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Study of Spinal anesthesia in patients with Scoliosis at a tertiary hospital

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ABSTRACT

Background: Scoliosis is a complex deformity of the vertebral spines resulting in lateral curvature, rotation of the vertebrae and deformity of the rib cage. 75 -90% of cases of scoliosis are of the idiopathic type, out of which the adolescent type is most common. Patients with scoliosis present challenges in administration of anesthesia during surgical procedures. The common problems are airway management and respiratory conditions. **Aims and Objectives:** The present study was aimed to study spinal anaesthesia in patients with scoliosis at a tertiary hospital. **Materials and Methods:** The present study was a prospective, observational study conducted in department of anesthesiology, in patients between age group 18 and 60 years with scoliosis (Cobb's angle of >15°), American Society of Anesthesiology physical grade I/II, posted for elective, lower limb orthopedic soft tissue release procedures under spinal anesthesia. All details were noted in case proforma and entered in Microsoft excel sheet. Statistical analysis was done using descriptive statistics. **Results:** A total of thirty-two patients were included in present study. The mean age was 25.27 ± 4.81 years. Male (63%) were more than female (37%). Male to female ratio 1.7:1. As per American society of anaesthesiologist physical grading grade I patients were 78% while grade II was 22%. The onset of sensory block was in 7.9 ± 2.3 mins and onset of motor block was in 4.9 ± 2 mins. Maximum extent of sensory blockade till T5-T4 was noted in 66% patients. Time taken for complete recovery of motor block to its preoperative level was 94.3 ± 26.2 min. **Conclusion:** With proper preoperative assessment, spinal anesthesia can be safely used in patients with scoliosis. Patients with scoliosis needs good preoperative assessment, well equipped setup and team efforts for good outcome.

Key words: Scoliosis; Spinal Anaesthesia; subarachnoid block

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INTRODUCTION

Scoliosis is a complex deformity of the vertebral spines resulting in lateral curvature, rotation of the vertebrae and deformity of the rib cage. Seventy-five to ninety percent of cases of scoliosis are of the idiopathic type, out of which the adolescent type is most common.[1] Remaining cases belongs to other etiologies such as neuromuscular (cerebral palsy, spina bifida, poliomyelitis), metabolic (Hunter's syndrome), congenital malformations (hypotonia), osteoporosis, tuberculosis, trauma, malignancy, dysmorphic syndromes (Marfan's syndrome, osteogenesis imperfecta, neurofibromatosis),etc.[2]

There is usually secondary involvement of the respiratory, cardiovascular and neurologic systems. Airway (altered airway anatomy, difficult laryngoscopy and intubation), respiratory (restrictive lung disease, pulmonary hypertension, hypoxic, pulmonary vasoconstriction), cardiac (cor pulmonale, right ventricular hypertrophy, cardiomyopathy) conditions noted in patients with scoliosis.[3] Scoliosis may cause restrictive lung disease which decreases vital capacity, tidal volume, functional residual capacity and increased respiratory rate.[4]

Patients with scoliosis present challenges in administration of anesthesia during surgical procedures. The common problems are airway management and respiratory conditions.

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Spinal anesthesia proved to be extremely safe and require a small volume of drug, less systemic pharmacologic effects and produces profound, reproducible sensory anesthesia and motor blockade.

Anesthesiologists are reluctant to administer spinal anesthesia in patients with scoliosis due to multiple attempts required, unpredictability in the level and pattern of blockade of spinal anaesthesia.[5] But studies advocated spinal anesthesia in patients with scoliosis recently.[6-8] The present study was aimed to study spinal anaesthesia in patients with scoliosis at a tertiary hospital.

MATERIAL AND METHODS

Present study was a prospective, observational study conducted in department of anesthesiology and critical care, Government Medical College, Srinagar. The study was approved by the Institutional Ethical Committee. The study was undertaken between January 2019 to December 2019 (1 year).

Inclusion criteria

- Patients between age group 18 and 60 years with scoliosis (Cobb's angle of >15°), American Society of Anesthesiology physical grade I/II, posted for elective, lower limb orthopedic soft tissue release procedures under spinal anesthesia

Exclusion criteria

- Patients with history of chronic obstructive pulmonary disease (COPD),
- Past history of respiratory failure,
- Patients with cardiovascular abnormalities, abnormal renal/hepatic function, spinal cord dysfunction, coagulopathy,
- Patients who underwent prior corrective surgery for scoliosis
- Patient's refusal for regional anesthesia.

