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A Prospective Study of Thoracic Epidural Anaesthesia for Upper Abdominal Surgeries

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Abstract

Background: Upper abdominal surgeries were coneventionally done under general anaesthesia. Now a days epidural anaesthesia is being used for upper abdominal surgeries as it can be used for both intraoperative anaesthesia & postoperative analgesia thus decreasing postoperative morbidity. *Materials & methods:* 50 patients in the age group of 20 to 50 years of either sex, with ASA physical status score 1 or 2, scheduled to undergo elective upper abdominal surgeries were included in the study. Epidural catheter was inserted in T8-T9 interspace in all patients considered for the study. 10cc 0.5% bupivacaine was given in all patients. All the observations were noted down & results analysed. *Conclusion:* Thoracic epidural anaesthesia is an excellent option for upper abdominal surgeries. It provides good intraoperative anaesthesia & postoperative analgesia facilitating early recovery. It prevents the risks associated with general anesthesia. Hence, we conclude that thoracic epidural anaesthesia should be a part of the armamentarium of anaesthesiologists in upper abdominal surgeries.

Keywords: Epidural; Thoracic; Upper Abdominal Surgery.

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Introduction

Major surgery induces profound physiological changes in the preoperative period, characterized by increase in sympathoadrenal and other neuroendocrine andalso an increased cytokine production. As epidural anaesthesia can attenuate this "stress response" to surgery, improve the quality of postoperative analgesia in comparison with systemic opioids, and hasten recovery of gut function, it been suggested that conducting surgery under epidural anaesthesia may reduce preoperative morbidity and mortality compared with general anaesthesia alone [1].

All segments of the spinal canal from base of skull to sacral hiatus are available for epidural injection and epidural analgesia can be adapted to almost any type of surgery below chin [2]. Dawkins and steel [3] reported that ideal conditions for upper abdominal surgery can be obtained by instilling the local anesthetic agents into the epidural space at the midpoint of nerve supply to the site of operation.

Thoracic epidural anaesthesia was introduced fifty years ago to provide anaesthesia to awake unintubated patients during intrathoracic surgical procedures [4]. Subsequently, thoracic epidural anaesthesia and analgesia have been utilized in the intraoperative and post operative anaesthetic

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management of patients undergoing thoracic and upper abdominal surgery [5-6]. Although lumbar spinal and epidural blockade are often preferred by the anesthetist, primarily because of the technically less difficult needle placement and decreased probability of dural puncture and neural injury, thoracic epidural anaesthesia provides selective blockade of the surgical site, with diminished requirement of opioids and local anaesthetics. In addition thoracic epidural anaesthesia provides pain relief and sympatholysis of such magnitude that allows patient to cough, breathe deeply, drink and mobilize which can contribute to enhanced post operative outcomes such as improved respiratory function, reduction in ileus and protein sparing [7].

The routinely followed anaesthetic technique for upper abdominal surgeries was conventional general anaesthesia. General anaesthesia has its own drawbacks especially in patients with pulmonary disease, cardiac disease, metabolic disease or patient with morbid obesity where it leads to instrumentation of airway, ventilation perfusion mismatch, and administration of depressant drugs, which can lead to intra-operative and post-operative complications.

So, we decided to do this clinical study to evaluate the usefulness of employing the thoracic segmental epidural blocks for various upper abdominal surgeries using 0.5% bupivacaine. The effectiveness of thoracic epidural anaesthesia for upper abdominal surgeries using 0.5% bupivacaine, was analysed and the following parameters were studied, time of onset of analgesia, level of blockade, quality of analgesia, degree of motor blockade, duration of analgesia, hemodynamic response to anaesthesia and surgery (HR, NIBP, $SpO_2$and RR), and intra-operative and post-operative complications.

Methods

This prospective clinical study was conducted in the Department of Anaesthesiology, at McGann Hospital, Shimoga Institute of Medical Sciences, Shivamogga by a single anaesthetist. After informed and written consent 50 patients in the age group of 20 to 50 years of either sex, with ASA physical status score 1 or 2, scheduled to undergo elective upper abdominal surgeries wereincluded in the study. Exclusion criteria were ASA grade 3 and 4, Contraindications for epidural anaesthesia like, uncooperative patients, severe haemorrhage or shock, coagulation defects, local inflammation and failed epidural or inadequate block level, for surgery.

