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ASIAN ARCHIVES OF ANAESTHESIOLOGY AND RESUSCITATION

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ASIAN ARCHIVES OF ANAESTHESIOLOGY AND RESUSCITATION

Office Address : Room No : 306 - 309, Department of Anaesthesia,3rd Floor, BL Taneja Block, MAMC and LN Hospital, New Delhi (INDIA)

ANAESTHESIA & ALLIED SCIENCES
FOR PARAMEDICS

A Comprehensive textbook of Anaesthesia, Intensive Care, Anatomy, Physiology, Biochemistry, Pharmacology, Pathology and other Special topics

(A Textbook for B.Sc. Operation Theater Students, Trauma Technicians, Nurses, Physiotherapists)

'ANAESTHESIA AND ALLIED SCIENCES FOR PARAMEDICS' is first book of its kind that comprises of six sections. The section one consists of anatomy, physiology and biochemistry for paramedics. The details of all muscles, their actions, nerves and vessels are compiled in tabular form so that it is easily learnt and recapitulated by students. Essential physiology and clinical biochemistry are concised subsections of this section.

The second section provides details of anaesthesia and its various sub-specialities. This section has several chapters and starts from history of anaesthesia till modular operation theatre suit details.

Third section, 'Drugs and Pharmacology' provides details of all the anaesthesia and emergency drugs. Section four covers all the instruments which are used in anaesthetic practice including anaesthesia machine to Automated External Defibrillator. The details of instruments will be very beneficial for the students during examinations and table viva.

Fifth section provides knowledge of unique topics of modern anaesthetic practices that need utmost attention in day - to - day life. The sixth section is a final section highlights all the scoring systems and grading in anaesthesia.

This book will be extremely useful to all paramedics i.e BSc Medical Technology students, operation theatre technicians nurses, physiotherapists and trauma technicians, in all types of examinations, skill development and knowledge augmentation.

The book is a sincere tribute to my father who had this dream for me. I am fortunate enough to have blessings from Almighty, my teachers and parents. All the contributors of this book have provided me a great support and deserve my heartfelt gratitude.

About The Editor

Dr Manpreet Singh is a graduate and post-graduate from Jawaharlal Nehru Medical College, Aligarh. He worked at University College of Medical Sciences and GTB Hospital , Delhi in various capacities as Senior Resident, Sr. Research Associate and Specialist Consultant in Department of Anaesthesia and Critical Care. He has done various fellowships and courses related to Emergency Medicine, Critical Care and Emergency Life Support and is a Fellow of Chest Care Physician (USA), Fellow of Academic College of Emergency Experts in India and Fellow of International Medical Sciences Academy(FIMSA) .

He is an instructor and provider of various courses in India like Advanced Cardiac Life Support (through American Heart Association), Fundamental Critical Care Support , Paediatric and Neonatal Life Support, Trauma Life Support and Advanced Ultrasound trauma Life Support. He is a certificate holder of 'Basic Law and Medicine' (Mumbai) and National Disaster Management (NIDM).He is a course coordinator of various workshops and training courses in Community CPR, Community Trauma and Training & Airway Management courses along with many eminent teachers all over India.

He is a member of more than 10 international and national professional societies, has written more than 52 research papers and presented more than 65 research papers or lectures as invited faculty in various national and international conferences. He is a co-editor of two national journals and reviewer of 8 indexed and non-indexed journals.

Currently, he is Assistant Professor in Department of Anaesthesia and Intensive Care, Govt. Medical College and Hospital-32, Chandigarh .His exceptional skills as a writer ,speaker and editor have been reflected in all major conferences, workshops and publications. His colleagues hold him in high esteem for his academic and professional excellence. Presently he is involved in teaching the students of BSc Medical Technology and Operation Theatre, Trauma Technician course, MBBS and MD (Anaesthesiology).

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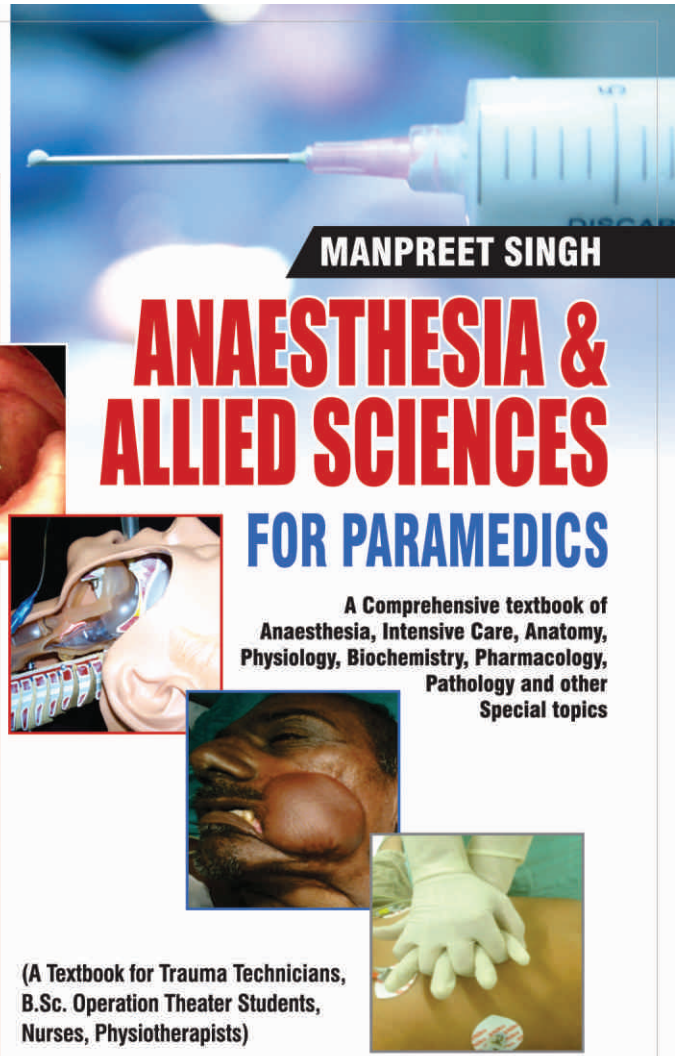
MANPREET SINGH



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COMPARATIVE STUDY OF THORACIC EPIDURAL DEXMEDETOMIDINE ALONE OR IN COMBINATION WITH MAGNESIUM SULPHATE USED AS AN ADJUNCT TO ROPIVACAINE FOR THE RELIEF OF POST-OPERATIVE PAIN IN THORACIC SURGERY

Venketesh Babu[1], Anil Kumar Paswan[2] Yashpal Singh[3], Shashi Prakash[3], Alok Bharti[2], Rajesh Meena[3], Sandeep Loha[3].

ABSTRACT:

Objective: Magnesium and dexmedetomidine has been used as an adjuvant by different routes for postoperative analgesia. Our aim was that, the efficacy of single bolus administration of magnesium with dexmedetomidine or dexmedetomidine alone in combination with ropivacaine by thoracic epidural for postoperative analgesia in patients undergoing posterolateral thoracotomy. The study is a randomized double blind trial.

Methods: Eighty one patients of either sex, ASA II and III, undergoing thoracotomy were enrolled to receive either dexmedetomidine(Group D) ,dexmedetomidine plus magnesium sulphate (Group MD) and ropivacaine as control (group C) till first thoracic epidural top up. In Group D, patients received 1 µg/kg dexmedetomidine plus ropivacaine 0.375% , group MD patients received 1 µg/kg dexmedetomidine plus magnesium sulphate 75 mg along with ropivacaine 0.375% and control group C received plain ropivacaine 0.375% epidurally as an initial bolus dose. Pain assessment using a visual analogue scale (VAS), Time to reach maximum sensory block, Sensory block level, and first epidural top were observed in the postoperative period. In post – operative monitoring, any untoward complications like hypotension, hypertension, bradycardia, tachycardia, nausea, vomiting, respiratory depression were also observed.

Results: The demographic profile of patients was comparable in all groups. Time to reach maximum sensory block level in Ropivacaine (control group) was significantly earlier (13.4 ±2.6) as compare to group D and MD (15.20±5.7 and 16.31 ±4.2) . Need of first epidural top up (VAS >4) significantly earlier in

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control group ropivacaine (4±2.41) as compare to dexmedetomidine or added magnesium to dexmedetomidine (12±2.33 &11.70±1.56).But nothing difference in duration of Postoperative analgesia in between group D and MD. While the incidence of dry mouth, decrease heart rate and blood pressure significantly were higher in the D and MD group.

Conclusions

Dexmedetomidine plus magnesium and Dexmedetomidine alone as epidural adjuvants are equally effective,safe and provide comparable stable hemodynamics.

Keywords: Thoracotomy; Thoracic Epidural Dexmedetomidine and Magnesium sulphate; Postoperative analgesia.

Introduction

Thoracic epidural analgesia is used to treat acute pain after thoracic surgery, abdominal surgery, and rib fractures. Epidural analgesia is a gold standard to control postoperative pain. Combining thoracic epidural local anaesthetics and adjuvants produces superior analgesia compared with using epidural local anaesthetics alone. It is well known that thoracic epidural local anaesthetic and dexmedetomidine combinations is the one of the way to minimize motor and sympathetic blockade, maintain conscious level, cough reflex and produce prolonged analgesia with movement and increased respiratory function and early mobilization after thoracotomy. Recent studies suggest the role of magnesium sulfate as an adjuvant to local anesthetics in epidural anaesthesia showed promising result [1, 2]. Exact site of action of magnesium is probably at the NMDA receptors of spinal cord (billir et al). Noxious stimulation causes release of excitatory amino acids such as glutamate and aspartate mediated by NMDA and non-NMDA receptors. [3-4]

Combination of ropivacaine with dexmedetomidine plus magnesium through epidural route is very scarce in literature. We therefore conducted a prospective, randomized, controlled clinical trial with a hypothesis that the epidural injection of dexmedetomidine plus magnesium along with ropivacaine increases the duration of postoperative analgesia.

However, placement of a thoracic epidural catheter may be technically more difficult because of caudal angulation of the spinous processes more than lumbar spine. Besides, frequency of hypotension is more because of significant bilateral sympathetic blockade especially in hypovolemic patients.

Methods

After Institutional Ethical Committee approval and informed written consent from the patients, 81 adult patients of either sex of American Society of Anesthesiologist (ASA) grade II or III, in the age group of 30-60 years, undergoing thoracotomy were enrolled into the study. Various thoracic surgeries included were decortication, lobectomy and excision of hydatid cyst in the lateral decubitus position and one-lung ventilation. Exclusion criteria included patient's refusal, total pneumonectomy, spinal deformity, bleeding diathesis, sepsis, significant cardiorespiratory and hepatic, renal and neurological disease.

In the operating theater, the patients were connected to a multichannel monitor showing electrocardiography (ECG), heart rate (HR), pulse oximetry (SpO_2) and respiratory rate (RR). A peripheral venous access with 18G cannula was secured. Internal juglar vein and radial arterial line were cannulated and secured under general anesthesia for central venous and invasive blood pressure monitoring.

After induction of anaesthesia, under all aseptic precautions T6-7 or T 7-8 intervertebral space was identified. Epidural space was identified by18G Tuohy's needle with the loss of resistance to air technique in paramedian approach. Epidural catheter was threaded 2-4 cm inside the epidural space and fixed. Ventilation was controlled with Fio_2 0.5-1.0 and a tidal volume of 7- 10 ml a to maintain Etco2 in the range of 35 to 45 mm Hg.

Erythrocyte transfusions were administered to maintain a haemoglobin level of 10 g/dL.Volume treatment was controlled in both groups with crystalloids and colloids to keep the patient in stable fluid balance. After adequate reversal with neostigmine and glycopyrrolate, patients extubated and finally shift to postoperative room and monitored.

In the postoperative room while patients complaints of having pain (VAS>4) study started. A test dose of 3 ml of 1.5% lignocaine with adrenaline (1:200,000) was given after initial negative aspiration for blood and cerebrospinal fluid. Patients were randomly divided by computer generated random numbers into three groups in a double-blinded fashion of 27 each. Group D to received 8ml of ropivacaine 0.375% plus dexmedetomidine 1 mcg/kg, group MD to received 8 ml of ropivacaine 0.375% plus magnesium sulphate 75mg and dexmedetomidine 1 mcg/kg and control group C received only 8 ml of ropivacaine 0.375%. The study drugs were prepared by a trained anesthesia technician and the anesthesiologist giving the epidural block and making the observations in post-operative period was unaware of the drug used. After administering the drug, the following parameters were noted by the observer. The pain score, by using Visual Analogue Score (VAS) until the need for next epidural top up (epidural drug administration to once the patient asks for additional epidural analgesia with VAS>4.), sensory block was assessed by pin-prick method using a blunt needle, observation of vital parameters such as IBP, pulse rate and complications such as hypertension/ hypotension, respiratory depression, nausea- vomiting, sedation (Ramsay sedation scale), pruritis and dry mouth was noted and treated accordingly.

Once the patient asked for additional epidural analgesia (VAS>4) for pain relief during the observation period, the study terminated and the above mentioned parameters was noted. Post-operative maintenance IV fluids were given as per body weight.

Statistical Analysis

The collected data for statistical analysis using Statistical Package for the Social Sciences version 20. During the planning stage of the study, the sample size was calculated with the help of power analysis. Assuming type I error of 0.05 and a type II error of 0.1 to detect 30 min difference in post-operative analgesia so as to yield a power of 80%. Data is expressed as mean with a standard deviation. Normally distributed continuous variables were compared using ANOVA with *post hoc* analysis. Chi-square test and Fischer exact test were used to compare discrete variables between the groups. A $P < 0.05$ was considered as a significant difference and $P < 0.0001$ as highly significant.

Results

The all three groups were comparable with regard to age, weight, gender distribution of the patients and duration surgery (Table 1).

