**EAS Journal of Anaesthesiology and Critical Care**
*Abbreviated Key Title: EAS J Anesthesiol Crit Care*
ISSN: 2663-094X (Print) & ISSN: 2663-676X (Online)
Published By East African Scholars Publisher, Kenya

OPEN ACCESS

Volume-3 | Issue-3 | May-Jun-2021 | DOI: 10.36349/easjacc.2021.v03i03.002

**Original Research Article**

# Balanced Anaesthesia for Lumbar Spine Surgery

Dr. Md. Abu Zahid Ph.D.[1*], Dr. Md. Monzurul Haque[2], Dr. Md. Sofikul Islam[3], Dr. Sharmin Sultana[4], Dr. Md. Samiul Alam[5], Dr. Md. Anwarul Haque[6]

[1]Associate Professor, Department of Anesthesiology, Rajshahi Medical College, Bangladesh
[2]Assistant Professor, Department of Neurosurgery, Rajshahi Medical College, Bangladesh
[3]Assistant Professor, Department of Ortho Surgery, Rajshahi Medical College, Bangladesh
[4]IMO, Department of Gynae & Obstetrics, Rajshahi Medical College Hospital, Bangladesh
[5]Junior Consultant, Department of Anesthesiology, Rajshahi Medical College Hospital, Bangladesh
[6]Junior Consultant Upazila Health Complex, Paba, Rajshahi, Bangladesh

**Article History**
Received: 22.04.2021
Accepted: 30.05.2021
Published: 04.06.2021

**Journal homepage:**
https://www.easpublisher.com

**Quick Response Code**

**Abstract:** Selected patients undergoing lumbar spine surgery in Rajshahi Medical College Hospital and some clinics within Rajshahi city, Bangladesh, were given balanced Anaesthesia as well as General Anaesthesia. The procedure will be thoroughly explained, and the findings will be presented. This research looks at patients who were admitted and operated on between July 1, 2019, and December 31, 2020. At that time, we conducted a prospective study of all of the patients who were operated on in the hospital. Case notes were gathered and analyzed. The demographics, specifics of the process, and short-term outcomes were all recoded into a database. A total of 82 patients underwent lumbar spine surgery. 34 patients underwent one-level lumbar spine decompression, 22 patients underwent two-level decompression, 06 patients underwent spinal tumor surgery, 14 patients underwent cauda equina syndrome (CES) due to spinal stenosis, and 06 patients underwent lumbar listhesis with fixation. There were no significant anesthetic or surgical complications in any of the patients after surgery. Minor problems including vomiting, hypotension, restlessness, and so on can occur and be treated. Lumbar spine surgery can be safely conducted under balanced Anaesthesia, as shown by the fact that post-operative analgesia was sustained for more than 4 hours after surgery. For patients undergoing lumbar decompression surgery, balanced Anaesthesia is a viable option with possible benefits. In our experience, patients accepted the operations well, and the short-term result was also satisfactory.

**Keywords:** Laminectomy, Discectomy, PLID, Lumbar decompression, Surgery, Balanced Anaesthesia, Rajshahi Medical College.



## INTRODUCTION

Lundy coined the term "Balanced Anaesthesia" in 1926, implying that a combination of agents and techniques (e.g., premedication, regional Anaesthesia, and light general Anaesthesia with one or more intravenous anesthetic agents) should be used to achieve the various components of general Anaesthesia (i.e., analgesia, amnesia, muscle relaxation, and the abolition of autonomic reflexes with preservation of consciousness) (Lundy JS., 1926; Steven MY., 2000) [1], this type of Anaesthesia aims to combine the desired effects of general Anaesthesia with the undesirable side effects of individual Anaesthesia. Underbalanced Anaesthesia, lumbar discectomy, and laminectomy can be performed successfully with good results and satisfaction. Lumbar surgery may be done safely under balanced Anaesthesia; Mixter and Barr performed the first laminectomy and discectomy in 1934 [2, 3]. Lumbar laminectomy or discectomy is done with the patient in the prone or lateral decubitus position. The lumbodorsal fascia is incised by a midline paramedian incision. The laminae are exposed during periosteal dissection and are removed when required to gain access to the thecal sac and nerve roots. The nerve roots are retracted medially to reveal the intervertebral discs' posterior longitudinal ligament. The discectomy is performed by cutting the ligament and using forceps to remove the disc material. In cases of spinal stenosis, the laminar resection may also be extended to include canal decompression [4, 5]. The lumbar spine has the largest vertebral bodies and carries the most weight, so it's important to remember that. The body's center of gravity is about 1 cm behind the sacral promontory, putting the whole weight of the body directly on the sacral promontory [6, 7]. The discs become less fluid and more fibrocartilagenous as they age, with little