The course of sub-arachnoid block was compared between the groups.

The study design was explained to patients in local language and individual informed consent was taken from all the patients for participation in study. The patients included in the study were evaluated preoperatively. The severity of scoliosis was assessed by subjective clinical judgment and whenever available radiological assessment of spine for the measurement of Cobb's angle. In patients with Cobb's angle more than 70°, pulmonary function tests and arterial blood gas analysis were performed.

After complete evaluation fit patients were posted for surgery. Patients were pre-medicated with Tablet Alprazolam 0.5 mg the previous night of surgery.

In the operation theatre patients were preloaded with Ringer Lactate. Monitoring done with electrocardiography (ECG), noninvasive blood pressure (NIBP) and pulse oximetry. Under strict aseptic precautions with patient in the sitting position, lumbar puncture was performed at L3-L4 intervertebral disc space using 25G Quincke needle via midline approach. When free and clear flow of cerebrospinal fluid (CSF) was noted, 10 mg of injection 0.5% heavy bupivacaine was given intrathecally. The operation table was kept in the neutral position throughout the procedure.

The patients were made to lie down immediately, the time of which was defined as 'zero'. The sensory block was assessed on either side of abdomen at 5, 10, 15, 30, 60 and 120 min with short bevel end of a 27G dental needle using pinprick method. The maximum height of sensory block, bilateral spread and time taken for two segment regression of sensory block from maximum height were noted. The motor block was assessed using the modified Bromage scale. Time taken for complete motor block and time taken for complete recovery from motor block were noted.

The following parameters were measured: heart rate (HR) by three-lead electrocardiogram (ECG), systolic blood pressure (SBP), diastolic blood pressure (DBP) and mean arterial pressure (MAP) by the non-invasive automatic oscillometric method, arterial oxygen saturation (SpO2) by pulse oximetry and respiratory rate (RR) throughout the procedure. Inadequate block was considered when level of block was at L1/below L1 or when patients complained of pain during surgery and they were administered general anesthesia to facilitate the surgical procedure.

After completion of the surgery and when the sensory block recedes by two segments, patients were shifted to post-operative ward and monitored till complete recovery. All details were noted in case proforma and entered in Microsoft excel sheet. Statistical analysis was done using descriptive statistics.

RESULTS

A total of 35 patients were considered for present study, among them in three patients failed spinal block was noted. The failed spinal block patients were excluded from study. So a total of 32 patients were included in present study. Mean age was 25.27 ± 4.81 years. Male (63%) were more than female (37%). Male to female ratio 1.7:1. As per American society of anaesthesiologist physical grading grade I patients were 78% while grade II was 22%.

Major hemodynamic parameters as heart rate (mean heart rate, incidence of bradycardia), blood pressure (systolic,

diastolic, mean arterial pressure) was measured and analysed. The observations are depicted in Table 2.

Onset of sensory block was in 7.9 ± 2.3 mins and onset of motor block was in 4.9 ± 2 mins. The maximum extent of sensory blockade till T5-T4 was noted in 66% patients. Time taken for complete recovery of motor block to its preoperative level was 94.3 ± 26.2 min.

DISCUSSION

Anatomical factors affecting the normal spine curvatures, like scoliosis, kyphosis is responsible for the technical difficulties in neuroaxial blocks due to obliteration of the interspinous spaces and difficulties to give position to patient. This may cause interference with spread of local anesthetics.

Table 1: General characteristics

Characteristics	Number of patients (%) / Mean ± SD
Age (years)	25.27±4.81
Gender -- Male/ Female	19 (63%)/ 13 (37%)
Male : Female	1.7:1
Weight (kgs)	47.6±11.4
Height (cms)	160.3±9.4
American society of anaesthesiologist physical grading	
ASA I	25 (78%)
ASA II	7 (22%)

Table 2: Comparison of intraoperative/ postoperative hemodynamic parameters

Hemodynamic parameters/ complications	Values (mean ± standard deviation)
Heart rate (beats/min)	73.5±11.3
Bradycardia (<50 beats/min)	3/32
Systolic blood pressure (mm of Hg)	115.4±17.3
Diastolic blood pressure (mm of Hg)	68.6±7.3
Mean arterial pressure (mm of Hg)	86.9±7.4