Table 1: **Demographic Profile.**

Parameters	Group D	Group MD	Group C
Age in Years	35.2+-4.6	36.54±5.1	37±5.9
Weight in Kg	52±7.2	53±6.2	52±5.4
Male /Female	13/14	12/15	15/12
Mean duration of surgery (min)	124±9.3	123±16.5	122±12.3
ASA 2& 3	20/7	22/5	23/4

D=Ropivacaine and Dexmedetomidine; MD=Ropivacaine + magnesium sulphate and Dexmedetomidine As showed in Table 2, there was significance difference between the all three groups as regards the time to reach peak sensory level were earlier in control group(13.4 ±2.6) as compare to study group D & MD (15.20±5.7 & 16.31 ±4.2).

Table 2: Comparison of analgesics

Characteristic of Block	D	MD	C
Time to reach maximum sensory block level(min)	15.20±5.7	16.31 ±4.2	13.4 ±2.6
First epidural top up in Hrs.(after VAS>4)	12+-2.33	11.70±1.56	4±2.41
Max. Sensory block level	T3-T4	T4-T5	T3-T4

Time to first epidural top up was significantly higher in group D and MD (12±2.33 & 11.70±1.56) as compare to control group (4±2.41). Means duration of analgesia was higher in group D and MD .Maximum segment level of sensory block was T3. The pain scores were significantly less in group D and MD as compared to group C while there was no much difference in the VAS between group D and MD throughout the study period as shown in fig.1.& 1a.

Fig: 1. Visual analogue scale score (VAS) observation at different interval.

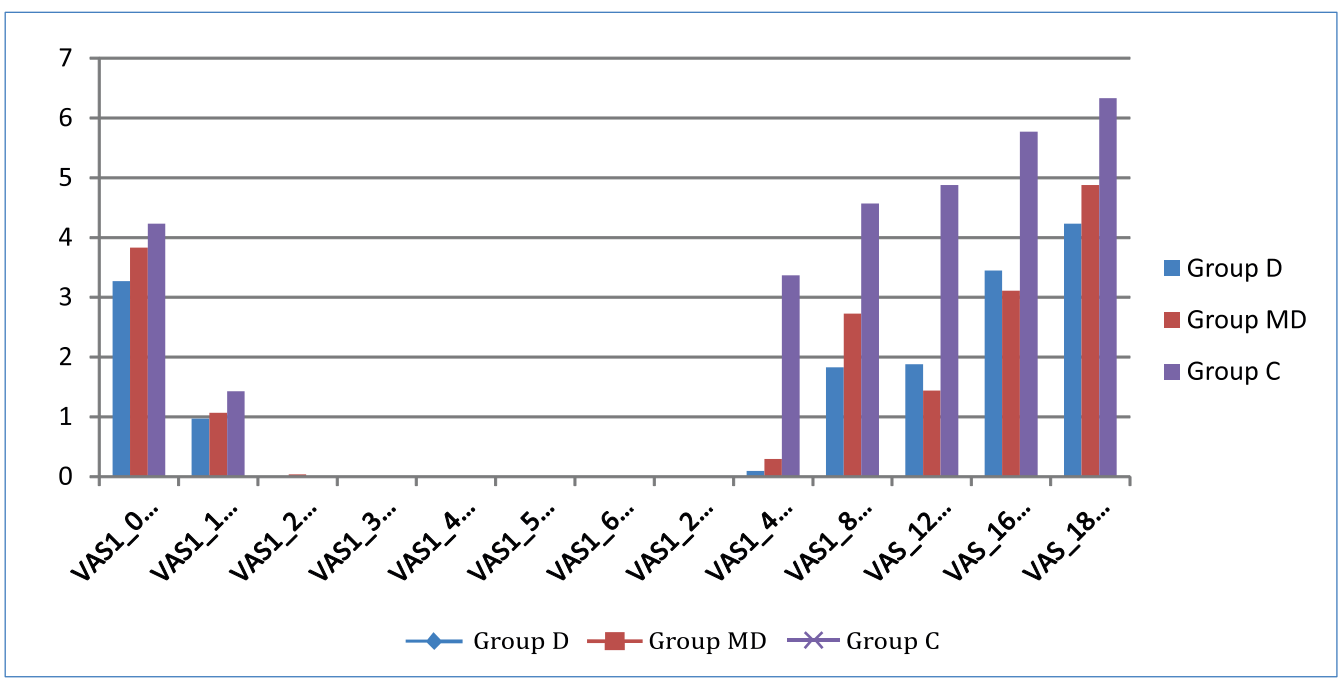


Fig: 1a. Visual analogue scale score (VAS) observation at different interval

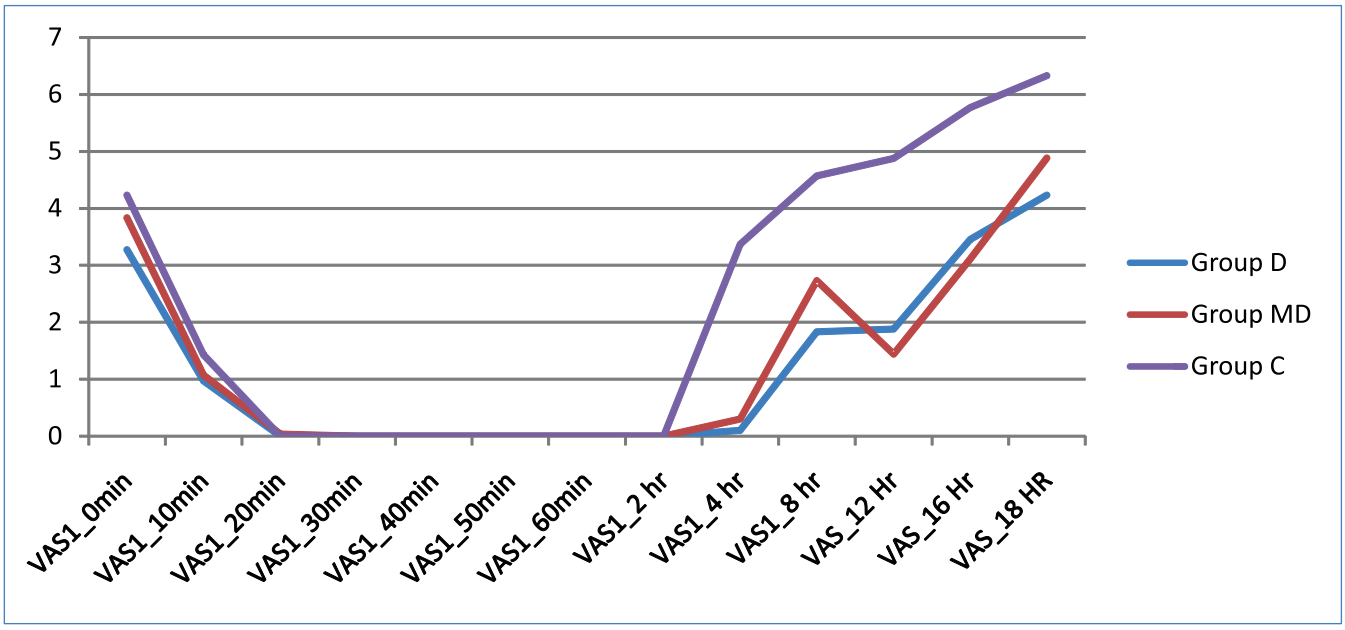


Fig. 1 and 1a, showed the VAS score followed a decreasing trend from 0 to 20 min of post-epidural. From 20 min to 4 hr, the VAS score was zero and this period was totally pain free in group D and MD. After the first 4 hrs, VAS score showed an increasing trend,while in control group the VAS score was zero up to 2 hrs after that showed increasing trends of VAS. All the patients of either groups asked for additional epidural drug when the average VAS score was >4. C group needed epidural top up earlier than D and MD group.

There was fall in the pulse rate in Group D and MD (up to 60 min) which was statistically significant difference ($P < 0.001$) as compare to control group in as shown in figure 2.

Fig 3. Showed Systolic and diastolic blood pressure (SBP) did not fall significantly, however blood pressure was in decreasing trend in group D and MD (up to 2 hours).

Fig 2: Heart rate observations in all groups at different time intervals.

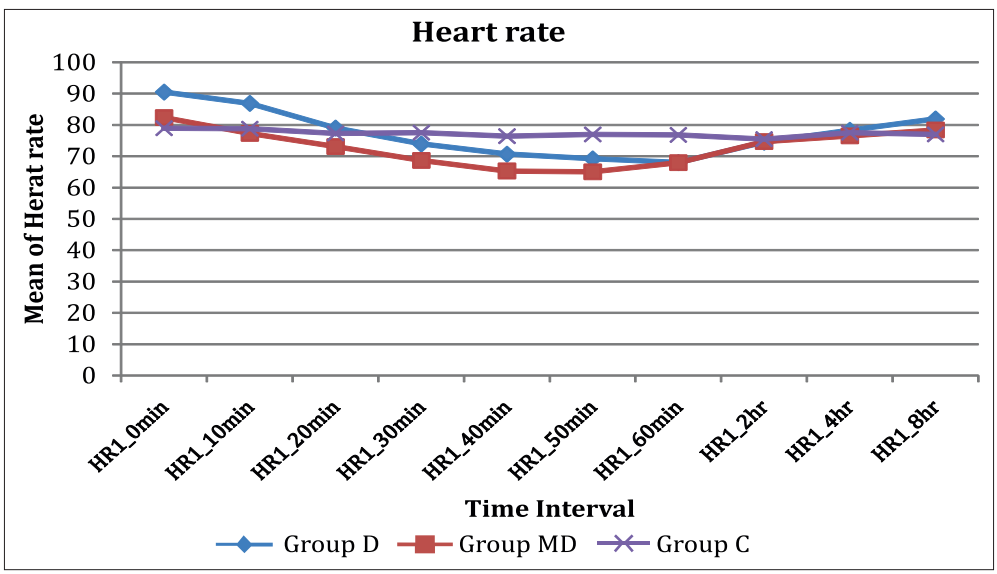
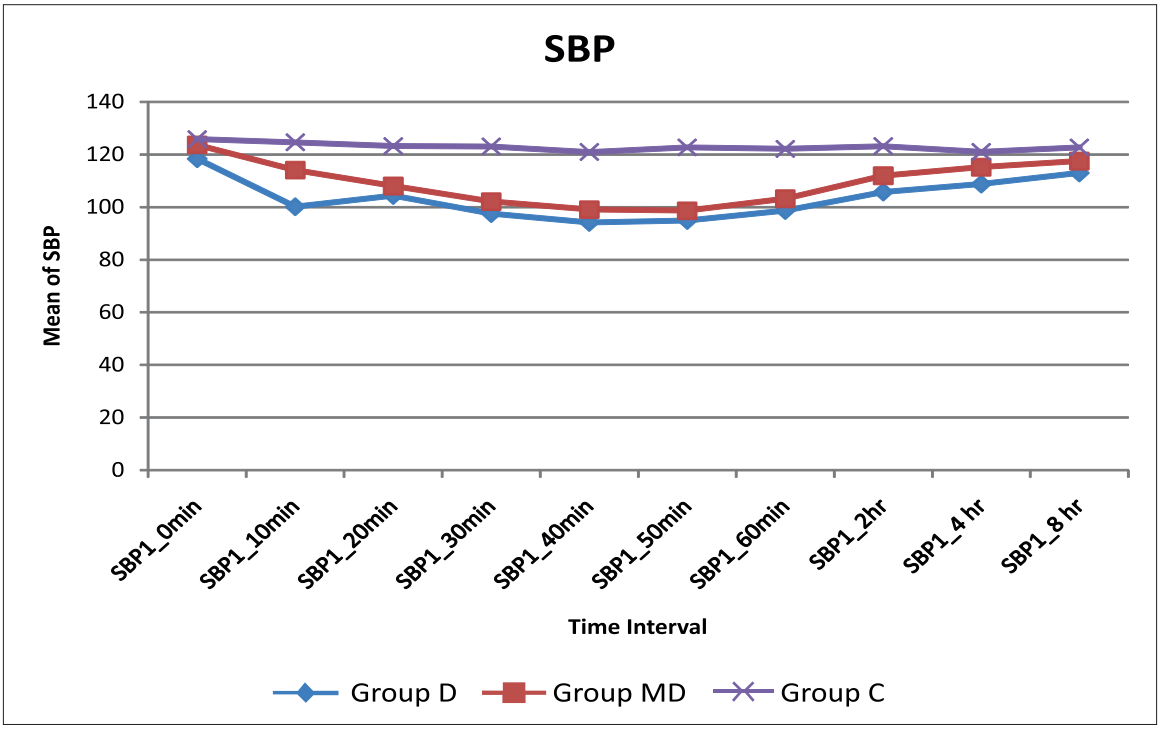


Fig.3: SBP at different time intervals.



As shown in Table 3, fewer minor side effects were observed during the study period. In group D and MD ; hypotension, bradycardia, sedation (ramsay sedation <3), and dry mouth were usual side effects. Almost all the tolerable side effects were most commonly found in dexmedetomidine group. No side-effects including nausea, vomiting, and respiratory depression were reported in either group.

Table 3: **The comparison of side effects in all groups**.

Side effects	Group D (N=27)	Group MD(N=27)	Group C(N=27)
Hypotension	18 (66.66%)	15 (55.55%)	0
Bradycardia	20 (74.07%)	17 (62.96%)	1 (3.70%)
Respiratory depression	0	0	0
Sedation (<3)	16 (59.25%)	17 (62.96%)	0
Dry mouth	8 (29.62%)	7 (25.92%)	1 (3.70%)
pruritis	2 (7.40%)	0	0
Nausea & Vomiting	1 (3.70%)	2 (7.40%)	2 (7.40%)

DISCUSSION

Thoracotomy supposed to be associated with a high incidence of chronic neurogenic pain, which might be reduced by good acute postoperative analgesia. There are multiple advantage of thoracic epidural analgesia:

- Decreased duration of mechanical ventilation
- Superior postoperative analgesia compared with systemic NSAID or Opioids.
- Decreased pulmonary complications
- Decreased mortality in patients with multiple rib fractures.
- Decreased duration of postoperative ileus after abdominal surgery

Studies suggest that adjuvants containing epidural local anaesthetics increase segmental bioavailability of adjuvants in the cerebrospinal fluid and blocking the release of substance P in the substantia gelatinosa of the dorsal horn of the spinal cord.

