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Role of Spinal Anaesthesia in Upper Abdominal Surgery in Modern Anaesthesia Practice: Prospective Randomised Study

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Abstract:
Aims and objectives:*To investigate the efficacy and complications of high spinal anaesthesia for upper abdominal surgeries.*
Methodology: *This is a prospective randomised study carried out on 60 patients, posted for upper abdominal surgeriesat SGT medical College. Spinal anaesthesia was administered with 3.5 - 4 ml of 0. 5 % hyperbaric bupivacaine at L 3-4 interspinous space. Haemodynamic parameters,sensory level, complications, and satisfaction level of the patients were analysed.*
Results:*. The procedure was well tolerated by 87% patients. The incidences of hypotension and bradycardia were 95 % and 50 % respectively, but easily manageable. There were no serious complications. Only 2 patients (3 %) needed supplementary GA due to excessive discomfort whereas 12% patients needed supplementation with analgesic doses of ketamine. The cephalad blockade extended beyond T 2 dermatome in 12% cases but did not result in serious respiratory embarrassment.*
Conclusion: *With proper knowledge, experience, close monitoring and prompt corrective measures, most of the complications can be avoided and SA can be used more liberally for upper abdominal surgeries.*
Keywords:*Anaesthesia, Complications, High- spinal, Surgery- upper abdominal*

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I. Introduction

Spinal anaesthesia (SA) for upper abdominal surgeries has not gained much popularityover the years. Dominant factor affecting its popularity was high rate of cardiovascular complications and need for close vigilance. Few cases of cardiac arrests have also been reported in late eighties, due to accidental high block and poor monitoring facilities[1-6]. However, due to better knowledge of pathophysiology, refined techniques, introduction of newer drugs, and above all better monitoring facilities, has contributed to the increasing safety of SA in the recent years. But, SA has been popular mainly for infra-umbilical surgeries. There has been only sporadic use of SA for upper abdominal surgeries [7 -10] , though some authors have reported thoracic epidural [11-14] and combined spinal-epidural techniques with or without GA[15-16] in a few cases of upper abdominal surgery. Many cases of unpredictably higher spread of SA for lower abdominal surgeries were successfully tackled due to close monitoring and prompt remedial measures. Encouraged by the success of these cases and a subsequent pilot study (unpublished), this study was conducted to assess suitability of SA for upper abdominal surgeries.

II. Material And Methods

After the ethical approval, 60 adult, American Society of Anaesthesiologists (ASA) grade I and II patients of both sexes, age ranging from 21 to 60 years, scheduled to undergo elective upper abdominal surgery, were selected for this prospective study. Specific exclusion criteria were anxiety prone patients, spinal deformity and COPD. Written, informed consent was obtained. Premedication was not given but patients were reassured. After noting down the basal values of vital parameters in the OT, all patients were preloaded with 15ml/kg of Ringer’s lactate over 20 min, using 18 /16 gauge IV cannula.SA was administered using 25 – 27 gauge Quincke’s spinal needle at L3-4 interspinous space in lateral decubitus position. After ascertaining the free flow of CSF, 17.5- 20 mg of bupivacaine in dextrose was injected depending on the built, height and sex of the patients. Then the patients were turned to supine position with slight trendelenburg tilt. Oxygen was given via nasal prongs.

All the patients were continuously monitored for SpO_2, HR, NIBP and ECG. Other parameters recorded were respiratory discomfort/ distress, nausea,vomiting, level of block and satisfaction level of the patients. Surgery was allowed to proceed once a sensory level reached T- 5 dermatome.Atropine was given IV in case of bradycardia (HR < 60/min) in aliquots of 0.6 mg. Hypotension was defined as systolic BP < 20% of basal value. Patients having systolic BP < 90 mm Hg were given 6- 9 mg of IV mephenteramine sulphate, (depending on severity of fall), along with IV fluids. Intra-operatively patients were asked to take deep breaths intermittently in order to confirm adequacy of chest movements. Patients were also occasionally engaged in conversation to gain confidence and to know about any discomfort/alarm. Intra-operatively, discomfort score were recorded as 0-3 (0=No discomfort, 1=Slight discomfort needing midazolam sedation (1 -2 mg), 2=Moderate discomfort needing midazolam + sub anaesthetic doses of ketamine 1 mg/kg), 3=Severe discomfort needing light GA). Level of block as ascertained after 30 min with pin prick was noted. Postoperatively, patients were asked about level of satisfaction (pleasant, tolerable or unpleasant) and record maintained.

