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Advancing Lumbar Surgery: Exploring the Efficacy and Outcomes of Spinal Anesthesia in 41 Cases.

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Abstract

Background: Spinal anesthesia has emerged as a safe and effective alternative for patients with lumbar spine degenerative disease, particularly those with comorbidities. The aim of this study was to investigate the role of spinal anesthesia in the management of lumbar disc degeneration at the Neurospinal and Cancer Care Institute in Karachi.

Methodology: This prospective cohort study was conducted at the Neurospinal and Cancer Care Institute's Department of Neurosurgery. The study included patients with a mean age of 53.43 ± 8.11 years and was carried out from February 2019 to August 2022, following approval from the Institutional Review Board.

Results: The study comprised predominantly high-risk patients, with 32 individuals (78%) having associated comorbidities. The American Society of Anesthesiologists (ASA) classification was used to assess the patients' risk level, with 3 patients (7.31%) classified as ASA grade I, 21 patients (51.21%) as ASA grade II, 16 patients (39.02%) as ASA grade III, and 2 patients (4.87%) as ASA grade IV. The most commonly affected level of disc degeneration was L4-L5 (63.41%), followed by L5-S1 (36.58%), with the majority of stenosis occurring at L4-S1. No complications such as urinary retention, vomiting, or dural tear were observed. Pain relief was assessed using the visual analogue scale (VAS), with 23 patients having a preoperative VAS score of 7, 14 patients with a score of 8, and 4 patients with a score of 9. Postoperatively, 18 patients (43.9%) had a VAS score of 2, 23 patients (56%) had a score of 1, and 5 patients (12%) had a score of 0.

Conclusion: Based on the findings of this study, spinal anesthesia can be considered a suitable alternative to general anesthesia for patients with comorbidities or those classified as ASA grade I/II. This technique offers several advantages, including cost-effectiveness, shorter anesthesia duration, and fewer complications. These findings support the use of spinal anesthesia in patients with limited spinal pathology in the lumbar spine.

Keywords

Neurosurgery, Spinal Anaesthesia, General Anaesthesia, Bupivacaine, Lumbar Microdiscectomy.

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Introduction

Spinal anesthesia is a well-established technique that has been widely used as an alternative to general anesthesia, not only in neurosurgery but also in other medical disciplines. While awake procedures in neurosurgery are commonly performed for cranial approaches, recent advancements have shown that spinal procedures can be a viable option for patients with relevant comorbidities[1]. Patients with back pain requiring surgical intervention often present with symptoms such as back pain, leg numbness, neurogenic claudication, and radiation pain[2].

In the past few decades, spinal surgery has evolved with various surgical techniques, including the use of spinal anesthesia. This approach offers several potential benefits, including cost-effectiveness, reduced blood loss, faster recovery, shorter hospital stays, and improved surgical outcomes. Common procedures performed on the lumbar spine include foraminotomy, discectomy, decompression, cyst removal, and different types of fusions. While these procedures are typically performed under general anesthesia, there is growing clinical research proposing the use of spinal anesthesia for lumbar spinal surgery, particularly for patients with comorbidities and elderly individuals with additional health concerns[3-4].

In addition to discectomy and lumbar stenosis surgery, awake surgery is being increasingly performed for spinal tumors and fusion procedures in many spinal institutions, with reports of improved outcomes[5]. However, it is important to note that awake spinal surgeries can carry similar complications to general anesthesia, such as durotomy, infection, re-herniation, nerve injury, and may sometimes require revision surgery. Therefore, patient selection is crucial, with preference given to cooperative individuals who can actively participate during the procedure[6-7].

Recent advances in spinal disc and degenerative procedures have led to a variety of options that are routinely performed at medical centers worldwide. The approach can vary depending on the patient, including endoscopic methods, microsurgery, fusion, and hemilaminectomy, with the aim of minimizing patient invasiveness and improving daily quality of life[8].

Lumbar discectomy is the most common surgical procedure performed for disc-related issues, while hemilaminectomy is commonly used for lumbar stenosis. Over time, these procedures have become more minimally invasive, and there has been a shift from general anesthesia to spinal anesthesia, allowing patients to remain awake during the surgery[9-10]. While spinal anesthesia has been traditionally used in gynecological procedures, it has gained popularity in neurosurgery in recent times. In this study, we aim to present our experience and expertise with spinal anesthesia, as there is currently no regional-level study available. If the results prove to be acceptable, this approach can potentially reduce costs, hospital stays, and the need for unnecessary general anesthesia in selected patients, particularly those with comorbidities. The primary goal of this research is to facilitate spinal degenerative surgery for patients with comorbidities through the use of epidural anesthesia, ultimately reducing the duration of post-operative recovery, hospital stay, and operative time in lumbar discectomy surgery.

Methodology

Study Design

This prospective cohort study was conducted at a single center in Karachi, Pakistan, from February 2019 to August 2022.

