



INDIA

ASIAN ARCHIVES OF ANAESTHESIOLOGY AND RESUSCITATION

Founder Editor
(Late) Prof. N.P. Singh

Editor-in-chief
Dir. Prof. U.C. Verma

Co-Editors
Dir. Prof. Baljit Singh
Dir. Prof. R.S. Rautela
Dr. Manpreet Singh

Indexed in: MedIndia, Indian Citation Index, HUG-Services
d'anesthesiologie, World cat, Research bible, OpenMed, Indian Medical Journals

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, Psychology and other Special topics

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

ANAESTHESIA AND ALLIED SCIENCES FOR PARAMEDICS is textbook for paramedical students. The author is an expert in anatomy, physiology and biochemistry. The book is a complete text which includes all the topics of anatomy, physiology and biochemistry. The book is a complete text which includes all the topics of anatomy, physiology and biochemistry.

The book is a complete text which includes all the topics of anatomy, physiology and biochemistry. The book is a complete text which includes all the topics of anatomy, physiology and biochemistry.

The book is a complete text which includes all the topics of anatomy, physiology and biochemistry. The book is a complete text which includes all the topics of anatomy, physiology and biochemistry.

The book is a complete text which includes all the topics of anatomy, physiology and biochemistry. The book is a complete text which includes all the topics of anatomy, physiology and biochemistry.

The book is a complete text which includes all the topics of anatomy, physiology and biochemistry. The book is a complete text which includes all the topics of anatomy, physiology and biochemistry.

The book is a complete text which includes all the topics of anatomy, physiology and biochemistry. The book is a complete text which includes all the topics of anatomy, physiology and biochemistry.

The book is a complete text which includes all the topics of anatomy, physiology and biochemistry. The book is a complete text which includes all the topics of anatomy, physiology and biochemistry.

The book is a complete text which includes all the topics of anatomy, physiology and biochemistry. The book is a complete text which includes all the topics of anatomy, physiology and biochemistry.

About the Editor

Dr. Manpreet Singh is a graduate and postgraduate from Jawahar Education Society's Medical College, Amritsar. He worked at Government College Hospital, Amritsar and at Government Medical College, Amritsar. He is a member of the Indian Medical Association, Amritsar. He is a member of the Indian Medical Association, Amritsar. He is a member of the Indian Medical Association, Amritsar.



The book is a complete text which includes all the topics of anatomy, physiology and biochemistry. The book is a complete text which includes all the topics of anatomy, physiology and biochemistry.

The book is a complete text which includes all the topics of anatomy, physiology and biochemistry. The book is a complete text which includes all the topics of anatomy, physiology and biochemistry.

The book is a complete text which includes all the topics of anatomy, physiology and biochemistry. The book is a complete text which includes all the topics of anatomy, physiology and biochemistry.

The book is a complete text which includes all the topics of anatomy, physiology and biochemistry. The book is a complete text which includes all the topics of anatomy, physiology and biochemistry.

The book is a complete text which includes all the topics of anatomy, physiology and biochemistry. The book is a complete text which includes all the topics of anatomy, physiology and biochemistry.

The book is a complete text which includes all the topics of anatomy, physiology and biochemistry. The book is a complete text which includes all the topics of anatomy, physiology and biochemistry.

The book is a complete text which includes all the topics of anatomy, physiology and biochemistry. The book is a complete text which includes all the topics of anatomy, physiology and biochemistry.

The book is a complete text which includes all the topics of anatomy, physiology and biochemistry. The book is a complete text which includes all the topics of anatomy, physiology and biochemistry.

The book is a complete text which includes all the topics of anatomy, physiology and biochemistry. The book is a complete text which includes all the topics of anatomy, physiology and biochemistry.