Table 3: Spinal anaesthesia outcome

Characteristics	Number of patients (%) / Mean ± SD
>2 attempts for spinal block	14 (44%)
Onset of sensory block (mins)	7.9±2.3
Onset of motor block (mins)	4.9±2
Maximum extent of sensory blockade	
T5-T4	21 (66%)
T8-T6	8 (25%)
T10-T9	3 (9%)
Two segment regression time for sensory block (min)	68.9±11.5
Time taken for complete recovery of motor block to its preoperative level (min)	94.3±26.2
Duration of surgery (mins)	49.8±36.6

Intrathecal spread of local anesthetics is due to interplay between solution physical characteristics, gravity, and the configuration of the vertebral canal.[3] The curves of the vertebral column are important in solution spread and any obvious abnormality such as scoliosis and/or kyphosis may interfere with the process. Preoperative examination of the patient gives idea regarding vertebral column abnormality but it is difficult to predict whether the effect will be excessive spread or failure.[6] The degree of lateral curvature is determined by the Cobb angle. The Cobb angle is measured between the most tilted vertebral bodies in the coronal plane.[9]

Time for 2 segment regression is defined as time elapsed from spinal injection to regression of sensory level by two dermatomes. In present study time for 2 segment regression was 68.9 ± 11.5 minutes. In study by Koramutla Kumar was time for 2 segment regression was 52 ± 19 minutes and regression was faster in patients with cobs angle >40.[8]

Koramutla Kumar concluded that regional anesthesia is the safest approach, but technically challenging. Bilateral effective spinal blockade was achieved with flexion at the hips after giving spinal anesthesia thereby obliterating the spine curvature.[8]

In an observational study for spinal anesthesia in patients with scoliosis, Ballarapu GK et al concluded that significant disparities in spread of spinal anesthesia in patients with spinal curvature of thoracolumbar curve to right and number of failed spinal blocks was due to higher Cobb angle (Cobb angle >50°).[10] In present study three patients had failed spinal block. We did not measure Cobb angle for each patient. Kumari BG noted that spinal anesthesia can be safely administered in poliomyelitis patients with scoliosis with less adverse effects.[6]

Idiopathic scoliosis can be classified as nonstructural or structural. In patients with structural scoliosis vertebral curvature is a rigid curve, which cannot be modified significantly by postural maneuvers. In patients with nonstructural scoliosis, scoliosis can be corrected by positioning and the anatomy is well-defined, have less chances of failed spinal blocks.[11] Patient's co-operation and adequate time for the procedure provide better chance of success. Patients with previous spinal surgery are even greater challenge; research has shown that these patients have a greater failure rate for placement and longer procedure time than patients without prior spinal surgery.[12]

Patients with spine pathology, had greater chance to cause paresthesia. In case of scoliosis there is some rotation of vertebral bodies, a puncture perpendicular to the skin plane

can direct the needle to the lateral part of the dural sac, possibly causing paresthesias.[13] In present study we did not noticed paresthesia.

Based on anatomical consideration in patients with scoliosis, a modified paramedian approach with needle insertion toward convexity may offer several advantages.[7] In patients with scoliosis an inadverted rotation of the spine is a possibility, especially in the lateral decubitus position, lateral position is advised in such patients. If the spinous process is palpable or can be identified with a needle, then a paramedian approach could be attempted on the convex-side of the curve.[14,15] Difficulty in performing neuraxial anesthesia may result in neural injury, spinal haematoma, post-dural puncture headache, or infection.[16,17]

In case of patients with acute rotation of the spine or scoliosis, it would be convenient having an x-ray of the spine to identify the angle and plane of entry. Ultrasound-guided technique may help to teach and also to perform neuroaxial blocks, especially when difficulties are awaited in specific population categories (obese patients, parturients, scoliosis, hyperlordodis etc.).[18,19] Utilizing ultrasound in patients having high risk for difficult placement may improve the success rate. Ultrasound can provide enough anatomic detail to ascertain the location, depth, and angle needed to successfully place a spinal or epidural catheter.[20]

Limitations of the study

The present study limitations were small sample size, we have not measured, variability in Cobb's angle for assessment of the spread of local anesthetics. Larger multicentric studies are required to assess spread of local anesthetics with respect to variability in Cobb's angle; feasibility of paramedian approach for regional anesthesia, measures to provide ease of administering regional anesthesia in lateral position in patients with scoliosis.

CONCLUSION

With proper preoperative assessment, spinal anesthesia can be safely used in patients with scoliosis. Patients with scoliosis needs good preoperative assessment, well equipped setup and team efforts for good outcome.

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AG- Study design, patient recruitment, data collection data analysis, final drafting; **TMJ**- revising the article critically; **BS**- Concept of the study, final approval of the version to be published.

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