Study Site

The study was conducted exclusively at the Neurospinal Cancer Care Institute in Karachi, Pakistan.

Ethical Approval

Ethical approval was obtained from the Research Ethical Board Committee of the Neurospinal and Cancer Care Institute, with IRB number 9730/20, dated 22-02-2020. Informed consent was obtained from all participating patients.

Sample Size and Selection

A total of 41 patients were included in the study, consisting of 31 (75%) males and 10 (24.39%) females. The sample was selected using consecutive sampling at the study site.

Inclusion Criteria

Patients meeting the following criteria were included in the study:

- Unilateral radiculopathy
- Leg weakness and numbness due to herniation
- Lumbar disc herniation at a single level
- Lumbar stenosis
- Patients with associated comorbidities unable to undergo general anesthesia

Exclusion Criteria

Patients meeting any of the following criteria were excluded from the study:

- Previous spinal surgery
- Requirement for spinal fixation
- Lack of cooperation for surgical procedure under spinal anesthesia
- Patients with spondylolisthesis
- Refusal for surgery
- Localized infection
- Coagulopathy
- Follow-up period of less than 1 year

Diagnostic Procedures

Diagnostic procedures included MRI of the lumbosacral spine to visualize disc herniation or stenosis, as well as dynamic X-ray and AP and lateral view imaging.

Data Analysis

Data analysis was performed using the Statistical Package for Social Sciences software (SPSS) version 22. Descriptive statistics, such as means, standard deviations, and percentages, were calculated for the study variables.

Outcome Analysis

The primary outcomes were measured using the visual analogue scale (VAS) for pain assessment, the American Society of Anesthesiologists (ASA) classification for patient profile, and the duration of surgery.

Surgical Technique

During the surgical procedure, patients were positioned in a sitting position with ECG, blood pressure, and pulse oximetry monitoring. Spinal anesthesia was administered at the L2-L3 level using a spinal needle (gauge 21) and 0.75% bupivacaine in a drip of 8.5% dextrose solution. Once the regional block was effective, patients were turned into a right-up position with assistance. After ensuring numbness in the operative area, a skin incision was made, followed by separation of muscles and maintenance of hemostasis in the surgical fields. Hemilaminectomy and foraminotomy were performed as necessary. The surgical site was closed layer by layer, including the muscle, fascia, and skin. Patients were mildly sedated with Nalbuphine according to their body weight during the procedure. Nalbuphine was gradually tapered off, and patients were shifted to the High Dependency Unit (HDU) as required.

Results

Patient Profile

A total of 41 patients participated in the study, Based on the American Society of Anesthesiologists (ASA) classification, 32 (78%) patients had associated comorbidities. Among the comorbid patients, 3 (7.31%) were classified as ASA I, 21 (51.21%) as ASA II, 16 (39.02%) as ASA III, and 2 (4.87%) as ASA IV. The most common comorbidities observed were hypertension (26 patients, 63.41%) and diabetes mellitus (22 patients, 53.65%).

Surgical Characteristics

The most frequently observed level for lumbar disc pathology was L4-L5 (24 patients, 58.53%), followed by L5-S1 (11 patients, 26.82%). Six patients (14.63%) underwent foraminotomy for the management of their condition. The diagnosis was confirmed through MRI lumbosacral spine imaging, dynamic X-ray, and AP and lateral views.

Anesthesia and Surgical Technique

Spinal anesthesia using 0.75% bupivacaine in a drip of 8.5% dextrose solution was administered at the L2-L3 level using a spinal needle (gauge 21). The regional block was effective, allowing patients to be positioned in a right-up position. The surgical procedure involved hemilaminectomy and foraminotomy as per the requirement. Nalbuphine was used for mild sedation during the surgery, and patients were monitored and shifted to the High Dependency Unit (HDU) as necessary.

Outcome Analysis

No complications, such as urinary retention, vomiting, or dural tear, were observed in any of the patients. Preoperative pain, as measured by the visual analogue scale (VAS), had a mean score of 7 (53% of patients), with 8 (34.14% of patients) and 9 (9.7% of patients) being less common. Postoperatively, the VAS scores significantly improved, with a mean score of 2 (43.9% of patients) and the majority of patients (56%) reporting a VAS score of 1. Five patients (12%) reported a VAS score of 0, indicating complete pain relief. Mild hypotension and decreased heart rate were observed in some patients as common hemodynamic phenomena associated with spinal anesthesia.

Table 1: Patient Characteristics.

Variables		**N=41**
Gender	Male	31(75.0)
	Female	10(24.39)
Comorbid Patients		32(78.0)
Age; years (mean±SD)		53.43±8.11
BMI; kg/m^2 (mean±SD)		24.34±5.0
Duration of Surgery; mins (mean±SD)		145±17.2

Table 2: Surgical Characteristics.

Surgical Procedure	**Number of Patients**	**Percentage (%)**
Lumbar Disc	24	58.53
Lumbar Canal Stenosis	11	26.82
Foraminotomy	6	14.63

Table 3: Pre- and Postoperative Pain Assessment.