In all patients selected for the study, a detailed history of present and past medical and surgical illnesses and medication use was taken and a detailed general physical examination, including airway assessment, spine and systemic examination was done with required blood investigations like hemogram, bleeding time, clotting time, blood grouping and Rh typing, HIV 1 and 2, and HbsAg in all patients. RBS, blood urea, serum creatinine, ECG and chest X-ray was also done depending on the requirement.

All the patients were advised to remain nil per oral after midnight and was given tab Diazepam 0.2 mg/kg orally the night before surgery. On the day of surgery and on arrival into operating room, an 18 gauge i.v. catheter was secured and the patient was preloaded with 500 ml Ringer Lactate solution over a period of 20 to 30 min. Basal vital parameter like pulse rate/heart rate, blood pressure, ECG, respiration, oxygen saturation recorded.

Procedure

The patient in sitting or lateral position with the help of an assistant, under aseptic precaution, the back will be prepared with 5% povidine iodine solution, spirit and the area was draped. The inferior angle of scapula which corresponds to T_7 spine is palpated and T_8-T_9 space located. The skin is infiltrated with 2 ml of 2% lignocaine and after 60 to 90 seconds, a Tuohy`s epidural needle,18G will be introduced along the midline in T_8 -T_9 space and advanced obliquely with 45^0 to the skin till the needle is steady in the inter-spinous ligament. The stylet is removed and a 10 cc dry glass syringe with an air column of 5 cc is attached firmly to the hub of the needle. This unit was carefully advanced with 45^0 angle and constant pressure applied on the plunger of the syringe. As long as the needle point is in the ligaments there will be relative or absolute resistance to injection but as the point emerged from the ligamentum flavum onto the epidural space resistance suddenly disappeared. After confirmation of loss of resistance in all directions, 18G epidural catheter is threaded through the epidural needle into the epidural space in cephalad direction upto about 3 to 5 cm. The epidural needle is steadily pulled out without disturbing the catheter. The catheter was well secured with plaster and patient was positioned supine for surgery. A test dose of 3 ml of 2% Lignocaine with 15 µg of epinephrine was administered after negative aspiration for blood or CSF. The patient was observed for 5 minutes to ensure that the injection is not into the subarachnoid space or epidural vessels. Then 10 cc of 0.5% bupivacaine was injected steadily at a rate of 0.5 ml/second for all patients. Pulse, NIBP, SpO_2, ECG, and respiratory rate was recorded before the start of procedure (Baseline values) and every 5 min, 10 min, 15 min, 30 min, 45 min thereafter, till patient is shifted out from the recovery room. If bradycardia occurs at anytime (<50 beats / min), then 0.6 mg of injection atropine was given. If hypotension occurs then it is treated appropriately with i.v. fluids and vasopressors.

The parameters studied are,

1) Time of onset of analgesia in minutes - It is recorded as interval between the time of injection into the epidural space and development of loss of sensation to pin prick.

2) Quality of analgesia - This is graded as follows:

Grade I - Analgesia is complete and sedatives are administered only to relieve apprehension.

Grade II - Analgesia is incomplete, inadequate or patchy and supplementation is needed with narcotics or ketamine or N_2O/O_2/ halothane.

Grade III - Analgesia is very poor and the technique will be changed over to general anaesthesia.

3) Assessment of motor blockade - Abdominal muscle power is assessed by the rectus abdominis muscle (RAM) test.

100% Power: Able to rise from supine to sitting position with hands behind head.

80% Power: Can sit only with arms extended.

60% Power: Can lift only head and scapulae off bed.

40% Power: Can lift on shoulders off bed.

20% Power: An increase in abdominal muscle tension can be felt during effort - no other response.

Surgeon's opinion is also taken during the procedure and degree of motor blockade is graded as follows:

Grade I: Complete block - good relaxation

Grade II: Partial block - intermediate.

Grade III: No block - Poor relaxation.

4) Duration of analgesia - This is measured as the interval between onset of analgesia and regression of analgesia by 2 segments.

5) Intra operative complications - Patients are carefully monitored for any untoward effects like, hypotension, bradycardia, respiratory distress, nausea - vomiting, shivering.