Dexmedetomidine is highly lipid soluble and appears rapidly in CSF and has high binding affinity to a α 2 receptors in the spinal cord used as adjuvant to regional anaesthetic drug provide analgesia , sedative properties and causes minimal respiratory depression. [5-6]

Noxious stimulation leads to the release of neurotransmitters, which bind to various subclasses of excitatory amino acid receptors, including NMDA receptors. Magnesium, a noncompetitive NMDA receptor antagonist, has a role in prevention of central sensitization from peripheral noxious stimulus[1]. Wider-Smith O et al reported that magnesium inhibit the NMDA system differently.[7-8]

So we studied the efficacy of single bolus of epidural magnesium (75 mg) plus dexmedetomidine (1 µg/kg) with ropivacaine (0.375%) for postoperative analgesia after posterolateral thoracotomy approach .

The results of the present investigation showed that all three groups of demographic profile were comparable. We started the study with minimal pain of VAS >4.Duration of first epidural top up (mean VAS scores >4) were higher in group control group (4±2.41) in comparison to group D and MD (12±2.33 and 11.70±1.56) but there is no differences in VAS in between group D and MD at different time intervals as shown in Fig. 1.and table 2. In contrast to our study Billir et al [1] reported that co-administration of epidural magnesium 50 mg with fentanyl 25 µg for postoperative epidural analgesia provided a profound analgesia as compare fentanyl alone. Ko et al also suggested that Magnesium sulphate does not reduce postoperative analgesic requirements.[8]

Time to reach peak effect of analgesia significantly earlier in control group as compare to D and MD group. There are many studies have shown, the role of epidural magnesium for postoperative analgesia is not good as fentanyl /clonidine /dexmedetomidine [1,2, 9]. However, the systemic administration of magnesium is associated with smaller analgesic requirement and less discomfort in the postoperative period.[10]

Intrathecal administration of magnesium has been demonstrated by Buvanendran and colleagues[11] in pregnant women , if magnesium 50 mg and fentanyl 25 µg were given intrathecally, the median duration of analgesia was significantly prolonged compared with plain intrathecal fentanyl. Similarly, in another study had shown that the addition of intrathecal magnesium 50 mg to spinal anaesthesia prolonged the period of analgesia without any side-effects. [12,15] Concluded that by different researcher, it is an effective analgesic when magnesium added to intrathecal as compare to epidural-magnesium.

The side-effect (Table 3) profiles are quite favourable as none of the patient had profound deep sedation (ramsay sedation score>3) or respiratory depression. Postoperatively, HR and

IBP lower side in study group but remained stable and MD, none of them require atropine or vasopressure, while in group C vitals were stable(Fig 2 &3). Bajwa et al[13] reported that analgesic properties, lower side blood pressure and decrease heart rate mostly due to their increased affinity to α-2 receptors and decrease central sympathetic outflow and norepinephrine release. throughout the study period in group D and MD, none of them require atropine or vasopressure, while in group C vitals were stable(Fig 2 &3). Bajwa et al[13] reported that analgesic properties, lower side blood pressure and decrease heart rate mostly due to their increased affinity to α-2 receptors and decrease central sympathetic outflow and norepinephrine release.

None of groups of the patients in the present study developed motor blockade/ hemodynamic instablity. Dry mouth is a known side effect of α-2 agonists and the incidence in the present study was found more than 20% of D and MD group which is almost comparable to other studies.Goodman et al reported two case ,[14] larger doses (8.7 g, 9.6 g) of magnesium inadvertently administered into the epidural space did not cause any neurologic injury**.**

Our study has the **limitation** of only single dose response evaluation and epidural dose of magnesium was very small and require large number of sample size.

Conclusion

Epidural Magnesium sulphate added with dexmedetomidine showed no difference in VAS as compare to dexmedetomidine alone for providing prolonged post-operative analgesia . The results of the present investigation suggest that epidural magnesium added with dexmedetomidine may not be a useful at small dose.

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Conflicts of Interests: None

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ANAESTHETIC MANAGEMENT OF A PATIENT WITH PALATAL DEFECT

Dr. Hitesh S. Patel

ABSTRACT

Airway management of an adult patient with palatal defect is a challenging case to an Anesthesiologist. We report a 20 yr adult male patient who was an operated case of nasopharyngeal Angiofibroma posted for palatal defect (3.5-4.5 cm) repair. It was a major surgery lasted for 12 hours involving the airway shared by the surgeon. Challenges involved in this case management were airway edema, analgesia and fluid and electrolytes. Intraoperative period was uneventful. Patient was electively shifted to ICU for prophylactic ventilatory support with Endotracheal Tube in situ post procedure because it being a major surgery with compromised airway with poor pharyngeal reflexes, copious secretions, bite block and airway edema. Patient was postoperatively managed with adequate analgesia, sedation and muscle relaxation and was extubated on 3rd postoperative day. The details would be discussed in the report.

Keywords: Airway surgery, Nasopharyngeal Angiofibroma, Bite block, Ventilation.

Introduction

Airway surgery demands a high level of cooperation between surgical and anaesthetic teams. Surgery of an airway is a special endeavour where the airway is shared by the surgeon and the anaesthesiologist[1]. Knowledge of the various techniques for airway management is crucial since it is also necessary to provide the surgeon with a still and non-obstructed field[1].The population presenting for airway surgery mainly falls into two categories[1]. The first group comprises elderly patients with coexisting respiratory and cardiovascular morbidity resulting from long-term smoking and high alcohol intake. These patients often have malignant lesions and may show side-effects of its treatment (e.g. radiotherapy). They often require invasive intraoperative monitoring and short-acting opioids such as remifentanil. The second group comprises young children or those with learning difficulties who presented for cleft palate repair surgery and inhale or ingest foreign objects.

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Psychosocial factors include fear of choking, death, and inability to communicate following tracheostomy[1]. Many patients return for multiple procedures. A hoarse voice or previous prolonged intubation or tracheostomy should alert the clinician to the possibility of a stenotic airway at some level[2]. The combination of several minor physical anomalies may result in a difficult intubation even when no one single factor is severely abnormal. Difficult intubations also occur occasionally for reasons that are unexplained, and none of the available indices predicts all difficult intubations[1,2]. The truly life-threatening problem is the inability to ventilate when intubation is difficult or impossible[2]. Intraoperatively the anaesthetist must pay special attention to protecting eyes, neck, and teeth while optimizing surgical access in what may be a crowded area[1, 2].Airway management of a patient with palatal defect is a challenging to the anaesthesiologist because these patients presented for airway surgery of long duration which involve the risk of Airway edema, Hypothermia, Pain, Fluid and electrolytes[1,2].

Case Report

A 20 yr Male patient coming from lower socioeconomic status presented with chief complains of Difficulty in speech, Occasional nasal regurgitation, and heavy snoring since 10 years. He had a past history of surgery for Juvenile Nasopharyngeal Angiofibroma before 10 years resulting in large defect (3.5-4.5 cm) in hard palate; Patient was tracheostomised at that time due to breathing difficulty postoperatively and remains tracheostomised for 10 days. At present patient posted for cleft palate repair. On Examination tracheostomy scar was present over anterior part of neck. Patient was conscious, oriented and follow verbal command, Vitals: Pulse = 78 / min, BP = 110/70 mm of Hg, RR = 12-14 / min. Indirect Laryngoscopy was done and reveal normal bilateral vocal cord movements. On General Examination Height-170 cm, Weight-64 kg and others were normal, Neck movements were adequate, Airway examination shows Mallampati Grade- I, Mouth opening- 4 finger with a defect of 3.5 - 4.5 cm in hard palate, Temporomandibular joints movement normal. Cervical lateral and AP x-ray reveal no abnormality. On Systemic Examination RS, CVS, CNS normal. Investigations including Hemogram, Coagulation Profile, LFT, RFT, PT with INR, Serum Electrolytes, ECG, and Echocardiogram were within normal limits. After taking Informed and written consent patient shifted to Operation Theatre. On arrival to OT Monitoring ECG, NIBP, SPO2, ETCO2 and Urine Output, Temperature applied and two large bore 18 G IV cannula secured. All preparation for difficult intubation kept ready as patient had a history of previous tracheostomy.

General anaesthesia was given. Premedication in form of Inj.Glycopyrollate 0.04 mcg /kg,Inj. Dexamethasone 0.15 mg/kg and Inj. Fentanyl 2 mcg/kgi.v.3 minutes before induction given. Preoxygenation for 5 minute done with 100% Oxygen via Bain's circuit. And induction done with Inj. Propofol 2 mg/kg and Inj. Succinylcholine 2 mg/kg i.v. Intubation done with 8.5 mm portex cuffed South Pole oral RAE tube, correct placement of the tracheal tube was confirmed by chest auscultation and capnography and oral packing done. Maintenance of anaesthesia done with 50% O_2, 50% N_2O, Sevoflurane and infusion of non depolarizing muscle relaxant Vecuronium 0.0001 mg/kg/min. Depth of anaesthesia was maintained with Entropy monitoring. We didn't feel any difficulty during intubation as it was expected due to previous tracheostomy and we didn't have Fiberoptic Laryngoscopy in OT. Intraoperative Vitals were within range of Pulse-70-90/min; BP-100/60-130/80 mmhg. Intraoperative period was uneventful. Intraoperative blood loss around 400 ml. Intraoperative fluids were given to maintain Urine output 0f 1ml/kglhr. Surgery lasted for 10 hours and analgesia was provided with intermittent Fentanyl 300 mcg, Tramadol 100 mg

and after surgery oral pack was removed which was soaked with blood.

Postoperatively patient was electively shifted to ICU with ETT in situ for which south pole oral RAE tube is exchanged with oral endotracheal tube using tube exchanger and put on controlled ventilation because it being a prolonged intraoral surgery with airway edema with poor pharyngeal reflexes, copious secretions, bite block for maintaining integrity of anastomosis leading to increased prevention of aspiration of blood oozing from flap margin and anastomosis. In ICU patient was put on controlled ventilation VCV mode of ventilation with sedation Inj.Fentanyl (1 mcg/kg/hr) and Midazolam (0.05 mg/kg/hour), relaxant with Inj.Vecuronium (0.006 mg/kg/hr) using infusion pump in 50 cc infusion for 1day and then put on SIMV mode then T piece trial and extubated on 3rd postoperative day and shifted to ward and discharged after 25 days. In ICU all blood investigation including complete Hemogram, RFT, LFT, PT with INR, BT, CT and all reveal normal. Post operative oozing present from nasal and oral area so oral, nasal and ET suction done periodically. Perioperative period was uneventful.

SURGICAL REMARKS

a) Left forearm radial artery anastomosis with Facial artery and left forearm collateral circulation from ulnar artery checked.
b) Free flap from radial side of left forearm repositioned on palatal defect.

DISCUSSION

Surgery of an airway is a special endeavour where the airway is shared by the surgeon and the anaesthesiologist[1]. Hypoxemia and Hypercarbia are potential complications of Laryngoscopy and intubation that are not successful in a reasonable amount of time[1,2]. Careful evaluation of the airway can screen out most patients who cannot be adequately ventilated by mask or intubated. Ideally this type of patients with previous tracheostomy should be intubated with Fiberoptic Intubation so complication of difficult intubation can be avoided.[2,7] The Pulse oximeter is essential for detecting desaturation during this time. If neither mask ventilation nor intubation can be accomplished, the insertion of a supraglottic airway device such as the LMA or Combitube should be performed with TTJV or a surgical airway reserved for when less invasive maneuvers are unsuccessful.[2,7] Surgery including Airway is challenging to anaesthesiologist mainly in peri operatively. To establish, maintain, and protect the airway is the crucial point during the anaesthesia for palate surgery because the same area we have to share with the surgeon.[5,6] Failure of which leads to Hypoxia, Hypercarbia, Airway bleeding, Arrhythmia, Cardiac arrest and Death.[5,6] Intra-operatively the anaesthetist must pay special attention to protect eyes, neck, and teeth while optimizing surgical access. All instruments to deal with difficult airway should be ready during this type of surgery.[7] Other complications include obstruction of the endotracheal tube, inadvertent extubation during the procedure, bleeding, hypovolemia, airway oedema due to surgical manipulation, hypothermia.[5,6] Following surgery to the airway, there is the risk of laryngeal spasm, aspiration, or airway obstruction due to oedema or haematoma formation. To minimize the risk of laryngospasm, the patients should be positioned semi-sitting and should have their trachea extubated either awake or under deep anaesthesia (to allow airway reflexes to return without the stimulus of the tracheal tube) [1,2]. Post operatively problems like delayed emergence due to prolong anaesthesia, hypothermia, respiratory distress[5,6], Airway oedema leads to obstruction of airway due to manipulation prolong surgery, bleeding, and secretions and Respiratory depression.[2,4,5]Good communication between the surgeon and anesthesiologist is must as they both share the same airway.[5] Thorough suction of blood and secretion is must without disruption of suture

line.[5,6] Combination of airway oedema, closed palate, bleeding, residual anaesthetic effect, hypothermia leads to post operative airway obstruction and respiratory depression make extubation difficult.[2, 4, 5] So it will be advisable to shift the patient for elective ventilation as this was a prolonged surgery including airway and manipulation of upper airway till oedema regresses and oozing stops.