***Corresponding Author:** Dr. Md. Abu Zahid Ph.D.

difference between the nucleus and the annulus. Pathologic changes in the discs can result in herniation of the nucleus pulposus and compression of the neural elements. The disc or lamina is then removed with the aid of loops or microscopes, which takes about two hours on average. As a result, balanced Anaesthesia has become a popular alternative for these patients' anesthetic techniques. They found less blood loss and less postoperative analgesic usage in patients who had balanced Anaesthesia [8, 9]. We used a balanced anesthetic technique to conduct several operations in our Covid-19 situation. As a result, I'd like to focus on a balanced anesthetic technique for lumbar spine surgery because it's healthy for patients and the surgical team in covid-19 situations.

## MATERIALS AND METHODS

**Study population and place**

Patients of lumbar spine surgery admitted in Rajshahi medical college hospital and some clinics within Rajshahi city, Bangladesh.

**Study design**

This is a prospective study. In this study, 82 patients of lumbar spine surgery were randomly selected to receive either Balanced Anaesthesia or General Anaesthesia.

**Study Period**

Total study period was from 1st July 2019 till 31st December 2020.

**Sampling method**

Random sampling technique was used for the selection of cases between balanced Anaesthesia and General Anaesthesia that fulfilled the inclusion criteria of this study.

**Inclusion criteria**

Patients undergoing lumbar spine surgery ASA grading I, II & III with informed consent and operation usually within 3 hours duration in moderately healthy patients.

**Exclusion criteria**

Patients of ASA grading IV and V. Patients in the stage of shock or bleeding disorder, hypovolemia, infection at the injection site, history of seizure, and raised intracranial pressure.

After a thorough description of the anesthetic procedure and what to expect during the perioperative phase, the patients gave their informed consent. The team was asked to conduct routine inquiries, which they did. Over 15 minutes, patients were given 7 ml/kg of regular saline.

**Procedure**

The patients were positioned in a sitting position, their backs were washed, and aseptic draping was done. 3-4 ml of 2% Lidocaine was injected into the room to be used, which was normally L3/L4. Then, a 25 g spinal needle was inserted into the subarachnoid space of the spine before clear cerebrospinal fluid was detected. To achieve balanced Anaesthesia, 3 ml of Bupivacaine heavy plus 25 g of fentanyl were injected into the subarachnoid room. For 10-15 minutes, patients were forced to lie supine. Meanwhile, a catheter of sufficient size was inserted aseptically into the urinary bladder, and a prophylactic antibiotic was administered as needed. Patients were turned prone on bolsters to free the stomach and chest after developing a degree of the spinal block at T6–T10. Soft pillows were also used to protect the head, limbs, and pressure points. Blood pressure was controlled during the procedure, and hypotension (systolic blood pressure less than 90 mmHg) was treated with intravenous Ephedrine 5 mg injections. Any patient who seemed to be uneasy or nervous was given 50 µg of fentanyl plus 1-2 milligrams of midazolam intravenously. Other sedatives such as nalbuphine or propofol may be used in sedative doses. This could happen once in a while after lying prone for about an hour. Patients were turned back into a supine position after surgery. In the recovery room, you'll be monitored. Pain, nausea/vomiting, vital signs, and regression of sensory block to at least 2 segments below the initial stage were all evaluated in the recovery room.