Hypotension is considered when fall in systolic BP is 30% less than the baseline. Hypotension is treated with intravenous fluid administration and use of vasopressors as required. Bradycardia is considered when heart rate is less than 50 beats/ min, is treated with injection of Atropine 0.6 mg.

6) Post operative complications - All the patients are observed on the day of surgery and on the first and second post operative day to note any complications such as PDPH, Backache, nausea, vomiting, retention of urine, any signs of neurological sequelae, infection and catheter related problems (kinking, migration etc).

Results

Patients in the study had following demographic parameters, which included age, gender, height and ASA Physical status distribution (Tables 1-4).

Table 1: Demographic data

Age group (yrs)	Male	female	Total
21-30	9	11	20
31-40	7	8	15
41-50	9	6	15
Total	25	25	50
Mean ± SD	36.6±9.3	33.9±9.4	35.3±9.4

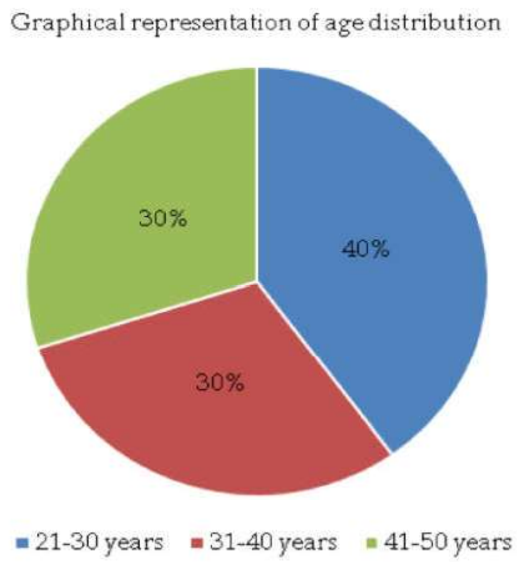

Fig. 1: Demographic data

Table 2: Height distribution

Height (cm)	Male	Female	Total
151-160	-	17	17
161-170	13	8	21
171-180	12	-	12
Total	25	25	50
Mean± SD	170.6± 3.7cm	159.3± 4.2cm	165.0± 6.9cm

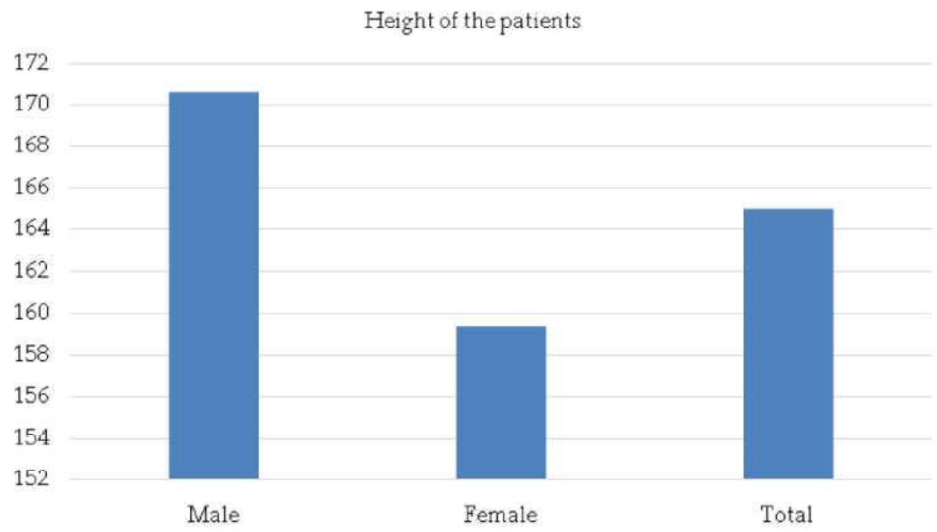

Fig. 2: Height distribution

Table 3: Types of surgical procedure

Surgical procedure	Number of cases	Percentage
Cholecystectomy	22	44
Epigastric hernia	8	16
GJ vagotomy	14	28
Hemicolectomy	2	4
Hydatid cyst liver	2	4
Pseudopancreatic cyst	2	4
Total	50	100

Table 4: ASA distribution

ASA grade	No of cases	Percentage
I	40	80
II	10	20
Total	50	100

Table 5: Onset of analgesia

Onset (In minutes)	No of cases	Percentage
15	12	24
16	9	18
17	4	8
18	11	22
19	1	2
20	8	16
22	3	6
Failure	2	4
Total	50	100

Range = 15-22 min Mean ± SD = 17.4 ± 2.1 min

The upper level of blockade for majority of the patients was T3-T4 level (Table 5).