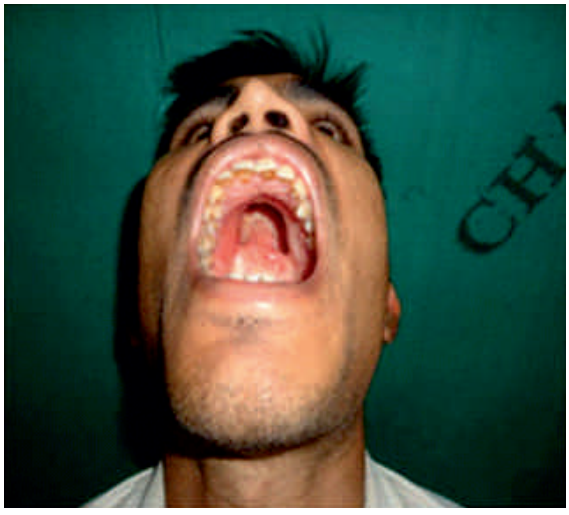

Fig.1 Preoperative

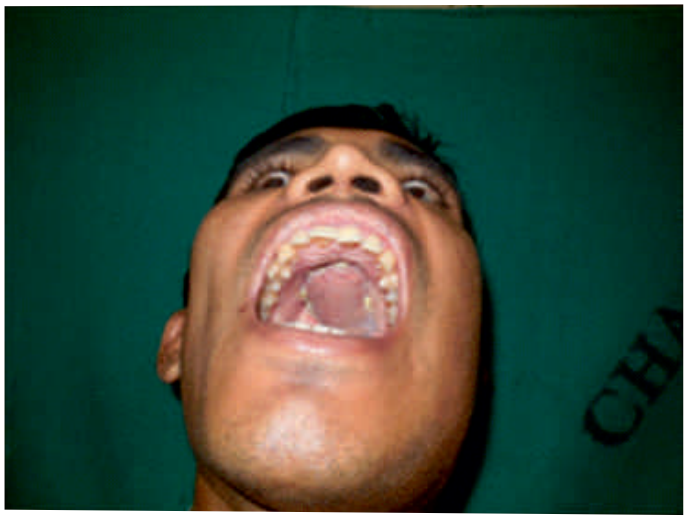

Fig.2: Post operative

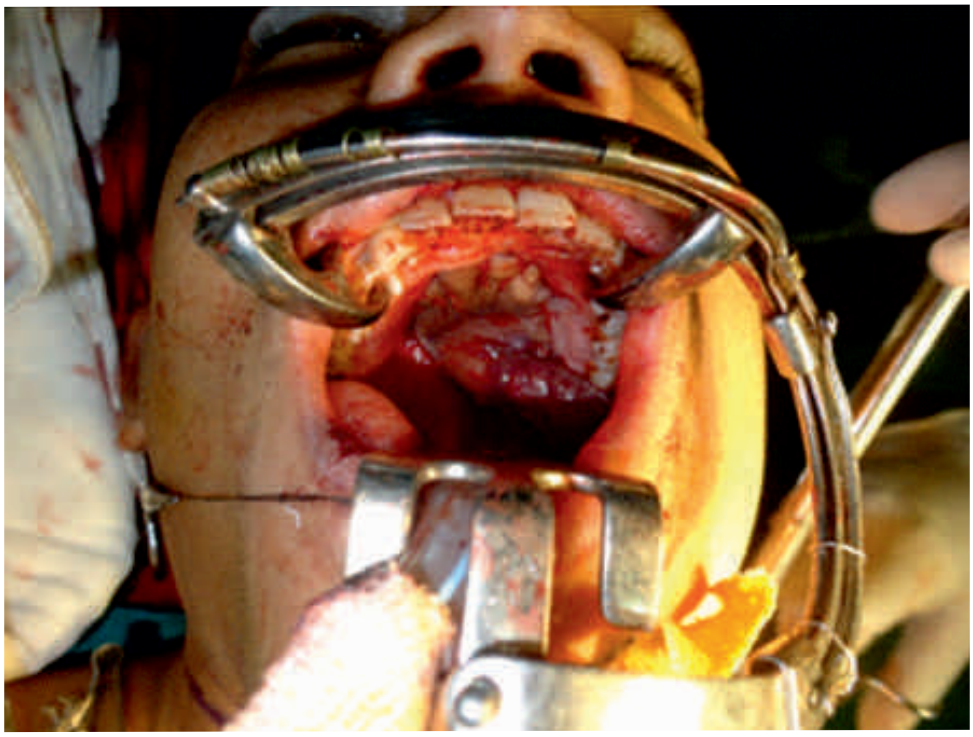

Fig.3: Intraoperatively

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A COMPARISION OF DEXMEDETOMIDINE AND MIDAZOLAM FOR SEDATION DURING SPINAL ANAESTHESIA IN GYNECOLOGIC SURGERY

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ABSTRACT

Background

Dexmedetomidine and Midazolam both provide sedation and anxiolysis. Our aim of this study was to compare sedative, hemodynamic, respiratory and side effects between dexmedetomidine and midazolam during spinal anesthesia in gynecologic surgery patients.

Method

This prospective, randomized, double blind study was carried out in 80 adult female patients with American Society of Anaesthesiologist (ASA) I and II for elective gynecological surgery who met the inclusion criteria for spinal anaesthesia.

Group D: received inj. Dexmedetomidine 0.5mcg/kg IV Group M: received inj. Midazolam 0.05mg/kg IV. Each group was premedicated 5 minutes before spinal anaesthesia. The study drug was premixed to a volume of 5ml and administered intravenously over 10 min. Hyperbaric 0.5% 3ml Bupivacaine, was injected intrathecally in all patients. Vital signs and sedation level were recorded at every 5 minutes in the operation room and every 30 min. for 2 hrs in the Post Anesthesia Care Unit (PACU). Time of recovery from spinal anesthesia and adverse effects of study drugs were recorded.

Results

Statistically significant decrease in heart rate,SBP, DBP and MAP was observed in group D when compared with group M ($p < 0.005$). Intraoperative sedation and patient's satisfaction were significantly better with dexmedetomidine than midazolam group ($p < 0.05$). Duration of spinal anesthesia was prolonged in D group compared to M group. There is no significant difference in respiratory rate and side effects in both the groups.

Conclusion: Compared with IV midazolam , IV Dexmedetomidine provides significant fall in pulse, BP, effective sedation with minimum respiratory depression and without any side effects in gynecologic surgery under spinal anesthesia.

KEY WORDS: Dexmedetomidine, Gynecology surgery, Midazolam, Sedation, Spinal anesthesia

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INTRODUCTION

Regional anesthesia is the safest, efficacious and cost effective method of anesthesia and analgesia into the perioperative period. It offers several benefits to the patients including cardiovascular and respiratory stability, preservation of airway reflexes , avoidance of intubation and pulmonary aspiration, rapid postoperative recovery, maintain spontaneous breathing and muscle relaxation.[1] The drawback of regional anesthesia are fear of needles and pain at the puncture site and recall of the procedure.[2] Adequate sedation in spinal anesthesia relieves the anxiety of patient, improves physiological and psychological stress and increases the satisfaction of both the surgeon and patient.[3]

During spinal anesthesia, propofol , remifentanyl ,dexmedetomidine and midazolam are commonly used for sedation.[4-6]

Midazolam has rapid onset and recovery time, the time of onset is slower than propofol.[4] Dexmedetomidine has sedative and analgesic effect due to the activation of alpha$_2$ – adrenergic receptors of the central nervous system.[6]

In this study, dexmedetomidine was compared with midazolam for sedation without significant side effects during spinal anesthesia in patients undergoing gynecologic surgery.

MATERIAL AND METHODS

In this prospective randomized double blind study 80 adult female patients (ASA I &II) were selected and randomly divided into two group of 40 patients in each group. Patients included in the study were female patients aged 30 to 65 years, belonging to ASA I & II and Scheduled for gynaecologic surgery under spinal anaesthesia. Exclusion criteria were contraindication to spinal anaesthesia (e.g. coagulation defect, infection at puncture site, pre-existing neurological deficits in lower extremities), known allergy to any of the test drug, patient's refusal to give consent, use of any opioid or sedative medication in three weeks prior to surgery, cardiovascular, respiratory, neurological, psychological, hepatic or renal disease and history of alcohol or drug abuse.

Patients were assessed a day prior to surgery for anesthesia fitness. History was taken to rule out any major systemic illness. All routine investigations were asked. Patients were randomized to receive either dexmedetomidine (group D) or midazolam (group M) for sedation. The anesthetist was blind to patient group assignment and study data was recorded by a blind observer.

Group D: received inj. Dexmedetomidine 0.5mcg/kg IV

Group M: received inj. Midazolam 0.05mg/kg IV

All patients were prehydrated with 500 ml of Ringer's Lactate solution via an 18-gauge IV cannula & premedicated with inj. Ondansetron 0.08mg/kg IV. Patient was monitored by non-invasive arterial blood pressure (BP), ECG, heart rate (HR) and pulse oximeter. All patients received 4 L/min of O_2 by nasal prong.

Patients allocated to group D received inj. Dexmedetomidine 0.5mcg/kg in total volume of 5ml over a period of 10 minute. While patients in group M received inj. Midazolam 0.05mg/kg in total volume of 5ml over 10min. Each group was premedicated 5 minutes before spinal anesthesia.

After performing the spinal block using hyperbaric o.5% Bupivacaine hydrochloride, the vital signs and sedation level were recorded at every 5 minutes in the operation room. For assessment of sedation Ramsay Sedation Score was used. It is as follow:

1 - Awake and anxious, agitated or restless
2 - Awake, co-operative, oriented, tranquil
3 - Awake, responds only to commands
4 - Asleep, brisk response to light glabellar tap or loud noise
5 - Asleep, sluggish response to light glabellar tap or loud noise stimulus but does not respond to painful stimulus

6 - Asleep, no response to light glabellar tap or loud noise

Time of recovery from spinal anesthesia and any adverse effects of study drugs were recorded. Time of sensory regression to S1 dermatome was considered as time of recovery from spinal anesthesia for comparison between two groups. Hypotension was defined as a systolic blood pressure of less than 90 mmHg and, was treated with a bolus administration of 300 ml of lactated Ringer's solution over 10 min and 6 mg of intravenous mephentermine.Bradycardia was defined as HR <50 beats/min, and was treated with 0.02 mg/kg of intravenous atropine.

In the Post Anesthesia Care Unit (PACU) the vital signs, higher mental function, reflexes, nausea and vomiting were recorded every 30 min. for 2 hrs.

STATISTICAL ANALYSIS

Continuous variables were compared between the two groups using unpaired t-test. The demographic data for the categorical variables and adverse effects and treatment factors were also compared using the chi-square test. Statistical software used was Graphpad.com. The P value of <0.05 was considered significant.

OBSERVATION AND RESULT

Eighty adult female patients belonging to ASA grade I or II were selected for the study.

It was observed that systolic blood pressure decreased in both groups. But significant difference between two groups was seen after 55-60 min. (P value <0.05). During first 55-60min. fall in systolic BP in both group might be due to effect of spinal anaesthesia.

The decrease in diastolic BP occurred in both the groups. But decrease in diastolic BP was more in group D as compared to group M. The difference in diastolic blood pressure was statistically significant in both the groups after 10 min. (P value <0.05). The difference in two group was statistically insignificant with respect to respiratory rate with P value >0.005.

The mean time of sensory regression to S1 dermatome in group D was 261±19.61 min and in group M 192.80±22.64 min. So, duration of spinal anesthesia was significantly prolonged in group D as compared to group M with P-value of <0.005.

Table I: Demographic data

		Group D (n=40) 50.1+- 9.12	Group M (n=40)
Age in yr		50.1+- 9.12	49.65 ± 10.11
Weight in kg		54.58 ± 11.79	59.83 ± 5.51
Duration of Surgery in min		126.38±11.09	128±6.87
ASA status	l	25	27
	ll	15	13

Values are the means ± standard deviations ,n= Number,ASA-American society of anaesthesiologist, Yr=year,Kg= kilogram,Min=Minute

Demographic data in all patients in both groups are comparable to each other and there is no statistical difference between them. (P value >0.05)(Table I)

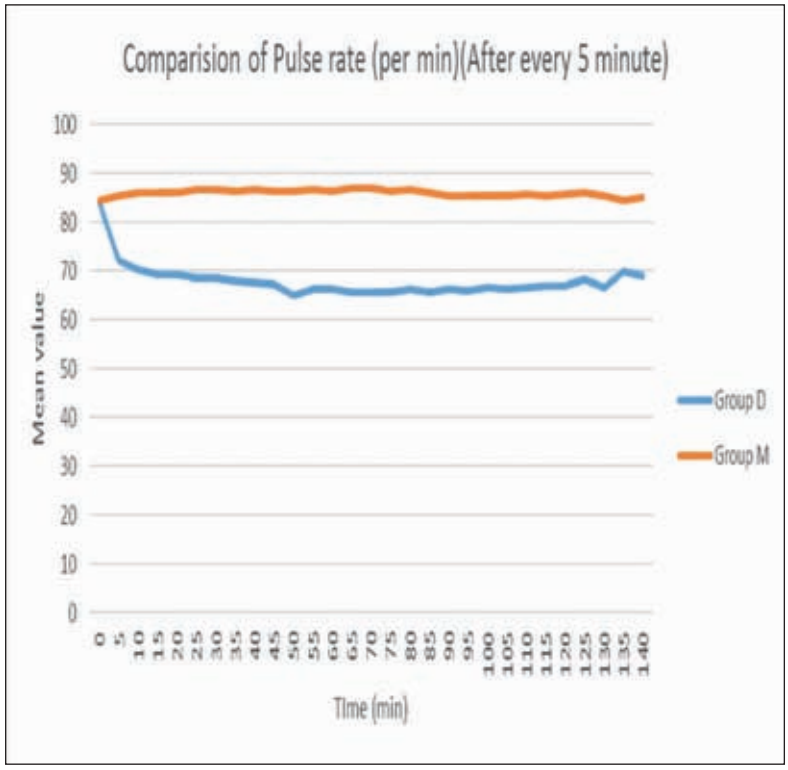
Table II : Comparison of Adverse Effects

Values in numbers (n/N) (%)			
	Group D	Group M	P value
Bradycardia	4/40(10)	2/40(5)	0.42
Hypotension	5/40(12.5)	2/40(5)	0.10
Nausea &Vomiting	1/40(2.5)	2/40(5)	0.60
Blood transfusion	2/40(5)	2/40(5)	0.12