In most cases, the spinal anesthetic will be administered before the patient is put in the prone position. Before spinal placement, the patient is usually given 400-600 mL of a controlled salt solution to increase intravascular volume. Many physicians tend to put the spinal block on the patient while they are seated. The seated position aids in the identification of the midline and allows for better delineation of the overall spinal anatomy, particularly in larger individuals. The patient may be put in the lateral decubitus position for spinal positioning in some cases. The back is prepped and draped in a sterile manner, and the best interspace, either L2-3, 3-4, or 4-5, is found. The region where the spinal needle will be implanted is anesthetized with 2-4 ml of 2% lidocaine. The majority of practitioners will use a 24g or 25g pencil-point spinal needle that is advanced via an introducer before the free flow of CSF is detected from the needle's hub. Following confirmation of subarachnoid placement, 2-3 ml of 0.5 percent plain bupivacaine or 3-4 ml of 0.5 percent bupivacaine heavy is injected into the subarachnoid room. The patient is returned to the supine position, and after obtaining a T8-10 level, he or she is rolled into the prone position and either allowing them to self-position their upper body for comfort in a Wilson or Andrews frame. The study participants were expected to remain supine for approximately 10 minutes after receiving the local anesthetic to ensure that the spinal level was maintained. Since patients are usually put in a prone position, a hyperbaric spinal must be fixed. If a hyperbaric solution is chosen without enough time for

fixation, the solution can monitor cephalad and result in a higher level than what is needed. Spinal Anaesthesia offers good surgical conditions for spine surgery if the sensory level is sufficient and ventilation is not hampered by a high block All injections were done in less than 5 seconds with the needle bevel facing cephalad. After being rendered supine for 10 minutes, the patients were turned prone to begin surgery. The onset of sensory and motor block was quicker with hyperbaric bupivacaine. Another study looked at injecting 15 mg of 0.5 percent plain bupivacaine at the L2-3 interspace and then placing the patient in the prone knee-chest position before spinal placement or positioning the patient supine after spinal placement and receiving the spinal volume before positioning the patient prone. The average systolic blood pressure drop in prepositioned patients was 30 mmHg, compared to 13 mmHg with spinal placement before positioning. A pencil-point needle, such as a Whitacre, is typically used instead of the traditional cutting Quincke form during the injection of the spinal anesthetic. While prone (for isobaric only), sitting, and lateral approaches for spinal Anaesthesia insertion have all been identified, it is important to remember that the spinal should eventually be positioned above the level of any lumbar stenosis (and below the level of the cord), since very tight stenotic lesions may affect local anesthetic spread.

## RESULTS AND OBSERVATIONS

This research looks at patients who were admitted and operated on between July 1, 2019, and December 31, 2020. Selected patients undergoing lumbar spine surgery at the Rajshahi Medical College Hospital and nearby clinics. In Bangladesh, A total of 82 lumber spine surgery patients have enrolled in our ongoing operation.

**Table-1: For the period of 1 July 2019 to 31 December 2020, the total case management profile will be used**.

| Total case management profile | Number |
|---|---|
| One level lumbar spine decompression | 34 |
| Two-level spinal decompression | 22 |
| Spinal tumor operation | 06 |
| Cauda equina syndrome (CES) Spinal Stenosis | 14 |
| lumber listhesis with fixation | 06 |
| Total number of operations | 82 |