VAS Score	**Preoperative**	**Postoperative**
0	-	5(12)
1	-	23(56)
2	-	18(43.9)
7	23(53)	-
8	14(34.14)	-
9	4(9.7)	-

VAS-Visual Analogue Scale

Discussion

The objective of this study was to evaluate the effectiveness of spinal anesthesia as an alternative to general anesthesia in patients undergoing lumbar spine surgeries, considering factors such as pain management, comorbidities, duration of surgery, and hospital stay. Our findings demonstrated improved pain levels based on the visual analogue scale and showed positive outcomes in terms of the American Society of Anesthesiologists (ASA) score. The most common level of disc degeneration observed was L4-L5, followed by L5-S1, with stenosis predominantly occurring at the L4-S1 level. A significant proportion of patients had hypertension (63.41%) and diabetes (53.65%). The most frequent procedures performed were lumbar discectomy (58.53%), lumbar canal stenosis (26.82%), and foraminotomy (14.63%).

Traditionally, general anesthesia has been employed for procedures such as lumbar discectomy and spinal lesion surgeries. However, both spinal and epidural anesthesia are becoming increasingly popular due to their convenience and favorable outcomes[11,12]. In our study, spinal anesthesia was used, allowing patients to remain awake during the procedure. This approach was particularly beneficial for patients with associated comorbidities who were not suitable candidates for general anesthesia. The overall experience and outcomes of our study support the use of spinal anesthesia in these patients. Although spinal anesthesia is not commonly used in lumbar spine surgeries, our case series provides valuable insights into the feasibility of this technique.

Another study evaluating spinal anesthesia in lumbar surgeries, including discectomies, laminectomies, and hemilaminectomies, with durations ranging from 1 to 2 hours, emphasized the importance of patient selection based on disease and comorbidities[13], as well as patient cooperation. In our study, we carefully selected patients with comorbidities who were willing to cooperate, resulting in no cases requiring redo surgery under spinal anesthesia, which can be more time-consuming and challenging due to scar marking difficulties.

In a separate study focusing on endoscopic lumbar procedures, such as discectomies, laminectomies, and hemilaminectomies, both epidural anesthesia and general anesthesia were found to be effective and safe. Neurosurgical complications did not significantly differ between the two anesthesia techniques. Epidural anesthesia provided effective pain control during the procedure while preserving motor function in the lower limbs. Careful administration of the drug ropivacaine was essential in epidural procedures[14].

Studies have demonstrated that spinal anesthesia is associated with lower operating costs compared to general anesthesia, primarily due to shorter anesthesia duration, reduced operative time, and controlled blood loss. These factors contribute to minimizing the complication rate. Our findings align with these studies, highlighting the potential cost reduction and shorter hospital stay in selected patients[15-17]. It is important to note that patient selection and counseling are crucial for achieving successful outcomes with spinal anesthesia. Surgeons experienced in quick decision-making and efficient operation are essential for performing these procedures.

Spinal anesthesia is not limited to lumbar disc surgeries but can also be employed in spinal tumor procedures and prepartum surgical treatments, ensuring the safety of pregnant patients[18]. The use of spinal anesthesia in gynecological procedures has been common for several decades.

Comparing visual analogue scale (VAS) scores for pain management, spinal anesthesia was not significantly different from general anesthesia. Epidural anesthesia may lead to minimal blood loss and hypotension due to sympathetic blockage and inhibition of stress hormones, resulting in fewer complications[19]. However, urinary retention, headache, and shorter duration of action are potential concerns. In our study, the VAS scores indicated effective pain relief, with a majority of

patients reporting lower scores postoperatively compared to preoperative scores.

Comparing general anesthesia and regional anesthesia, the latter was associated with fewer complications, including high-grade fever, reduced blood loss, decreased nausea, anti-emetic effects, and shorter post-surgery hospital stays[20,21]. However, large-scale multicenter studies are needed to further investigate these findings and evaluate pain management scores more comprehensively[22]. The effectiveness of spinal anesthesia as a fast-acting, safe, and efficient approach has also been supported by other studies[23].

Limitations

To improve the robustness of the findings, future studies should aim to increase the sample size and involve multicenter collaborations. Such collaborations would allow for the examination of different surgeons' experiences and reduce bias. This approach would ultimately benefit patients with comorbidities by enhancing the quality of care and treatment outcomes.

Conclusion

Spinal anesthesia can be a viable alternative to general anesthesia for patients with comorbidities or those classified as ASA grade I/II, specifically those with limited spinal pathology in the lumbar spine. The advantages of spinal anesthesia include relative cost-effectiveness, shorter anesthesia duration, and fewer complications. Further research, including larger multicenter studies, is warranted to validate these findings and optimize pain management scores.

Conflicts of Interest

The authors declare no conflicts of interest.

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