[n = no. of patients in which complication occurred, N=total no. of patients in study]

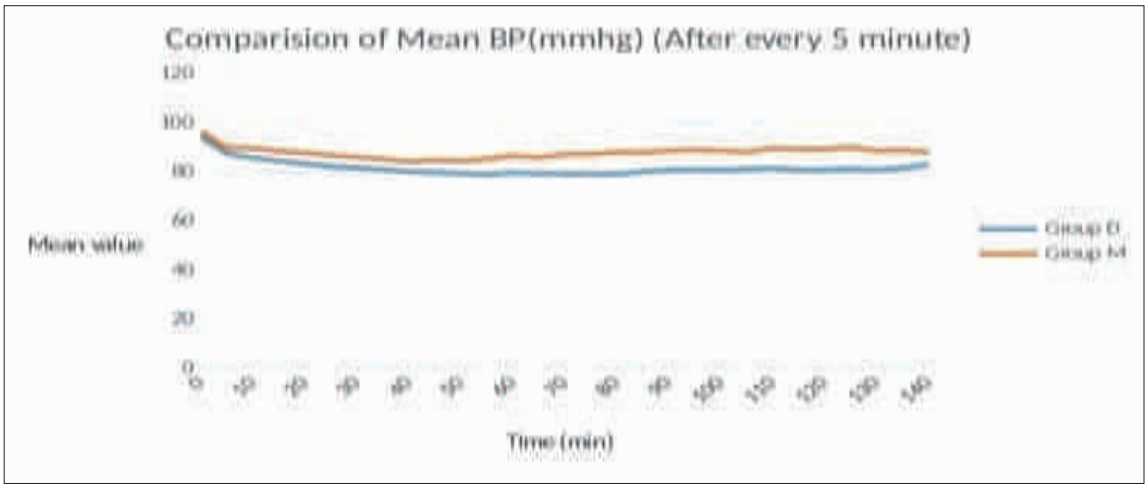
Table II shows that side effects were comparable in both groups. (P value >0.05)

Fig I: Comparison of Pulse Rate



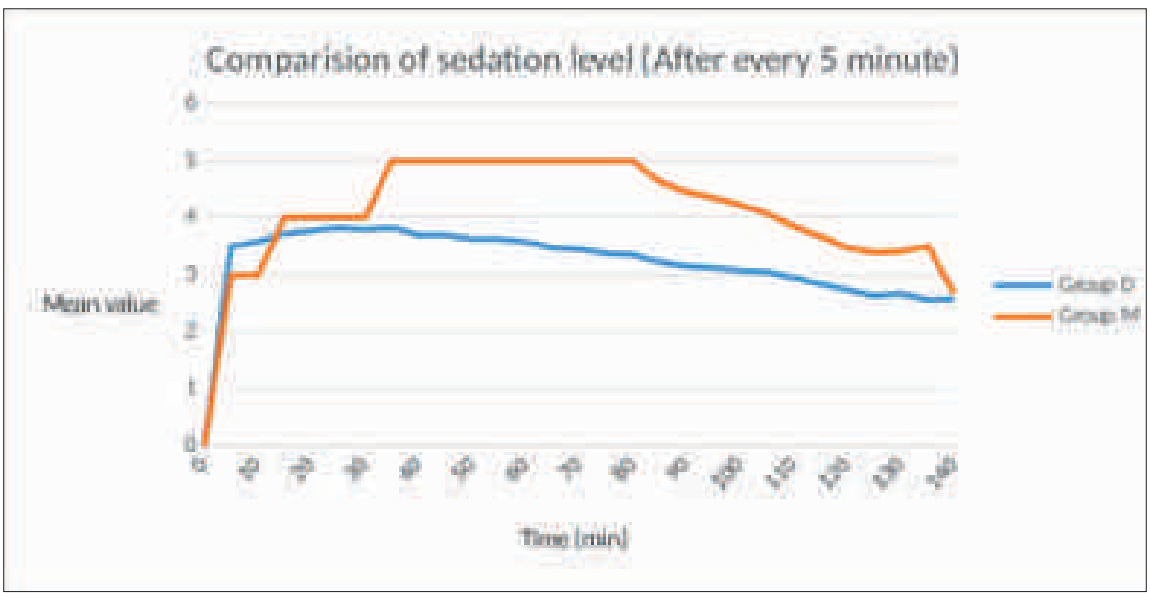
It was observed that baseline mean heart rate in both group were comparable. There was significant fall in heart rate in the group D compared to group M after 5min till shifting of patient to postoperative ward. Here P value is <0.005 which is statistically significant. (Fig I)

Fig II : Comparison Of Mean Blood Pressure



Decrease in MAP was more in group D as compared to group M. The difference in the two group was statistically significant with respect to mean blood pressure from 10 min onwards with P value <0.005. (Fig II)

Fig III : Comparison Of Sedation Level



It observed that mean sedation level by Ramsay Sedation Scale was between 3 & 4 in the group D and between 3 & 5 in the group M. There was significant difference between them from 5 min of injection of drugs to 115 min. In group D patient were easily arousable and calm. While in group M patients were deeply sedated during first 70-80min. with mean sedation level of 5. (Fig III)

DISCUSSION

In patients undergoing gynecological surgery under spinal anesthesia, intravenous sedative-analgesic drugs are often administered to make patient comfortable, eliminating mental stress and visceral reaction, to improve surgical conditions and to prevent recall of unpleasant events. Midazolam combined with opioids are commonly used for anxiolysis and/or analgesia. But this drug combination can cause respiratory depression placing the patient at risk for hypoxia. Bailey et al. reported in their study that the combination of midazolam and fentanyl increased the frequency of hypoxemia in 11of 12 subjects and produced apnoea in 6 of 12 subjects. [7]

Dexmedetomidine has potent sedative and analgesic property. At therapeutic doses dexmedetomidine is not associated with respiratory depression. [8,9,10] Because of sedation, analgesia and respiratory sparing properties, dexmedetomidine might prove useful for sedation during spinal anesthesia. Dexmedetomidine induced sedation qualitatively resembles normal sleep from which patient can be easily aroused.

Dexmedetomidine is a α_2 agonist and is expected to cause fall in heart rate. It was observed that heart rate in group D shows significant fall as compared to group M from 5min. after drug was injected, which is statistically significant with P value 0.0001. The lower HR observed in group D could be explained by the decreased sympathetic outflow and circulating levels of catecholamines that are caused by Dexmedetomidine.

These observations are comparable to studies by Berrin G.Naydin et al., Mahmoud M Al-Mustafa et al. with Dexmedetomidine in dose of 1 µg/kg. [11,12]

Group M also showed a fall in heart rate once the dose was given but it was not statistically significant. We compared the reduction in heart rate in both groups and found that dexmedetomidine was more effective in bringing down the heart rate.

In our study 4 patients in group D had episodes of bradycardia (HR<50) out of which 3 patient required Inj Atropine (0.02mg/kg) (P value >0.005) as bolus dose.

It was observed that the systolic blood pressure decreased in both groups. Initial decrease in blood pressure was due to spinal anesthesia. But after 55-60min. decrease in systolic pressure was significant in group D than group M with P value <0.005.

Mean value of diastolic BP also decreased in both the groups but there was significant fall in D group after 10-15mins with p value <0.005.

These findings were comparable to results found by Stephen M. Jacob; Esko Ruokon et al. [13] They compared dexmedetomidine versus midazolam or propofol for sedation during prolong mechanical ventilation.

In our study the mean blood pressure was also found to be decreased in both the groups, but after 20min significant fall in MAP was found in D group as compared to M group with P value < 0.005.

Our findings are supported by similar results of study done by Durmusand and colleagues and have proved in a placebo controlled study that dexmedetomidine decrease bleeding and anesthetic requirement. [14]

Our study demonstrated that dexmedetomidine can provide comparable sedation when compared to midazolam for gynecological surgery under spinal anesthesia. It is observed that mean sedation level by Ramsay Sedation Scale was between 3 & 4 in the group D and between 3 & 5 in the group M. There was significant difference between them after 5 min of injection of drugs to 115 min. In group D patient were easily arousable and calm. While in group M patients were deeply sedated during first 70-80min. with mean sedation level of 5. The patient receiving midazolam achieved level of sedation more rapidly than those receiving dexmedetomidine.

There are many studies to compare the usefulness of continuous infusion of midazolam and dexmedetomidine during regional anesthesia.[15,16] This study proved the bolus regimen of midazolam and dexmedetomidine as rapid and effective sedative during spinal anesthesia. Yongxin Liang, Miaoning GU, Shiduan Wang, Haichen Chu et al. [16] demonstrated that dexmedetomidine for sedation in gynecologic surgery under epidural anesthesia is safe and feasible. Compared with midazolam, it not only provides a satisfactory and arousable sedation but without respiratory depression. These findings are similar with our study.

There was no statistically significant difference in the intraoperative respiratory rate between two groups (P value >0.005). Although there was fall in mean respiratory rate from baseline in both the groups.

This finding is consistence with studies conducted by A. Koroglu, S. Demirbilek, H. Teksan, O. Sagir, A.K.But and M.O. Ersoy where they compared dexmedetomidine versus midazolam for sedation in children undergoing MRI. [17]

The mean time of sensory regression to S1 dermatome in group D was 261±19.61 min and in group M 192.80±22.64 min. So, duration of spinal anesthesia was significantly prolonged in group D as compared to group M with P-value of <0.05.

In a study of Abdallah FW, Abrishami A, Brull R. et al. when IV Dexmedetomidine accompanied spinal anesthesia, sensory block duration was prolonged by 34% and motor block duration by 17%.[18]

Vimal H Patel, Harsha R Patel also observed that administration of IV dexmedetomidine during spinal anesthesia prolongs the duration of sensory and motor blockade. [19]

Bradycardia, hypotension, need for atropine or mephentermine, need for blood transfusion, nausea or vomiting in the intraoperative or post-operative time were comparable in the two groups. Jung SH, Lee SK et and Abdullah FW, Abrishami A, Brull R investigated the effects of small, single dose intravenous dexmedetomidine administration after hyperbaric Bupivacaine spinal anesthesia and found no difference in incidence of hypotension and bradycardia among the groups. [20]

CONCLUSION

The present study shows that both dexmedetomidine and midazolam produce adequate level of sedation but dexmedetomidine could be used as better alternative to midazolam for intraoperative effective sedation with minimum respiratory depression with significant fall in pulse, BP and without any side effects in gynecologic surgery under spinal anesthesia.

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ATTENUATION OF PRESSURE RESPONSE TO DIRECT LARYNGOSCOPY AND ENDO TRACHEAL INTUBATION – A COMPARATIVE STUDY BETWEEN MORPHINE SULPHATE AND FENTANYL CITRATE

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ABSTRACT

Background: The pressure response to laryngoscopy and endotracheal intubation would be dangerous in patients with cardiovascular or cerebral disease which increases risk of morbidity and mortality from tachycardia, hypertension and arrhythmia. This study is designed to compare the safety and efficacy of intravenous morphine sulphate and fentanyl citrate in attenuation of hemodynamic response during laryngoscopy and intubation. Material and Methods:Total of 50 patients of ASA I and II between 18-65 years were selected and divided two groups. Group I (inj. morphine sulphate 0.15 mg/kg IV) and Group II (inj. fentanyl citrate 4 mcg/kg IV). Heart rate, blood pressure, ECG were monitored continuously and recorded before and after giving the study drug, after intubation at 1,2,3,4,5,6,7,10th,30thminutes and 1,2,3,4,5 and 6th hour post operatively.Result: Fentanyl is highly effective in attenuation of heart rate and blood pressure response as compared to morphine sulphate following laryngoscopy and intubation which is statistically significant (P value-<0.05). Mean HR in fentanyl group is 77.8bpm while 92.68 in morphine group. Mean SBP is 110.88 mm of hg, mean DBP is 63.8 mm of hg, MBP is 79.49 mm of hg in fentanyl group while mean SBP is 116.76 mm of hg, mean DBP is 69.56 mm of hg, MBP is 85.29 mm of hg in morphine group. No major complications have been observed during study except hypotension in 2 patients, bradycardia in 3 patients. None of the patient had respiratory depression.Conclusion: Fentanyl citrate is more effective than morphine sulphate in attenuation of pressure response following direct laryngoscopy and endotracheal intubation.

Keywords: fentanyl citrate, hemodynamic response, morphine sulphate, intubation

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INTRODUCTION

Direct laryngoscopy and endotracheal intubation in anesthetized patients are known to induce clinical changes in hemodynamic variables. Direct laryngoscopy produces marked short term stress response with detrimental effects on coronary and cerebral circulation in high risk patients, particularly in those with systemic hypertension, coronary artery or cerebrovascular diseases.[1,2] Tracheal intubation causes increase in catecholamine concentrations and a reflexive rise in sympathetic activity. This reaction is not prevented by regular premedication. [3, 4,5] Various drug regimens and techniques have been used from time to time for attenuating stress response to laryngoscopy and intubation including opioids, barbiturates, benzodiazepines, beta blockers, calcium channel blockers, vasodilators, etc.[6,7,8] Opioids in adequate doses have been commonly used to prevent hemodynamic response at laryngoscopy and intubation.[9]

In our study morphine sulphate and fentanyl citrate have been used for attenuation of sympathoadrenal stimulation caused by tracheal intubation. Opioids are effective in blunting pressure response to laryngoscopy and intubation. These opioids areassociated with some side effects like respiratory depression, nausea, vomiting anddrowsiness. But with doses used in clinical setting to attenuate this pressure response side effects are minimal.

The purpose of this study to evaluate the safety and efficacy of intravenous morphine sulphate and fentanyl citrate in attenuation of hemodynamic response during laryngoscopy and intubation.

AIMS AND OBJECTIVES

To compare changes in heart rates, systolic blood pressure, diastolic blood pressure, mean blood pressure and side effects like respiratory depression, vomiting, bradycardia etc. in both groups.