III. Results

Maximum number of patients (75%) belonged to 31-50 years of age group (Table-1) and 83% weighed between 41-60 kg. Out of the 60 patients studied, 48 were females. Types of surgery performed were, open cholecystectomy and biliary surgery in 53 patients, epigastric hernia in 4 cases and exploratory laparotomy in remaining 3 cases.Surgery lasted for 35-120 minutes with average of 50 ± 13 minutes.

Table-1: Patient Characteristics

Details	No. Of Patients	Percentage
Age (years)		
21 - 30	5	8.3 %
31 – 40	23	38.3 %
41 – 50	22	36.6 %
51 – 60	10	16.6 %
Weight (kg)		
41 – 50	18	30 %
51 – 60	32	53.3 %
61 – 70	10	16.6 %
Height (cm)		
150 -160	29	48.3 %
161 -170	21	35 %
171 -180	10	16.6 %
Sex		
Male	12	20 %
Female	48	80 %

Successful subarachnoid block was achieved in all cases. None of the patients needed blood transfusion and blood loss was negligible. Muscle relaxation as enquired from the operating surgeon, was excellent in 72%, good in 15% and satisfactory in 13% cases. Sensory block (Table-2) level was between T2-T4 dermatome in 80% patients and it extended to cervical dermatomes in 5% cases. There was no case of total spinal block.

Table-2: Level of Sensory Block

Sensory Dermatome	No. of Patients	Percentage
Thoracic		
T5	3	5%
T4	16	26.6 %
T2	34	56.6%
T1	4	6.6 %
Cervical	3	5 %

Oxygen saturation never fell < 90% and ranged between 93-100% (Table-3). Hypotension occurred in 95% cases from as early as 4 min to as late as 35 min after the block. Maximum fall occurred in first 10 min. In 8 patients (13%) systolic BP fell very rapidly to between 83-78 mmHg, but reverted back after prompt therapeutic intervention. Bradycardia occurred in 50% cases, out of which 22% needed 2 doses of atropine injection. There was no cardiac dysrhythmia or asystole in any patient.

Table-3: Prevalence of Intra-operative Complications

Complications	No.Of Patients	Percentage
Oxygen desaturation (SpO_2)	0	0
Hypotension	57	95 %
Bradycardia	30	50 %
RespiratoryDiscomfort (subjective)	17	28.3 %
Nausea / Vomitting	18	30 %
ECG Abnormality	0	0
Cardiac arrest	0	0
Total spinal	0	0

Breathing difficulty was complained by 17 patients (28%), but were able to take deep breath on command and there was no fall in SpO_2. Most of them (14) could be reassured and convinced. However 3 patients needed sedation with midazolam to allay apprehension. Majority of patients (85%) had nil or mild intra-operative discomfort and were cooperative (Table-4). Ketamine (1mg/kg), was needed in 1- 4 doses in 12% patients along with midazolam 1- 2 mg. Two patients (3%), needed light GA due to non-cooperative and severe discomfort. Most of the patients (87%) were reasonably satisfied with the technique (Table-4).

Table-4: Adequacy of Anaesthesia and Satisfaction Level of Patients

	No. Of Patients	Percentage
Discomfort score		
0	39	65 %
1	12	20 %
2	7	11.6 %
3	2	3.3 %
Satisfaction level		
Fully Satisfied	31	51.6 %
Tolerable	21	35 %
Not Satisfied	8	13.3 %

IV. Discussion

Sporadic cases of cardiac arrests, as reported by various authors around 1988 [1- 6], presumably due to high spinal block, had discouraged most of the anaesthesiologists to use this technique for upper abdominal surgeries. Etiological factors of cardiac arrests could be additive, primarily due to excessive sedation, lack of modern monitoring aids, increased vagal tone, high blockade and emotional stress. If life threatening cardio respiratory complications are not promptly detected and treated, cardiac arrest rapidly ensues [3].These cases of cardiac arrests were reported when there used to be only clinical monitoring. However, with the help of modern automated monitoring system, prompt detection and management of complications, has added to the safety of modern spinal anaesthesia practice.No fatalities have been reported in the last two decades. It is now being used increasingly for laparoscopic cholecystectomy [10,17,18] with varying results.It has also been used successfully for emergency laparotomy in recent years [19,20].