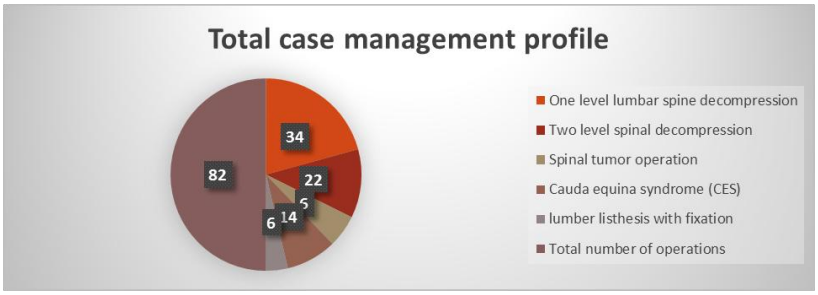


**Fig-1: Total case management profile.**

Above 82 patients half assigned to general Anaesthesia and the other half to balanced Anaesthesia. Fewer episodes of tachycardia, hypertension, and better postoperative pain with less analgesic requirement in the balanced anesthetic procedure. There were 45 males and 37 women, ranging in age from 34 to 72. The procedures took an average of 95 minutes for balanced Anaesthesia and 115 minutes for General Anaesthesia. The postoperative analgesia was sustained for more than 4 hours. In all cases, the patients and surgeon were delighted with the balanced Anaesthesia.

**Table-2: Peri-operative changes in mean Heart rate (HR) b/m (Mean ± SE)**

| Type of Anaesthesia | Base line | Intra-operative | Post-operative |
|---|---|---|---|
| **Balanced** | 84±2.73 | 64±1.52 | 75±2.54 |
| **General** | 82±2.17 | 88±1.61 | 92±1.22 |

P-value reached from unpaired t-test.

Table 2 shows that heart rate significantly decreased in the balanced anesthetic procedures as P value < 0.05.

**Table-3: Peri-operative changes in mean Blood Pressure (BP) mmHg (Mean ± SE)**

| Type of Anaesthesia | Base line | Intra-operative | Post-operative |
|---|---|---|---|
| **Balanced** | 86±2.58 | 68±2.96 | 74±2.53 |
| **General** | 84±2.32 | 94±3.31 | 96±2.42 |

Table 3: Shows intraoperative blood pressure significantly decreased in balanced anesthetic procedure and blood pressure significantly increased in the general anesthetic procedure as P value < 0.05.

**Table-4: Peri-operative changes in mean Oxygen saturation ($SPO_2$%) (Mean ± SE)**

| Type of Anaesthesia | Base line | Intra-operative | Post-operative |
|---|---|---|---|
| **Balanced** | 97±1.45 | 94±1.53 | 95±1.54 |
| **General** | 98±1.22 | 96±2.11 | 94±1.24 |

Table 4: Shows no significant changes in oxygen saturation in both balanced and general anesthetic procedures as P value > 0.05.