MATERIAL AND METHODS

After obtaining approval from institutional review board and written informed consent this prospective study was carried out on 50 ASA I and II patients, aged 18-65years, scheduled for elective surgery requiring general anesthesia with endotracheal intubation. Patients of ASA grade III and IV, patients requiring nasal intubation, previous history of difficult intubation, repeated attempts of intubation, emergency surgery,pregnant patients, known sensitivity or intolerance to morphine and fentanyl, patients with cardiovascular, cerebrovascular, and gastro esophagealreflux disease were excluded from study. Detailed pre anesthetic evaluation of each case was done after obtaining the medical history, thorough systemic examination was carried out to detect the presence of any systemic disease. Routine and systemic investigations were done accordingly.

All patients were instructed to remain nil by mouth for at least 8 hours before surgery. Patients were premedicated with tab.lorazepam hydrochloride 1 mg night before surgery. Five minutes prior to induction of anesthesia patient received study drug in Group I: Inj. morphine sulphate 0.15 mg/kg and in Group II: Inj. fentanyl citrate 4 mcg/kg IV. On arrival in the operation theatre patients were monitored with routine electrocardiogram (ECG), pulse oximetry (SPO2%), heart rate(HR), systolic blood pressure (SBP), diastolic blood pressure (DBP), mean blood pressure (MBP) and were recorded as baseline value. After securing intravenous line all patients were given inj. glycopyrrolate 0.2mg IV. Prior to injection of study drug HR, SBP, DBP, MBP were recorded and designated as pre induction value. Anesthesia technique was identical in both thegroups. After preoxygenation with100% O2 for 3 minutes patients were induced with inj. thiopental sodium 2.5% 5mg/kg and muscle relaxation was provided with inj. vecuronium bromide 0.15mg/kg IV. Intermittent

positive pressure ventilation was given for 3 minutes with 100% oxygen at rate of 12 breaths/minute. Laryngoscopy and intubation with proper size tube was carried out within 30 seconds by senior anesthesiologist. Anesthesia was maintained with O2 (50%) in N2O (50%) with sevoflurane (0.5-1%MAC).

All parameters including HR, SBP, DBP, MBP and side effects were recorded at following interval. Baseline: on arrival in operation theatre, pre induction: after inj. glycopyrrolate, 0 minute: at the time study drug given, after intubation 1, 2, 3, 4, 5, 6, 7, 10^{th}, 30^{th} minutes and 1, 2, 3, 4, 5, and 6^{th}hour post operatively. After completion of surgery patients were reversed with inj. glycopyrollate 20mcg/kg IV and inj. neostigmine 40 mcg /kg IV. All patients were extubated when fully awake and following verbal command then shifted to postoperative ward.

We had following parameters for study: Hypotension defined as SBP <25% of baseline value or <90 mm of hg whichever was lower. Hypertension defined as SBP >25% of baseline value or >150 mm of hg whichever was greater. Tachycardia was defined as HR >25% of baseline value. Bradycardia was defined as HR <60 beats/minute.

Pre intubation and post intubation data were compared by paired "t" test in both the groups using graph pad software.P value <0.05 was considered statistically significant.

RESULT

Both groups were comparable in respect to age, weight and gender (Table 1). Table 2 shows the type of the surgeries carried out. Graph 1 shows changes HR. Increase in HR is less in fentanyl group as compare to morphine group after intubation up to 1st hour following intubation. Fentanyl is more effective in attenuation of heart rate response (mean HR is77.8 bpm, SD-4.42) as compared to morphine sulphate (mean HR is 92.68bpm, SD-4.23) following laryngoscopy and intubation which is statistically significant (P value-<0.05). Graph 2, 3 shows changes in SBP, DBP before induction and after intubation. Increase in SBP, DBP less in fentanyl group as compare to morphine group. Fentanyl is more effective (mean SBP is 110.88 mm of hg, SD-7.92, mean DBP is 63.8 mm of hg, SD-5.27) in attenuation of blood pressure response as compared to morphine sulphate (mean SBP is 116.76 mm of hg, SD-8.17, mean DBP is 69.56 mm of hg, SD-5.50) following laryngoscopy and intubation which is statistically significant (P value <0.05). Table 3 shows occurrence of complications in both group. Hypotension was observed in 2 patients in both group which was treated by head low position and fast fluid. Bradycardia was observed in 3 patients in fentanyl group which was treated by inj.glycopyrrolate 0.2 mg IV.

TABLE: I DEMOGRAPHIC DATA

variables	group:M	group:F
Age (years)	**43.0+-10.1**	42.92±9.07
Sex (M:F)	4:21	6:19
Weight (kg)	54.12±6.28	53.92±6.99
Duration of surgery(hours)	4±0.31	4.04±0.34

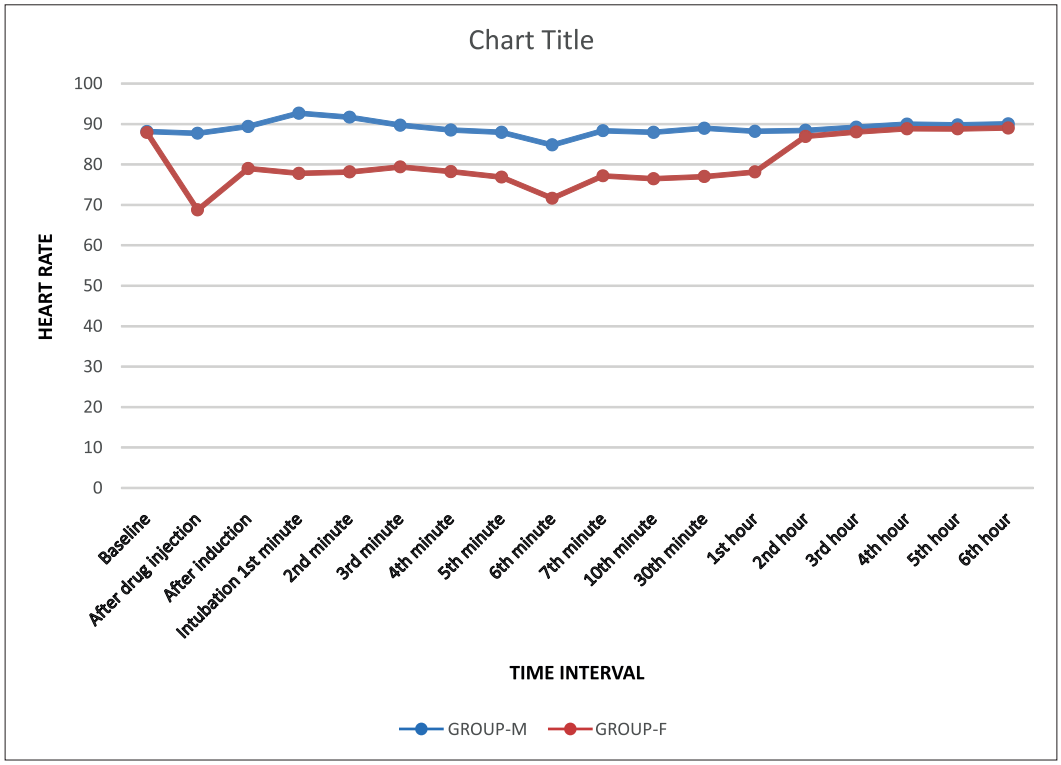
TABLE: II TYPE OF SURGERIES

Type of surgery	Group-M(no. of patients)	Group-F(no. of patients)
Staging laparotomy	7	6
Radical hysterectomy	1	0
Trans hiatal esophagectomy	4	2
Whipple procedure	1	0
Radical vulvectomy and groin dissection	2	1
Interval debulking	3	5
Abdominoperineal Resection	1	1
Colectomy	2	4
Exploratory laparotomy	4	5
Lower anterior Resection	0	1
Total no. of Patients	25	25

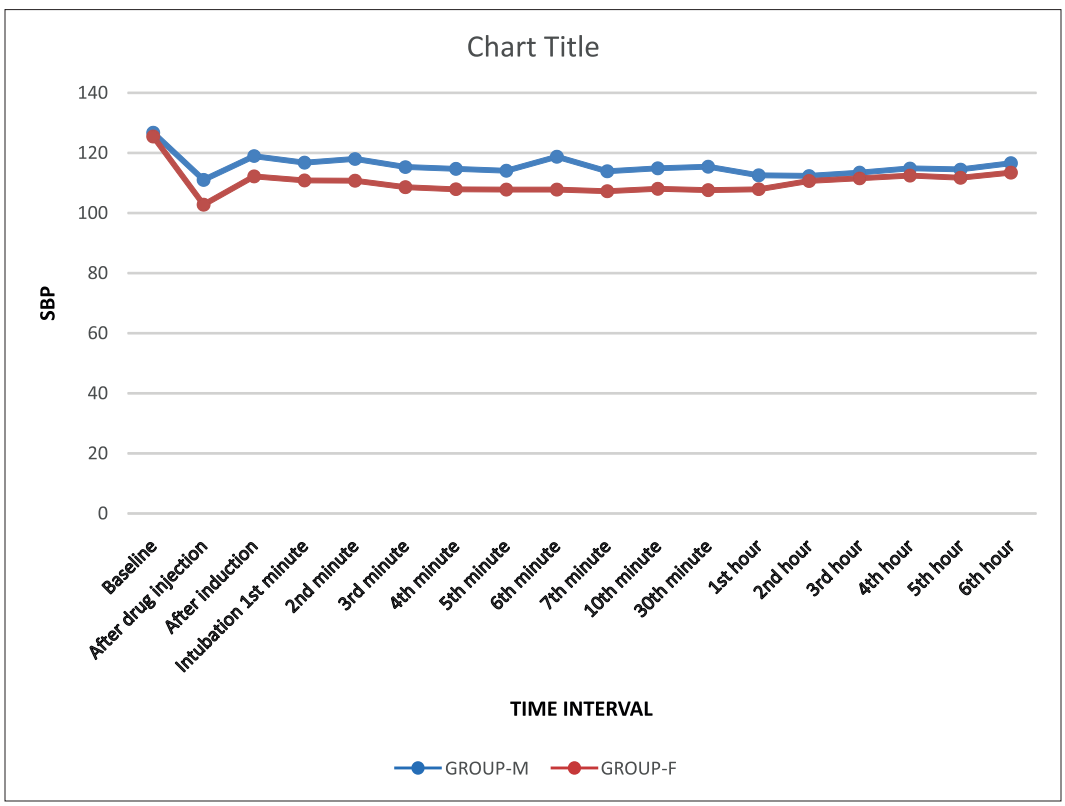
TABLE: III COMPLICATIONS IN BOTH GROUPS

Complications	No of patients	
	Group: M	Group: F
Bradycardia	Nil	3
Nausea	2	3
Vomiting	Nil	Nil
Respiratory depression	Nil	Nil
Hypotension	2	2

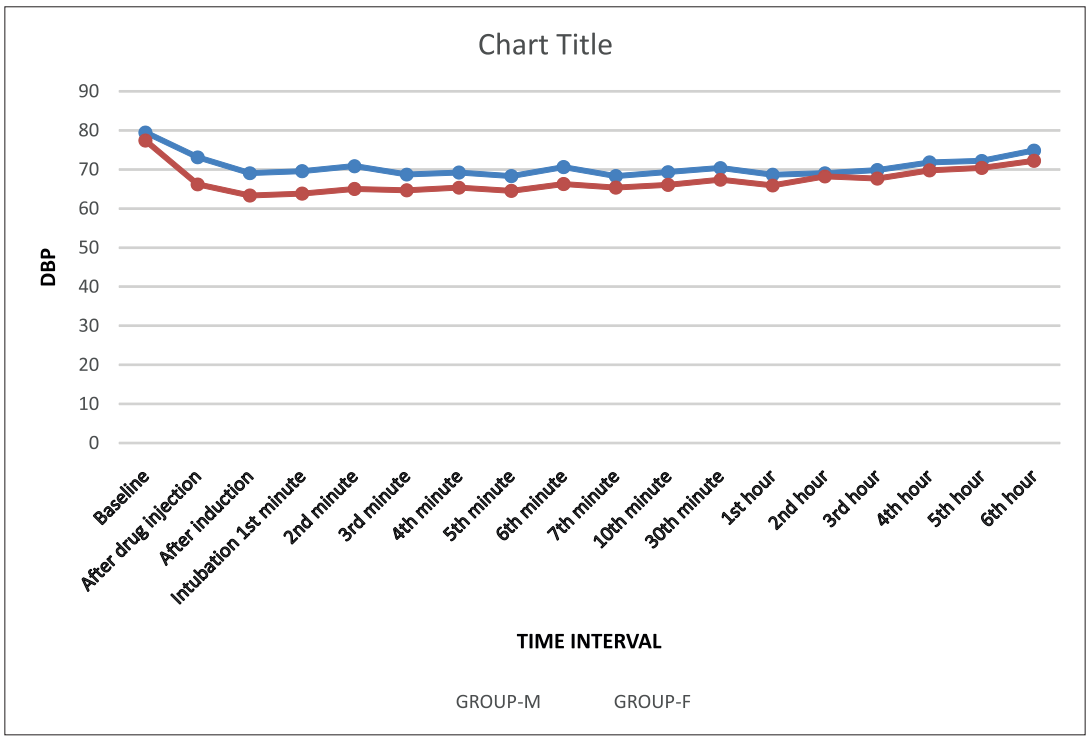
GRAPH: 1 MEAN HR AT DIFFERENT INTERVAL OF TIME



GRAPH: 2 MEAN SBP AT DIFFERENT INTERVAL OF TIME



GRAPH: 3 MEAN DBP AT DIFFERENT TIME INTERVAL



DISCUSSION

Laryngoscopy and endotracheal intubation are stressful noxious stimuli which results in marked increase in release of sympathetic amines like adrenalin and noradrenalin by stimulating tracheal and laryngeal sensory receptor. This increase in sympathetic amines associated with perioperative hemodynamic instabilities like hypertension, cardiac arrhythmia, and tachycardia.[3,4,5] In addition, sudden hemodynamic changes may lead to serious complications, especially in patients with co morbid diseases like hypertension.[3,4,7,8] Many agents have been used to attenuate sympathetic stimulation to decrease the incidences of perioperative complications like α adrenergic blockers, vasodilators, calcium channel blockers, sodium channel blocker, nerve blocks and inhaled anesthetics.[6,7,8] These drugs effectively attenuate hemodynamic responses butthey have no role for induction and maintenance of anesthesia and cause dangerous complications.[10] These hemodynamic responses to intubation were controlled effectively in our patients by using two drugs fentanyl and morphine. Narcotics are very commonly used for intraoperative analgesia, therefore there is no additional cost involved. Narcotics have advantage of having perioperative role in anesthesia. They can be used as sole or supplementary agent for induction of anesthesia.