S.R. Health Sciences Pvt. Ltd.
452611-A, T1, Daryaganj, New Delhi-110002, India
Phone: +91-11-23071932, 23052855
Fax: +91-11-42202024, Email: info@srhealth.in

ISBN-978-81-930464-1-1



9 78819304 641111

ANAESTHESIA & ALLIED SCIENCES FOR PARAMEDICS

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

**MANPREET
SINGH**



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

MANPREET SINGH

ANAESTHESIA & ALLIED SCIENCES FOR PARAMEDICS

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

Asian Archives of Anaesthesiology and Resuscitation

1971-2017

The Official Journal of "Anaesthesiology and Resuscitation Research Forum"

Volume 84 No. 1,2

July-Dec. 2017

CONTENTS

1	THE TALE OF AN ACCIDENTAL BULLET INJURY:LUCKY ESCAPE FOR AN OTHERWISE UNLUCKY CHILD	2560
	<i>Summit dev bloria, Vipin Garg, Ankur Luthra, Pallavi bloria, Ketan Kataria</i>	
2	TITLE OF THE ARTICLE: THE EFFECT OF POSITIVE END EXPIRATORY PRESSURE (PEEP) ON INTRAOCULAR PRESSURE (IOP) IN POSTSURGICAL MECHANICALLY VENTILATED PATIENTS	2562
	<i>Abu Nadeem, Rahul Gupta, Syed Moied Ahmed, Muazzam Hassan</i>	
3	EVALUATION OF THE EFFICACY OF DIFFERENT CONCENTRATIONS OF LEVOBUPIVACAINE WITH DEXMEDETOMIDINE FOR ULTRASOUND GUIDED SUPRACLAVICULAR BRACHIAL PLEXUS BLOCK.	2574
	<i>Farah Nasreen,Shoaib Parvez, Hammad Usmani, Nazia Tauheed</i>	
4	USE OF KETAMINE HYDROCHLORIDE NEBULISATION FOR ATTENUATION OF POST-OPERATIVE SORE THROAT	2584
	<i>Bhavna c patel, Jayshree Thakkar, Gaurav Malviya, Janak Bhalani, Twinkle Patel, Bipin Patel</i>	
5	USE OF TRANEXAMIC ACID TO REDUCE INTRAOPERATIVE BLEEDING IN CRANIOTOMY FOR MENINGIOMA PATIENTS	2594
	<i>AhsanKhaliq Siddiqui, Rajesh Raman, Zia Arshad, Hemlata, Satish Varma, Ahmad Suhaeb Hashmi</i>	
6	PREOPERATIVE HYPOGLYCAEMIA UNAWARENESS (HU) IN TYPE-2 DIABETES MELLITUS: A CASE REPORT	2604
	<i>Lakesh Anand, Manpreet Singh, Jasveer Singh, Dheeraj Kapoor</i>	
7	USE OF LEFT MOLAR APPROACH TO LARYNGOSCOPY IN AN ADULT PATIENT WITH AN UNANTICIPATED DIFFICULT AIRWAY: A CASE REPORT.	2610
	<i>Nishkarsh Gupta, Rohini Dattatri, Sachidanand Jee Bharti and Dr Anju Gupta</i>	
8	GUIDELINES TO CONTRIBUTORS	2613

Published and Printed by Dir. Prof. U.C.Verma on behalf of 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

Mobile No.: 09646121503, 09868399699 E-mail : aaarjournal@gmail.com

Typeset and Printed at Creative Offset Press, 131 Patperganj Industrial Area, Delhi -110092, Ph : 9136434848

ASIAN ARCHIVES OF ANAESTHESIOLOGY AND RESUSCITATION

EDITORIAL BOARD

Editor-in-chief

Dir. Prof. U.C. Verma

Founder Member

(Late) Prof. W.E. Sporel

(Late) Prof. N.P. Singh

(Late) Prof. S.D. Gupta

Co-Editors

Dir. Prof. Baljit Singh

Dir. Prof. R.S. Rautela

Dr. Manpreet Singh

Executive Director

Dr. Yashwant Singh

MEMBERS (FOREIGN)

1. Dr. T.C.K. Brown

Dept. of Anaesthesia
Royal Childrens' Hospital
Melbourne 3502 (Australia)

2. Dr. Rashid M. Khan

Sr. Consultant,
Khoula Hospital, Muscat
OMAN

3. Dr. Michael J.A. Parr

MBBS, MRCP, FRCA, FANZCA
Specialist in Intensive Care,
Liverpool Hospital.
Lecturer in Intensive Care,
Anaesth and Emergency Medicine
Intensive & Critical Care Medicine