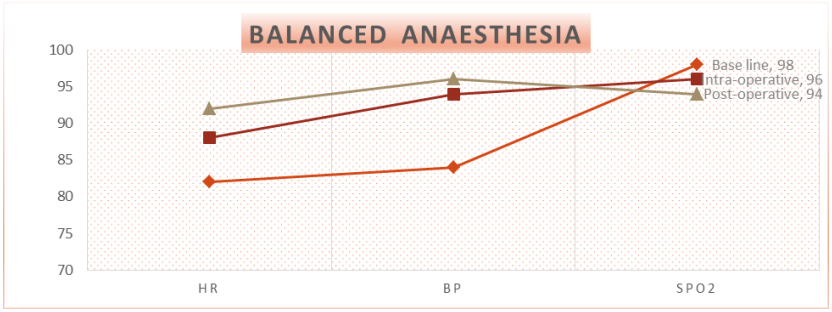


**Fig-3: Perioperative changes of HR, BP, and SPO2 in balanced Anaesthesia Procedure.**

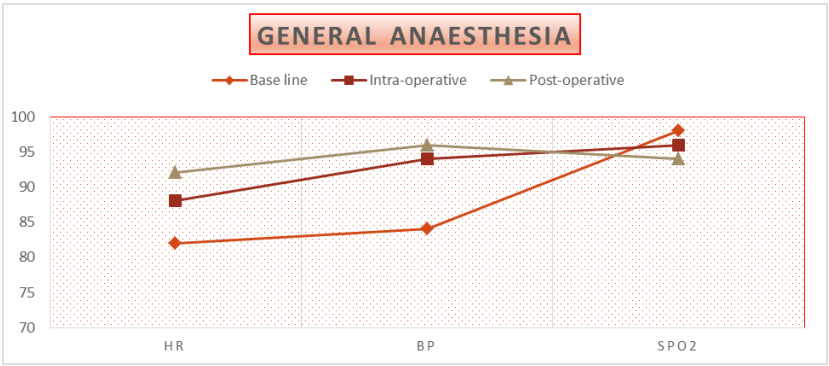


**Fig-4: Perioperative changes of HR, BP, and $SPO_2$ in general Anaesthesia Procedure.**

## DISCUSSION

General Anaesthesia or Balanced Anaesthesia have been used to successfully perform spine operations [10, 11]. There have been several studies conducted to determine the effectiveness and efficacy of regional Anaesthesia in lumbar surgery. We discovered that performing the surgery under regional Anaesthesia increased the number of people who came in for surgery at our clinic. It came as a relief to those who were given the choice of spinal Anaesthesia for brief spinal procedures that they could be awake and get their operation performed safely in this manner [12, 13] Patient selection must be meticulous, and informed consent must be obtained. The patient must cooperate and be tolerant of minor pain caused by the prone position. The procedure should also not take longer than 3 hours [14, 15]. Severe complications were recorded infrequently, and they were normally caused by the spread of Anaesthesia, which resulted in circulatory and respiratory insufficiency. It is also important to be able to quickly treat such complications. In our experience, patients tolerated the procedure well, with a quick recovery and few complications [16, 17].

In a prone position, a patient undergoes spinal surgery. The brachial plexus injury is the most common. The plexus also runs under the clavicle and immediately above the first rib. When the patient is in the prone position, particularly when the arms are adducted more than 90 degrees, brachial plexus injury is most common [18, 19]. Possible brachial plexus injuries include (A) stretching and compression between the clavicle and first rib; (B) damage to the plexus at the humeral head; and (C) compression of the ulnar nerve in the cubital tunnel [20].

In prone placed patients, the eyes and ears are also a source of concern. Increased intraocular pressure and potential blindness due to ischemic damage to the optic nerves may result from pressure on the globe or hypotension combined with venous congestion. The use of spinal Anaesthesia prevents these issues. The patient may be only mildly sedated, and self-positioning with their head on a pillow or cushion may be aided by using their upper body. These modifications are normally tolerated by patients with normal cardiac status [20,21]. Patients with impaired cardiac status, particularly those

with a reduced sympathetic tone, may not be able to tolerate supine to prone positioning. Consciousness and involuntary breathing can be affected by a significant drop in blood pressure or cardiac activity. Surgeries that last longer than 2-3 hours cannot be suitable for a cooperative surgeon to administer spinal Anaesthesia [22,23]. This technique works best for one to two-stage laminectomies or discectomies. A patient who is more heavily sedated Obese patients with protruding abdomens can struggle to tolerate prone positioning, particularly if they breathe spontaneously [24,25].

Improving postoperative analgesia in patients who have had spinal surgery is also a concern. Patients who received spinal Anaesthesia had lower pain scores and needed fewer analgesics. Patients who received spinal Anaesthesia had significantly lower initial pain scores than those who received general Anaesthesia Spinal Anaesthesia can have a preemptive effect, in which it reduces pain by inhibiting afferent nociceptive pathways. Furthermore, since sensory recovery takes longer than motor recovery after spinal block, patients who received neuraxial Anaesthesia were likely to have residual blockade even after the motor function had recovered [27,28]. Finally, spinal Anaesthesia for lumbar spine surgery reduces the risk of thromboembolic complications in the lower extremities. Neuraxial Anaesthesia with local anesthetics has been shown to increase fibrinolytic activity, decrease antithrombin III activity to normal levels, and minimize postoperative platelet activity increases [29, 30].