Fentanyl is available in our country since 1988 and has various advantages like rapid onset, short duration of action, cardio stability, no histamine release, and no bronchospasm. Fentanyl on mg basis is about 80 times more potent than morphine.[11] Fentanyl and morphine were given 5 minutes before intubation which is an optimum time to administer these drugs to protect circulatory responses to laryngoscopy and endotracheal intubation. Ko SH [12] et al had studied 2 mcg/kg of fentanyl given at different time interval before intubation and they found fentanyl given 5 minutes before intubation provides good cardiovascular control. So similarly we have done intubation 5 minutes after injection of study drugs.

Hoda MQ et al[6] in his study compared intravenous morphine sulphate 0.15 mg/kg with tramadol 2 mg/kg and they found that morphine is better drug with this dose as compared to tramadol (maximum increase in HR was 11.86%, SBP was none, DBP was 2.46%, MBP was 1.96% in morphine group while maximum rise in HR was 28.92%, SBP was 8.06%, DBP was 3.31%, MBP was 4.16% in tramadol group following laryngoscopy and intubation) which was statistically significant (P value <0.05). Bharat Chaudhry et al[13] in his study used two different doses of fentanyl citrate 2 mcg/kg and 4 mcg/kg in attenuation of pressure response to laryngoscopy and intubation and they concluded that fentanyl citrate 4 mcg/kg IV completely attenuate pressure response which is comparable with our study. Neha Sharma et al[10] in his study compared fentanyl 2 mcg/kg intravenous and nalbuphine 0.2 mg/kg IV for pressure attenuation and they found that fentanyl group had 12.5% increase in heart rate and nalbuphine group had 13.6% during intubation which is almost equal. Maximum rise in SBP and DBP in nalbuphin was 14.9%and 8.9% respectively while it was 4.8% and 4.5% respectevly in fentanyl group. So fentanyl significantly reduces blood pressure as compared to nalbuphine which is comparable with our study. Bharat Chaudhary et al[11] in his study did not see any severe complications like respiratory depression with 4 mcg/kg dose of fentanyl citrate which is identical to our study. Deborah et al[13] in his study observed pharmacokinetic of fentanyl citrate in dose of 3.2 to 6.4 mcg/kg and they observed prolonged and recurrent respiratory depression in three patients out of seven patients. In our study with dose of 4 mcg/kg of fentanyl citrate no respiratory depression was found. We observed bradycardia in three patients and hypotension in two patients. Thompson et al[14] in his study compared respiratory depression with morphine and morphine 6 glucuronide and they found that morphine in dose 10 mg per 70 kg patients was associated with respiratory depression. In our study we use 0.15 mg/kg dose of morphine sulphate which is identical with above study but we do not observed respiratory depression in our study. Hoda MQ et al[6] in his study did not seen any severe complications like respiratory depression with 0.15 mg/kg dose of morphine sulphate which is identical to our study.

Mean duration of surgery in fentanyl group of patients is 4.04 hours and in morphine group of patients is 4 hours might be the reason of absent of such complications.

CONCLUSION

Fentanyl citrate is more effective than *morphine* sulphate in attenuation of pressure response following direct laryngoscopy and endotracheal intubation during general anesthesia. Both these drugs with intravenous route of administration were simple, easy and safe for attenuation of pressure response without any serious complications.

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COMPARISON OF EFFECT OF LARYNGEAL MASK AIRWAY AND ENDOTRACHEAL TUBE ON PULMONARY FUNCTIONS IN EARLY POST -OPERATIVE PERIOD IN PATIENTS UNDERGOING MODIFIED RADICAL MASTECTOMY.

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Abstract

General anaesthesia has been associated with a significant decrease in pulmonary function during post-operative period. Our objective was to compare the effect of laryngeal mask airway (LMA) and endotracheal tube (ETT) on pulmonary function in early post- operative period when used for airway management for general anaesthesia.

Method: Forty patients of ASA grade I and II were randomly divided in group L and group T to receive either LMA or ETT for airway management. Pulmonary functions test (PFT) were recorded 24 hours pre-operatively (baseline), at 30 and 60 minutes after removal of airway device. Forced vital capacity (FVC), forced expiratory volume at first second (FEV_1), ratio of FEV_1/FVC, peak expiratory flow rate (PEFR) and SpO_2% were compared. Incidence of laryngospasm , coughing, hoarseness, nausea and vomiting were recorded.

Results: Pulmonary functions decreased significantly from baseline value in both groups at 30 and 60 minutes post operatively. Decrease in

PFT in group T was significantly greater than that in group L at all time intervals. The FEV_1/FVC ratio remain unchanged . There was no incidence of aspiration or laryngospasm in any group. The incidence of coughing, hoarseness, and sore throat was higher in group T but it was not significant.

Conclusion: Airway management with LMA causes less decrease in pulmonary function during early post operative period for general anaesthesia for peripheral surgery as compared to ETT. The incidence of coughing and sore throat were also less with LMA. LMA is better choice for airway management in peripheral surgeries.

Key Words: Laryngeal mask airway, endotracheal tube , pulmonary functions

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Introduction

General anaesthesia is associated with decrease in pulmonary functions during early post-operative period. There are many factors like obesity, abdominal surgery, postoperative pain contributing to decrease in pulmonary functions and hypoxemia.[1]Muscle relaxation and mechanical ventilation lead to atelectasis.[2,3] Airway intervention by any devices like laryngeal mask airway (LMA) or endotracheal tube(ETT)increases pulmonary airway resistance. Tracheal intervention by ETT causes more bronchoconstriction than LMA in anaesthetised patients.[4]With ETT complete airway control, positive end expiratory pressure and vital capacity manoeuvres can easily be applied to prevent atelectasis.[5] But airway irritation and effect of muscle relaxation become disadvantageous. LMA does not interface with larynx and muscle relaxation is not necessary which maintains diaphragmatic tonicity and help in prevention of lung collapse.[2] Studies conducted on LMA showed benefits like easy insertion avoidance of laryngoscopy, less harm to larynx and vocal cords.[6,7] Despite all these advantages LMA has restriction for wide acceptance because of controversy over gastric complications .

AIM

We compared the effect of airway management by LMA or ETT on pulmonary functions and incidence of coughing, sore throat, nausea and vomiting in early post-operative period after general anaesthesia in patients undergoing modified radical mastectomy (MRM).

Method

After obtaining institutional ethical committee approval we conducted the study on forty female patients aged between 18-60 years and with ASA grade I or II undergoing modified radical mastectomy. Patients having history of asthma or COPD, difficult airway, body mass index >30kg/m^2, history of motion sickness or hiatus hernia were excluded from the study.

Informed consent was taken. Preanaesthesia check up with routine investigations including x-ray chest and electrocardiogram was carried out. Patients were randomly divided in to two groups. Airway management was done with LMA in Group L and with ETT in Group T. Anaesthesiologist performing pulmonary functions test (PFT) was blinded to the study groups. PFT was done in all patients preoperatively and at every stage by same anaesthesiologist in supine position with 30degree head up tilt. Three trials of PFT were done and the one with best result was selected. Forced vital capacity (FVC), Forced expiratory volume in the first second of expiration (FEV_1), ratio of FEV_1/FVC, peak expiratory flow rate (PEFR), percentage saturation of oxygenated haemoglobin (SpO_2%) were recorded.

After applying routine monitor for SpO_2%, ECG, non-invasive blood pressure (NIBP), anaesthesia was induced with IV fentanyl HCL 2µg/kg, glycopyrolate 0.004 mg/ kg, propofol 2 mg/ kg. Rocuronium bromide 0.6mg/kg IV was given to facilitate muscle relaxation as single dose. No further dose of muscle relaxant was given.

LMAof size 3 was inserted in group L patients and cuff was inflated with 25 -30 ml of air . Absence of audible leak from the drain tube with peak airway pressure 20 cm H_2O or grater was confirmed. Presence of leak was considered significant and corrected accordingly with readjustment of LMA or inflating more air in the cuff. Cuff pressure was not measured as we had no facility for that. Endotracheal Cuff tube of 7 mm or7.5 mm size was inserted in Group T patients and cuff was inflated with 4-8 ml of air.

All the patients were ventilated with volume controlled ventilation with tidal volume 8 ml / kg,

rate 12/min, inspiratory: expiratory (I:E) ratio of 1:2 and maximum peak pressure set to 25 cm of H_2O. End tidal carbon dioxide pressure ($EtCO_2$) was maintained at 25-35 mm of Hg. SpO_2%, NIBP, heart rate and ECG were monitored during intra operative and post-operative period.

Intra operative anaesthesia was maintained with oxygen, nitrous oxide and sevoflurane with FiO_2 0.5. All patients received intravenous diclofenac sodium 75mg and ondansetron 8mg slowly 30 minutes before anticipated completion of surgery. Sevoflurane was discontinued 3 minutes before completion of surgery. All patients were reversed from neuromuscular block with IV glycopyrolate and neostigmine 0.05 mg/kg after giving 100% oxygen for 5 minutes. When the patients were fully awake and spontaneously breathing LMA or ETT was removed in head up position after proper oral suctioning . Patients were shifted to the recovery ward on room air . Patients were kept in head up position with oxygen at $FiO_2$0.2. Patients were assessed using the fast track score (>10).[8]Post-operative visual analogue score (VAS) was kept at

Results

Demographic data of patients of both groups were comparable as shown in Table 1. The mean duration of surgery was 95.25±11.5 min (mean±SD) in group L and 97.45±11.2min (mean±SD) in group T. Preoperative pulmonary functions were comparable in both the groups (Table-2). Insertion success rate for LMA was 90%. In 18 patients LMA was successfully inserted at first attempt whereas in two patients it was readjusted. Laryngoscopy was not required in any patient. All patients met fast track score >10 within 15-20 minutes in recovery ward. Comparison of PFT at 30 minutes after recovery from anaesthesia showed significant decrease in both groups, except FEV_1/FVC. The decrease was significantly less in group L (Table 2,3,4). PFT at 60 minutes after recovery from anaesthesia also showed significant decrease in both groups (Table 2,3,4), except FEV_1/FVC . PFT at 60 minutes after recovery showed improvement and % deficit was of lesser extent in both groups (Figure-1). Laryngeal spasm or bronchospasm did not occur in any patients in any group. Preoperative saturation(SpO_2%) was normal and similar in both groups (Table-1). Oxygen saturation decreased more in group T at 30 minutes and 60 minutes after recovery from anesthesia than group L (Figure -2, Table-2,3,4).

Table 1 : Comparison of demographic data between group L and group T.

Variable	Group L	Group T	*P* value
Age(years)	32.75±9.11	32.75±7.40	1
No of patients	20	20	1
Weight (kg)	61.86±6.82	60.55±6.77	0.54
Height(cm)	163±7.20	160±7.06	0.19
Mean duration of surgery(min)	95.25±11.5	97.45±11.2	0.54

Data presented asmean±SD , SD =standard deviation p>0.05 not significant.

Table 2 : Preoperative Pulmonary function test

PFT	Group L mean±SD	Group T mean±SD	*P* VALUE
FVC(L)	2.90±0.90	2.98+1.1	0.8026
FEV_1(L)	2.46±0.50	2.54±0.80	0.7066
FEV_1/FVC(%)	0.85±0.03	0.85±0.05	0.7035
PEFR(L/SEC)	5.41±1.9	5.71±1.6	0.5923
SpO2(%)	98.05±0.36	97.90±0.41	0.2265

Data are presented as mean± SD. SD=standard deviation. Group L= Laryngeal mask airway group, Group T =Tracheal tube group, PFT=Pulmonary function test, FVC= Forced vital capacity, FEV_1= Forced expiratory volume at first second, PEFR-Peak expiratory flow rate, SpO_2 =Peripheral saturation of oxygen.

Table : 3 Comparison of PFT in group L

PFT	PRE OPERATIVE	POST OPERATIVE					
		30 MIN			60 MIN		
	mean±SD	mean±SD	Deficit %	*P* value	mean±SD	Deficit %	*P* Value
FVC [L]	2.90±0.90	2.23±0.28	23%	0.0029	2.41±0.32	16.8%	0.0274
FEV_1 (L)	2.46±0.50	1.84±0.28	25.2%	0.0001	2.00±0.46	18%	0.0044
FEV_1/ FVC(%)	0.85±0.03	0.82±0.06	3.52%	0.0527	0.83±0.04	2.35%	0.0816
PEFR (L/SEC)	5.41±1.9	3.0±0.6	44%	0.0001	3.5±0.8	35%	0.0002
SpO_2 (%)	98.05±0.3	96.3±2.60	1.78%	0.0050	97.10+2.3	0.96%	0.0759

Data are presented as mean± SD. SD=standard deviation. . Group L= laryngeal mask airway group, PFT= Pulmonary function test ,FVC=Forced vital capacity, FEV_1=Forced expiratory volume at first second PEFR= Peak expiratory flow rate, SpO_2 =Peripheral saturation of oxygen.