Table 6: Upper level of blockade

Blockade level	Number of cases	Percentage
T1	5	10
T2	3	6
T3	15	30
T4	16	32
T5	8	16
T6	1	2

Table 7: Lower level of blockade

Blockade level	Number of cases	Percentage
T12	19	39.6
L1	19	39.6
L2	10	20.8

Hemodynamic parameters were as follows: systolic blood pressure and diastolic pressure were 122.4±11.3 mm Hg and 76.1±9.1 mm Hg at the beginning and at minutes 108.2±17.5 mm Hg and 72.2±9.4 mm Hg, and was 112.2±11.3 mm Hg and 78.6±6.4 mm Hg respectively. Heart rate/pulse rate and mean blood pressures of the patients is shown in the Fig. 3 and 4 (Table 6 and 7).

Table 8: Duration of analgesia

Duration(min)	No of cases
110	4
115	5
120	8
125	4
130	11
135	8
140	8

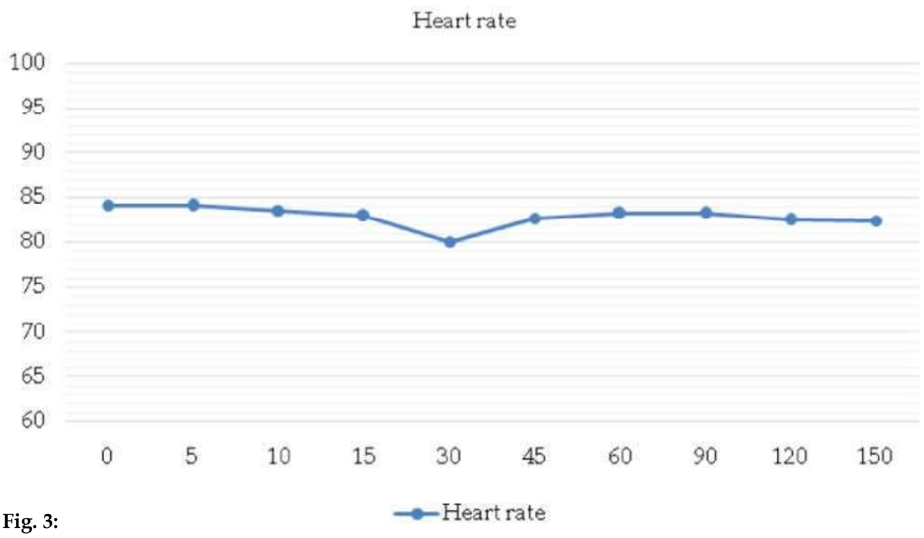

Fig. 3:

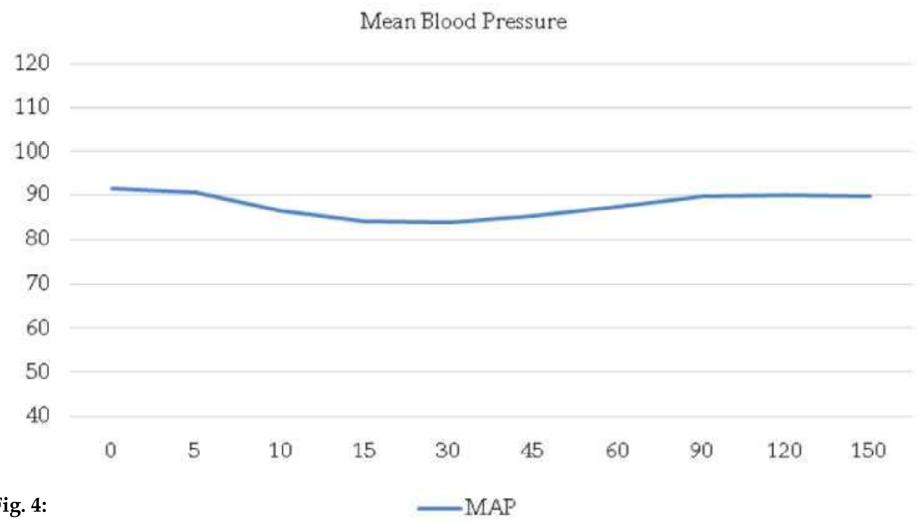

Fig. 4:

