration of general anaesthesia.

Limitations of study:

Retrospective nature of study, selection bias and small sample size are the three main limitations of our study. Single surgeon and same anaesthesia team performed the cases limiting the biases.

Further prospective and randomized control trials with larger sample size are needed to corroborate findings.

5. Conclusion:

Our study concludes that SA is safe and effective mode of anaesthesia for TLIF surgery and has additional advantages over GA in terms of lesser OR time, lesser post-operative nausea and vomiting, lesser post-operative analgesia and early first ambulation. Thus, SA has higher probability of being adapted as choice of anaesthesia for lumbar spinal fusion surgeries.

6. References:

1. Deng QF, Gu HY, Peng WY, Zhang Q, Huang ZD, Zhang C, Yu YX (2018) Impact of enhanced recovery after surgery on postoperative recovery after joint arthroplasty: results from a systematic review and meta-analysis. Postgrad Med J 94, 678–693.
2. Zhu S, Qian W, Jiang C, Ye C, Chen X (2017) Enhanced recovery after surgery for hip and knee arthroplasty: a systematic review and meta-analysis. Postgrad Med J 93, 736–742.
3. Roberto J. Perez-Roman, MD, Vaidya Govindarajan, BS, Jean-Paul Bryant, MS, and Michael Y. Wang, MD. Spinal anaesthesia in awake surgical procedures of the lumbar spine: a systematic review and meta-analysis of 3709 patients. Neurosurg Focus 51 (6):E7, 2021
4. Garg B, Ahuja K, Sharan AD. Awake spinal fusion. J Clin Orthop Trauma. 2020 Sep-Oct;11(5):749-752
5. Attari MA, Mirhosseini SA, Honarmand A, Safavi MR. Spinal anaesthesia versus general anaesthesia for elective lumbar spine surgery: A randomized clinical trial. J Res Med Sci. 2011 Apr;16(4):524-9.

ISSN: 0975-3583, 0976-2833 VOL14, ISSUE12, 2023

6. David Urick a, Brandon Sciavolino b, Timothy Y. Wang c, Dhanesh K. Gupta d, Alok Sharan e, Muhammed M. Abd-El-Barr c. Perioperative outcomes of general versus spinal anaesthesia in the lumbar spine surgery population: A systematic review and meta-analysis of data from 2005 through 2021. Journal of Clinical Orthopaedics and Trauma 30 (2022) 101923
7. Robert F McLain [1], Iain Kalfas, Gordon R Bell, John E Tetzlaff, Helen J Yoon, Maunak Rana, Comparison of spinal and general anaesthesia in lumbar laminectomy surgery: a case-controlled analysis of 400 patients, J Neurosurg Spine. 2005 Jan;2(1):17-22.
8. Gaetano De Biase, MD,1 Shaun E. Gruenbaum, MD, PhD,2 James L. West, MD,1 Selby Chen, MD,1 Elird Bojaxhi, MD,2 James Kryzanski, MD,3 Alfredo Quiñones-Hinojosa, MD,1 and Kingsley Abode-Iyamah, MD1. Spinal versus general anaesthesia for minimally invasive transforaminal lumbar interbody fusion: implications on operating room time, pain, and ambulation. Neurosurg Focus 51 (6): E3, 2021.
9. Agarwal P, Pierce J, Welch WC. Cost Analysis of spinal versus general anaesthesia for lumbar discectomy and laminectomy spine surgery. World Neurosurg. 2016; 89:266-271.
10. Davis FM, Laurenson VG, Lewis J, Wells JE, Gillespie WJ. Metabolic response to total hip arthroplasty under hypobaric subarachnoid or general anaesthesia. Br J Anaesth. 1987; 59(6):725-729
11. De Cassai, A.; Geraldini, F.; Boscolo, A.; Pasin, L.; Pettenuzzo, T.; Persona, P.; Munari, M.; Navalesi, P. General Anaesthesia Compared to Spinal Anaesthesia for Patients Undergoing Lumbar Vertebral Surgery: A Meta-Analysis of Randomized Controlled Trials. *J. Clin. Med.* 2021, *10*, 102