Table : 4 Comparison of PFT in group T

	PRE OPERATIVE	POST OPERATIVE					
		30MIN			60MIN		
PFT	mean±SD	mean± SD	Deficit %	*P* value	mean±SD	Deficit %	*P* Value
FVC(L)	2.98±1.1	1.97±0.36	33.8%	0.0004	2.23±0.20	25.16%	0.0047
FEV_1(L)	2.54±0.80	1.56±0.22	38.5%	0.0001	1.75±0.30	31.1%	0.0280
FEV_1/ FVC(%)	0.85±0.05	0.80±0.02	5.88%	0.0650	0.82±0.04	3.52%	0.0889
PEFR (L/SEC)	5.71±1.6	2.58±0.7	54.81%	0.0001	2.98±0.8	47.8%	0.0491
SpO_2(%)	97.90±0.41	93.8±2.9	4.18%	0.0001	94.75±2.6	3.21%	0.05

Data are presented as mean± SD. SD=standard deviation. . Group T =Tracheal tube group, PFT= Pulmonary function test, FVC=Forced vital capacity, FEV_1=Forced expiratory volume at first second PEFR=Peak expiratory flow rate, SpO_2 =Peripheral saturation of oxygen.

Table : 5 Incidence of complications

Variables	Group L (No of pt.)	Group T (No of pt)
Coughing	0	1
Sore throat	0	2
Nausea	1	0
vomiting	0	1

Figure:1 Postoperative pulmonary functions - difference from pre-operative baseline (in % deficit)

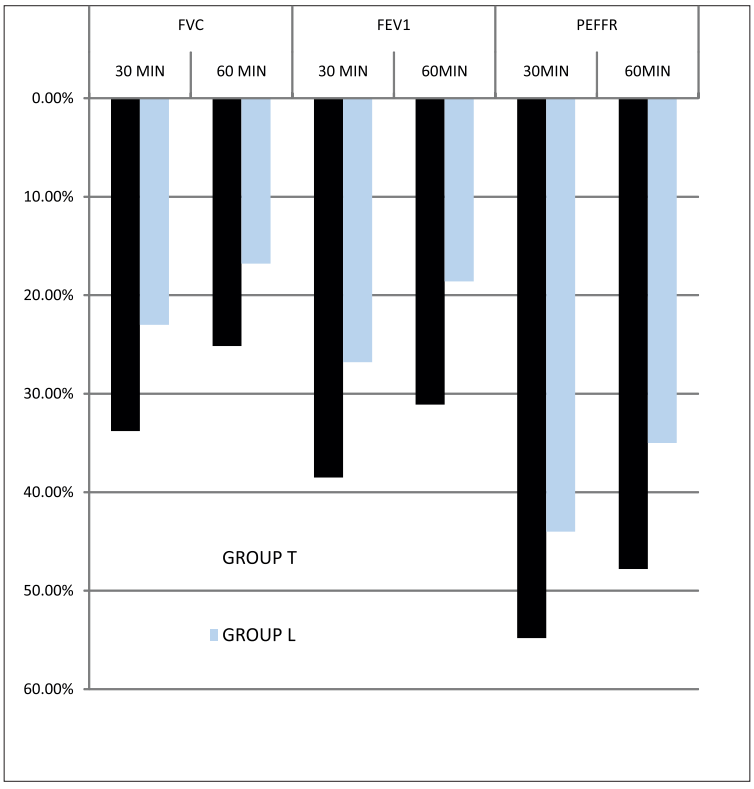
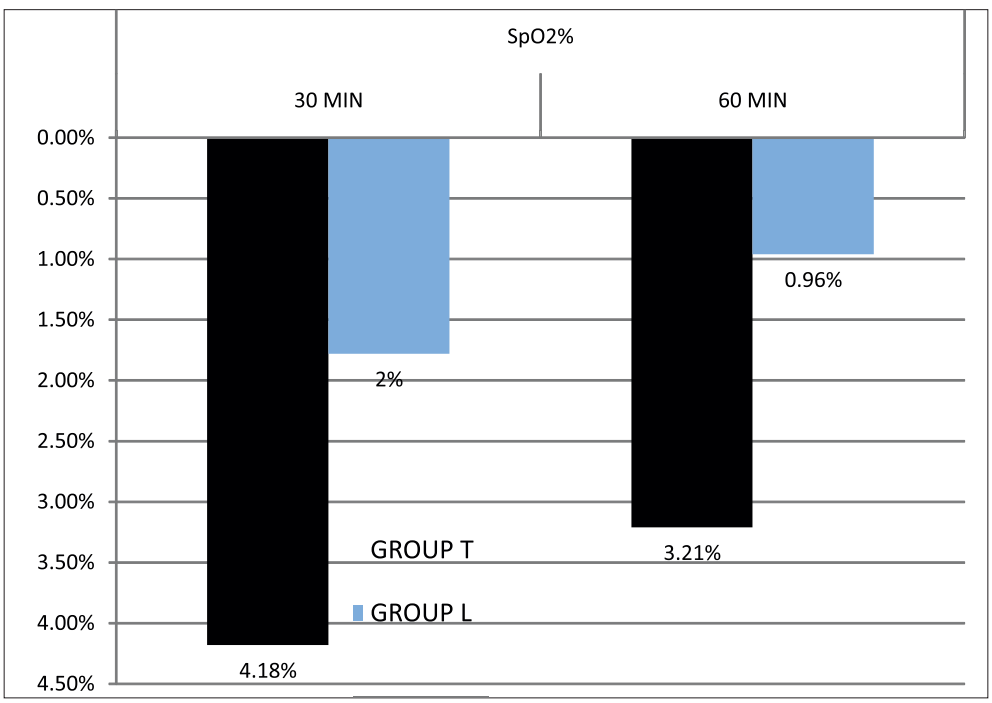


Figure: 2 Postoperative oxygen saturation difference from preoperative baseline (in%deficit)



Discussion

The results of our study showed that postoperative PFT value decreased at lesser extent in LMA group as shown in Figure 1 and Figure 2. This may be because LMA produces less bronchoconstriction because of the lack of direct tracheal stimulation as it covers the laryngeal inlet and actual contact is minimal.[4,9]

The study by Kim, Eun S and et al showed reversible component of respiratory system resistance after ETT but not after LMA and concluded that LMA is a better choice for airway management to minimize airway reaction.[10] A study by Rooked GA et al with various inhalation agents to study bronchodilating effects had found lack of any change in respiratory system resistance after 10 minutes of 1 MAC (minimum alveolar concentration) Isoflurane anesthesia in LMA group and suggested that LMA produces relatively little reversible bronchoconstriction.[11]

The reflex response occurs as sympathetic stimulation as well as by airway irritation. A study in children with upper respiratory tract infection revealed bronchospasm was common after ETT placement but did not occur after LMA placement.[12] Pulmonary airway resistance increased regardless of LMA or ETT insertion however increase in resistance was lower with LMA in a study by Berry Alison [4] et al on peak airway pressure and mean airway resistance (device resistance plus pulmonary airway resistance) at three different tidal volumes (5,10 and15 ml/kg). They found peak airway pressure, mean airway resistance, device resistance and pulmonary airway resistance were greater for ETT. Pulmonary airway resistance for LMA includes glottic resistance suggests that the difference in subglottic component of pulmonary airway resistance is even greater between the devices. They concluded that LMA triggers less bronchoconstriction than does ETT in paralysed and anaesthetized patient. This may maintain pulmonary function and reduces the risk of atelectasis and pulmonary infection.[4]In contrast to this a study by Boisson Bertrand et al found that pulmonary airway resistance was similar between the LMA and ETT groups.[13]

We focused on the immediate post-operative period when lung volumes could be most severely affected because most pulmonary complications occurs in the immediate postoperative period. Our results showed FEV_1/FVC did not alter significantly at any stage in any group. This may be because FVC and FEV_1 both decreased and thereby ratio remained same. Similarly Sharma R, Dua CK found unaltered FEV_1/FVC ratio in their study.[14] Similar to our study decrease in VC, FVC, FEV_1, and PEFR followed the same trend and FEV_1/FVC ratio did not changed in a study by B.S.VonUngern-Sternberg et al on effects of obesity and site of surgery on perioperative lung volumes.[1] They concluded that the resistance decreased rapidly only in patients with ETT after they received isoflurane,a potent bronchodilator suggesting that reversible bronchodilatationwas present in patients with ETT but not in those with LMA.Similarlyin a study inspiratory and expiratory lung function test and oxygen saturation were found significantly reduced and remained reduced on the 1st day after surgery up to 25% of baseline value. Lung function and oxygen saturation were significantly better in LMA group at all stages.[2]Similar to this study we found fall in $SpO_{2\%}$ in both groups. It recovered at 60 min in group L up to 97%, however recovery was at lesser extent in group T(Figure -2).

Endotracheal intubation causes greater airway irritation with subsequent tissue oedema which could mimic obstructive lung disease. In our study surgical time did not exceed 120 minutes and the cuff was not inflated more than just to prevent audible leak.

Some patients receiving intraoperative muscle relaxants may have residual neuromuscular block afterextubation which may affect the reliability of the study.To eliminate this possibility the minimum surgery time was kept 40 minute and no additional dose of muscle relaxant was given and rocuronium bromide was chosen as neuromuscular blocking agent.

Ourfindings indicate that airway management has major impact on post-operative lung volume. The decrease inspiratory capacity might affect the ability to cough effectively and predispose to respiratory complications. Significant depression of PFT was found in both groups at 30 minutes and 60 minutes after removal of device. The decrease was significantly lower in LMA group(L).In an another study 37% decrease in mucociliary clearance was found after one hour with cuffed TT, but no change was seen with an uncuffed TT. [15] A study with new TT with a no pressure seal kept at glottis did not affect mucociliary clearance after 3 hour of intubation, but it decrease up to 67% with standard TT. [16] These studies implies that LMA decreases mucociliary clearance less than TT in anesthetized patient which may reduce the risk of retention of secretion, atelectasis, and pulmonary infection leading to decrease pulmonary function in post-operative period.[14]

In our study we found high rate(90%) of insertion success for LMA. Similar to our study in a study of 100 cases of laparoscopic surgery found 80% insertion success rate for LMA at first attempt. In their study excessive secretions were noted in 18 patients, leak in 13 patients and blood staining on the cuff following removal in 9 patients bronchospasm was seen in 5 patients , Sore throat was reported in 3 patients and tongue lip dental trauma was noted in 4 patients. [17]

Complications with LMA insertion related to vomiting, aspiration, sore throat,coughing vocal cord paralysis and acute epiglotitis are reported. [18] We did not observed these side effects in our study. Similar to this.[2] M.Zorendra did not observed any difference in major adverse events between the groups. As there is no need of laryngoscopy LMA causes lesser hemodynamic response to insertion. The device does not pass the larynx so it decreases laryngeal complications and sore throat.[19] Inconsistent with this in our study we found coughing and sore throatat lesser extent in group L as compared to group T. Maltby et al reported that LMA and proseal LMA provided effective pulmonary ventilation without clinically significant gastric distension in their patients.[20] Coughing was at much lesser extent as compare to ETT.[21] These studies suggest that LMA insertion is not difficult andis associated with less coughing and sore throat.

Limitation of our study is small sample size.In spite of this our study results show pulmonary function preservation with LMA over ET tube.

CONCLUSION

LMA is a better alternative for airway management for general anesthesia in patients undergoing peripheral surgery. Airway management for general anesthesia with LMA causes less decrease in pulmonary function during early postoperative period as compared to ETT .The incidence of coughing and sore throat is also significantly lower with LMA.

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BOOK REVIEW

ANAESTHESIA AND ALLIED SCIENCES FOR PARAMEDICS,2013,first edition

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The editor of this book, Dr Manpreet Singh is involved in teaching the students of BSc Medical Technology and Operation Theatre, Trauma Technician courses, MBBS and MD (Anaesthesiology and Intensive care) at Government Medical College, Chandigarh ,India.

'ANAESTHESIA AND ALLIED SCIENCES FOR PARAMEDICS' is first book of its kind and comprises of six sections. All sections are colour coded for easy identification.

Section one consists of anatomy, physiology and clinical biochemistry for paramedics. Details of all muscles, bones and joints along with their actions, nerves and vessels are compiled in a tabular form so that it can be easily learnt and recapitulated by students. Essential physiology and clinical biochemistry are concised subsections of this section.

Second section provides every detail about anaesthesia and its various sub-specialities. This section has 40 chapters i.e from history of anaesthesia till modular operation theatre suit details. Apart from basics of anaesthesia and sub-specialities of anaesthesia, it highlights operation theatre suit, air-conditioning of Operation theatre and ICU, sterilization, pain management, dialysis room management and transportation of patients and anaesthesiologists.

Third section, 'Pharmacology in Anaesthesia' describes intricacies of all anaesthetic drugs and emergency drugs. These drugs are described in tabular forms in easy language. This section will help the students to explain the drugs that are asked in table viva during examination.

Section four covers all the anaesthesia instruments. These includes anaesthesia machine , automated external defibrillator, sutures, vaporizers and all airway management equipments. The details of instruments will be very beneficial for the students during training periods, examination, table viva and day-to-day practice.

Fifth section provides knowledge of 32 unique topics of modern anaesthetic practices that requires utmost attention. It highlights brief knowledge about clinical audit, hospital waste management, ECG, EMG, cardiopulmonary resuscitation 2010 guidelines, intensive care topics and physics in anaesthesia.

The final section 6, highlights all the scoring systems, algorithms and grading in anaesthesia. The students will be elated to read this section as they will feel comfortable to find all gradings at one place.

This book will be extremely useful to all residents of anaesthesiology and paramedics i.e MSc. Operation Theatre, BSc Medical Technology students, operation theatre technicians nurses, physiotherapists and trauma technicians. I assure that the student will not move away from this comprehensive book that will be useful in all types of examinations, skill development and knowledge augmentation.

The book is a sincere tribute to my father who had this dream for me. I am fortunate enough to have blessings from Almighty, my teachers and parents. All the contributors of this book have provided me a great support and deserve my heartfelt gratitude.

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