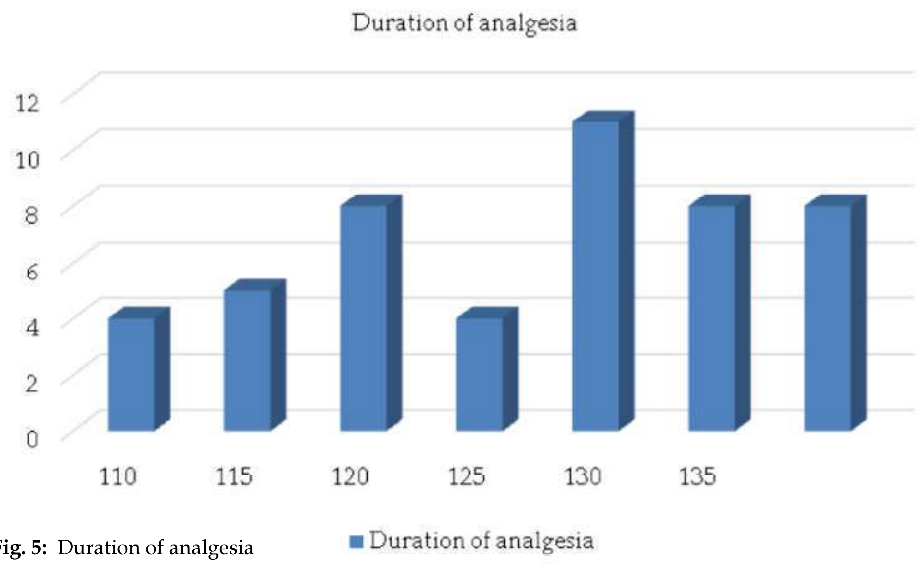

Fig. 5: Duration of analgesia

Table 9: Intra operative complications

Complications	No of cases	Percentage
Hypotension	10	20
Bradycardia	6	12
Shivering	5	10
Nausea & vomiting	8	16
Respiratory arrest	-	-
Cardiac arrest	-	-

Table 10: Postoperative complications

Complications	No of cases	Percentage
Backache	2	4
Nausea & vomiting	4	8
PDPH	-	-
Infections	-	-
Neurological sequelae	-	-

Discussion

Over a course of fifty years thoracic epidural anaesthesia has been utilizedin unintubated awake patients undergoing thoracic or upper abdominal surgeries for intraoperative anaesthesia & postoperative analgesia. Although thoracic epidural anaesthesia is technically difficult compared to lumbar spinal & epidural, thoracic epidural blockade provides good intraoperative & postoperative anaesthesia. Balzarena et al. found that regional anaesthesia had better outcome than general anaesthesia in thoracic & upper abdominal surgeries [8]. In areview of non-analgesic effects of thoracic epidural anaesthesia, studies have suggested that thoracic epidural anaesthesia attenuates the preoperative stress response after major surgery [9,10,11]. The possible mechanism of action include an improvement of left ventricular function by direct anti- ischemic effects, a reduction in cardiovascular complications, an advance on gastrointestinal function, and a reduction in pulmonary complication, as well as a positive impact on the coagulation system and the postoperative inflammatory response [10,11]. There was lesser incidence of pulmonary complications & deep vein thrombosis along with advantage of early ambulation & excellent postoperative analgesia [9]. Regional anesthesia will avoid airway instrumentation & problems associated with it such as bronchospasm, laryngospasm in cases with pulmonary diseases. This study was done on 50 patients posted for elective upper abdominal surgery. 0.5% bupivacaine was given in thoracic epidural space & effectiveness of thoracic epidural anaesthesia was checked in terms of onset, level & duration of sensory & motor blockade. Hemodynamic changes & intraoperative, postoperative complications were noted if any.