No routine sedation was given to the patients under study in order to assess the correct incidence of intra-operative discomfort and other alarms. Moreover, it has been established that patients having high SA, are more sensitive to sedatives and thus may further compromise ventilation and oxygenation [21,22]. Midazolam sedation has also depressant effect on respiratory response to hypoxia and hypercapnia [23 -25]. Cardiac arrests have been reported in such cases inspite of supplemental oxygen [1]. In fact, adequate surgical anaesthesia following properly conducted SA dramatically reduces the requirement of sedation. In this study only 20% patients needed intra-operative sedation, probably due to high anxiety level. Proper selection of patients preoperatively as per anxiety level will further minimise the requirement of sedation.Excellent muscle relaxation obtained under proper SA is unrivalled by neuromuscular blocking agents under GA. However, as per study conducted by Freud et al. paralysis of intercostal muscles, apart from abdominal packs and retractors, may interfere with diaphragmatic movements and compromise the respiration [26]. This can be tackled by asking patient to take deep breaths if needed. None of our patients had serious respiratory problem. This may have been due to various factors like supplementary oxygen, absence of sedation, and close monitoring. Contrary to the popular belief, ventilatory impairment is unusual even during high SA [26], though coughing may be impaired due to laparotomy and paralysis of abdominal muscles. Tidal volume is unchanged during high SA and vital capacity is decreased to a minimal amount due to decrease in diaphragmatic function [27-29]. Rare respiratory arrest associated with high SA, is also not associated with phrenic nerve, but is due to hypoperfusion of respiratory centre in the brain stem [28]. Such apnea always disappears with prompt restoration of cardiac output and BP. Sheskey et al also reported sensory block up to cervical dermatomes without respiratory failure [29]. Phrenic nerve (C3-5), is very thick nerve and fairly difficult to block. The subjective feeling of difficulty in breathing or feeling of suffocation during high SA, as was also reported by 17 (28%) of our patients, is due to loss of proprioceptive sensations from the chest wall [30]. In the present study there was no compromisation of respiratory function as evidenced by deep breathing on command, normal SpO_2 and normal phonation. Moreover, absence of sedation and supplementation of oxygen provided a buffer against hypoxia secondary to possible hypoventilation.

Hypotension is the most common but easily manageable complication following SA, more so during high SA. Sympathetic blockade leads to venous pooling, causing a decreasing in venous return which in turn results in diminution of cardiac output and consequent hypotension. Incidence of hypotension was 95% in this study, which is almost at par (45-100%) with that reported in most vulnerable obstetric patients [31-33]. The incidence could have been decreased by volume preloading with colloids [33] or prophylactic ephedrine/ dopamine drip titrated to optimum BP. In this study, atropine premedication was not given to avoid discomfort due to dry mouth in an awake patient, and also to assess the correct incidence of bradycardia. So a prudent approach will be to give it as on required basis. Bradycardia, if not treated is forerunner of asystole. Here, it may also be emphasized that if hypotension and bradycardia are resistant to treatment, IV adrenaline in titrated doses should be given without wasting further time [34-35].Nausea and vomitting can be disturbing to patient, anaesthesiologist and to surgeon alike. Prophylactic/ therapeutic anti-emetics like ondansetron can be helpful, apart from restoration of BP. Chest discomfort as complained by some patients, is due to referred pain from nociceptive afferents in the parietal peritoneum [36-37]. These patients were comfortable after mild sedation with midazolam with or without subanaesthetic doses of ketamine.

One of the distinct advantageof SA for upper abdominal surgery is that chances of postoperative hypoxemia are predictably less compared to GA and patients can be immediately transferred to the recovery room on completion of surgery. Overall economic advantages need no emphasis. Bessa *et al,* in a study, found that laparoscopic cholecystectomy, done under SA results in significantly less early post-operative pain, compared to that performed under general anaesthesia ,[38].By addition of adjuvants like clonidine, fentanyl, etc, post-operative analgesia can be further enhanced [39,40].

V. Conclusion

Hence, balancing the risks and benefits, SA for upper abdominal surgery can be considered fairly safe andspecially recommended for conducting upper abdominal surgeries in developing countries where cost factor is important.Further controlled studies will be required to establish the safety of high SA for different types of upper abdominal surgeries and to bring out the appropriate protocols and guidelines.

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