Because of better gastric emptying, low-level T-8 or bolus spinal Anaesthesia has been shown to have a lower incidence of nausea and vomiting than GA. There have been no records of headaches following a Dural Puncture. One theory is that surgery near the spinal cord triggers inflammatory responses that aid in the sealing of any minor puncture sites. Furthermore, the presence of small amounts of post-procedural blood can act as a sealant, just like a blood patch. According to Dripps and Vandam's widely cited report, properly administered spinal Anaesthesia is healthy. Local anesthetic toxicity caused by maldistribution and high concentrations is well known in spinal Anaesthesia. Cauda equina syndrome has been used with microcatheters used for continuous spinal Anaesthesia as a result of this toxicity. The proposed mechanism is based on the blockade of sympathetic efferents, which causes Bradyarrhythmias due to vagal predominance. The presence of vagal-induced bradycardia and reduced venous return from vasodilation combine to make injection Atropine even more problematic. Spinal Anaesthesia also activates 5-HT3 receptors in the vagal nerve endings. The administration of ondansetron, a 5-HT3 antagonist, combined with injection Atropine will eliminate the 5-HT3 signal [31].

When compared balanced Anaesthesia to general Anaesthesia has been shown to improve hemodynamics in the post-Anaesthesia treatment unit (PACU). During their stay in the recovery room, patients who had balanced Anaesthesia had significantly lower blood pressure.

Avoiding factors such as-

- Use of beta-blocking medications
- Baseline heart rate of < 60
- Sensory level > T6.

Maintaining preload wherever possible is recommended, accompanied by intervention with atropine (0.4-0.6 mg), ephedrine (25-50 mg), and, if still not receptive, epinephrine (0.2-0.3 mg) intravenously/ Adrenaline in dilatation [1:10 ml D/W] [32].

## CONCLUSION

A perceived reduction in blood loss, lower rates of thromboembolism, less hypertension or tachycardia, and improved postoperative pain management are all benefits of balanced Anaesthesia for lumbar Spine surgery. Furthermore, the patient is only mildly sedated with a benzodiazepine or propofol, or opioids during spinal Anaesthesia. It has been found that cases performed under balanced Anaesthesia are perceived to have less surgical blood loss. The fact that spinal Anaesthesia causes a marked reduction in the high venous pressure that occurs in response to sympathetic activity elicited by tissue Damascus pain may be linked to the preload mechanism by which spinal Anaesthesia can minimize blood loss. As compared to general Anaesthesia with positive pressure ventilation, spinal Anaesthesia allows for spontaneous ventilation during surgery, resulting in lower intrathoracic pressure in the prone position. The epidural veins are less distended and intrathoracic pressure is lower while positive pressure ventilation is avoided. The vena cava receives more blood, and the venous plexus receives less blood flow and distention, allowing for improved surgical visibility. Because of the reduced time to impact hemostasis, the reduced blood loss observed during spinal Anaesthesia may promote disc or vertebral body removal and result in less surgical time. A substantial drop in cardiac output is seen if normovolemia is not preserved. Patients who received spinal Anaesthesia had lower mean arterial pressure and heart rates. In a recent review, Attari et al. found that spinal Anaesthesia preserves hemodynamic stability with little effect on heart rate. For lumbar spine operations lasting two to three hours, balanced Anaesthesia is the best option. The use of this anesthetic procedure would be supported by a suitable patient and a cooperative surgeon. This procedure is superior to general Anaesthesia in terms of overall patient satisfaction and decreased morbidity since it provides a better postoperative experience with less discomfort, nausea, and hemodynamic stability. More advantageous, especially if considering same-day

discharge and a shorter hospital stay for a day case anesthetic patient.

For basic lumbar spine procedures, balanced Anaesthesia is a safe and effective alternative to General Anaesthesia. The team must be mindful of any potential issues. Hypotension, blockade failure, and other potentially severe complications are examples. (Ouro-Bang'na Maman et al). as paraplegia Overall, the patient and family were pleased with the conclusion of the procedures in our experience. From these data, it appears that balanced Anaesthesia is a promising method of Anaesthesia for Lumbar Spine Surgery and with proper monitoring, it could potentially be evolved as the new gold standard anesthetic approach for Lumbar Spine Surgery in moderately healthy patients.

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**Cite this article:** Abu Zahid *et al* (2021). Balanced Anaesthesia for Lumbar Spine Surgery. *EAS J Anesthesiol Crit Care*, *3*(3), 32-38.