Onset of analgesia was noted as onset of sensory block. It was time taken from injection of drug in epidural space to attainment of upper level of block. In our study mean duration of onset of sensory blockwas found to be 17.4±2.1 min. In a study by Bromage it was found that onset of analgesia with 0.5% bupivacaine was 19 min [2]. Comparison of epidural ropivacaine & bupivacaine was done by Morrison et al. It was found that mean onset time for bupivacaine was 18±10 min [12]. Hence, the onset of analgesia in our study was comparable to other studies. Senagore et al used 8cc of 0.5% bupivacaine with 100 μg fentanyl for hemicolectomyin their study [13]. Sakura & collegeaues have used 10cc 2% lignocaine for upper abdominal surgeries in their study [14]. In our study we have used 10cc 0.5% bupivacaine. In this study we gave a constant volume of 10cc 0.55 bupivacaine to all patients at T_{8-9} interspace. Upper level of blockade was having a range of T_{1-6} with 62% of the patients having block at the level of T_{3-4}. Lower level of blockade was having having range of T_{12}-L_2 with 80% of patients having block at the level of T_{12}-L_1. The dosage of 0.5% bupivacaine was calculated in regard to the study done by Bromage [2]. In the study by Waters et al. it was found that local anaesthetic solution containing epinephrine enhanced duration of analgesia by 20% [15]. Bromage found that epidural block in thoracic region required 40% less local anaesthetic solution when compared to lumbar region [2]. Hence, this explains the lesser duration of analgesia as there is lesser drug used. Thoracic epidural anaesthesia causes blockade of cardiac sympathetic fibres arising from T_1-T_4, splanchnic fibres arising from T_6-L_1 causing decreased cathecholamine secretion & venous pooling [16]. All these cause decreased cardiac output, decreased systemic vascular resistance & hence hypotension occurs [17,18]. With the use of bupivacaine there was an observation that there is lesser tendancy for rapid fall in blood pressure as bupivacaine has slower onset. Pre-operatively average MAP was found to be 91.6±9.1 mmHg & it decreased to minimum of 83.8±13.5 mmHg at 30 min. Later on compensatory mechanism begin to act & bring back average MAP to pre-operative levels. Similar changes were seen in systolic BP & diastolic BP. 10 cases (20%) had significant hypotension (>20% of basal reading) & were treated with Inj Mephertermine 6 mg i.v bolus. Mac Lean & Colleagues found that the fall in MAP was 15-20% in patients receiving high thoracic block [19]. Studies have shown that thoracic block upto level of T_1 cause blockade of cardiac sympathetic fibres [16]. 6 patients in the study had bradycardia (heart rate < 50 bpm). They were treated with inj atropine 0.6 mg i.v, elevation of foot end & inj mephentermine 6 mg i.v. Blockade of cardiac sympathetic fibres, decreased venous return due to hypotension & increase in vagal tone due bowel traction are causes for bradycardia in this study. Hypotension (20%) & bradycardia (12%) were the intraoperative complications for which Inj mephentermine & inj atropine was given i.v. 10% of patients developed shivering due to vasodilatation & were treated with inj tramadol 1 mg/kg iv. 16% of the patients developed nausea & vomiting due to traction to stomach & lower esophagus following vagus nerve stimulation. It was treated with inj ranitidine 50 mg iv & inj metoclopramide 10 mg iv. Incidence of technical complications like dural puncture, bleeding & difficulty in threading catheter was comparable to study done by Giebler RM [20]. In our study we had 2 cases of dural puncture but no incidence of epidural hematoma, bleeding, infection & neurological sequelae. Giebler RM in his study on 4185 patients regarding neurological sequelae in thoracic epidural catheterization showed an incidence of 3.6% of neurological sequelae whereas DeLeon-Casasola et al. showed incidence of 0.07% [21]. These results are comparable to our study.

Conclusion

Thoracic epidural anaesthesia is an excellent option for upper abdominal surgeries. It provides good intraoperative anaesthesia & postoperative analgesia facilitating early mobilization & recovery postoperatively. It prevents the risks associated with general anesthesia such as deep vein thrombosis & pulmonary complications. Hemodynamic changes were significant but can be managed satisfactorily. Hence we conclude that thoracic epidural anaesthesia should be a part of the armamentarium of anaesthesiologists in upper abdominal surgeries.

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