-
- | | |
|--|-------------------------------------|
| 1. Prof. (Dir.) Rajiv Chawla, New Delhi | 11. Prof. Shahjahan Bano, Aligarh |
| 2. Prof. (Dir.) Deepak K. Tempe, New Delhi | 12. Prof. Lalit Maini, New Delhi |
| 3. Dr. S.C. Parakh, Hyderabad | 13. Prof. A.M. Hashia, Solan |
| 4. Dr. Pramod Kumar, Jam Nagar | 14. Prof. Mridula Pawar, New Delhi |
| 5. Prof. Dilip Pawar, New Delhi | 15. Dr. Sunila Sharma, New Delhi |
| 6. Dr. V.P. Kumra, New Delhi | 16. Prof. S.M. Ahmad, Aligarh |
| 7. Dr. S.C. Manchanda, New Delhi | 17. Dr. Dheeraj Kapoor, Chandigarh |
| 8. Dr. (Col.) S.K. Chadha, New Delhi | 18. Prof. Lakesh Anand, Chandigarh |
| 9. Prof. L.D. Mishra, Varanasi | 19. Dr. Deepak Thapa, Chandigarh |
| 10. Prof. H.C. Chandola, Allahabad | 20. Prof. S.K. Malhotra, Chandigarh |

*Correspond : 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
E-mail: aaarjournal@gmail.com*



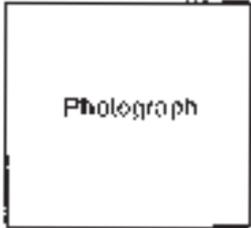
National Association of Critical Care Medicine (India)
 (Affiliated to the world Federation of Societies of Intensive & Critical Care Medicine)



President - Dir. Prof. U.C. Verma
 Vice President - Dir. Prof. Baljit Singh
 G. Secretary - Dr. Manpreet Singh
 Jt. Secretary - Dir. Prof. R.S. Rautela
 Treasurer - Dr. Yashwant Singh

Office Address:
 306- 309, DEPARTMENT OF
 ANAESTHESIA 3RD FLOOR,
 BL TANEJA BLOCK
 MAMC and LN HOSPITAL,
 NEW DELHI, INDIA
 naccm2007@gmail.com
 www.aarnaccm.com

LIFE MEMBERSHIP FORM



Photograph

Dear Sir

I wish to become a member of National Association of Critical Care Medicine and my particulars are as follows

Name (Capital Letters)

Date of Birth

Under Graduation ... (University/College)

Post Graduation ... (University/College)

Official Address

Correspondence Address

Ph No (R) Mobile email.....

Permanent Address:

I am enclosing here with bank draft/cheque* for Rs. 2500/- (Two thousand five hundred only) towards my Registration for Life Membership of National Association of Critical Care Medicine

I would abide by the constitution of National Association of Critical Care Medicine

* Rs. 155/- to be added if payment is through outstation cheque

Cheque/Draft should be sent in favour of National Association of Critical Care Medicine, payable at New Delhi

Cheque/Cash..... Cheque No Date Amount

Dated.. Signature

Please send all the correspondence at the above mentioned address for which I would acknowledge the receipt
 National Association of Critical Care Medicine, Registered Society under Act XXI of 1980 Regd. No. 10874 Affiliated with
 World Federation of Societies of Intensive & Critical Care Medicine

Exempted from Income Tax under Section 35 of Income Tax Act 1961 vide letter No. 1231 (F.N. DG/IT/E/ND/-81/35 (i), (22)/90-IT (E) of 26-10-94 from Dept. of Revenue, Min. of Finance, Govt. of India (1.4.93-31.396)

THE TALE OF AN ACCIDENTAL BULLET INJURY: LUCKY ESCAPE FOR AN OTHERWISE UNLUCKY CHILD

Summit dev bloria¹, Vipran Garg¹, Ankur Luthra¹, Pallavi bloria², Ketan Kataria¹

ABSTRACT

Bullet injuries are dangerous and can lead to mortality. We report an anaesthetic management of a 10 year old female child who accidentally suffered from penetrating brain trauma due to a bullet injury and was subsequently operated for the removal of same.

Keywords: Bullet injury; penetrating injury

INTRODUCTION

The use of fire arms can lead to severe injuries and can lead to death. The harm caused by a bullet depends on a multitude of factors, including the path travelled by the bullet, velocity of bullet when it came in contact with the person and the damage caused by it to the tissues it travelled through. A bullet injury to head is in most cases severe and can cause instant death.

CASE REPORT

We report the anaesthetic management of a 10 year old female child who accidentally suffered from penetrating brain trauma due to a bullet injury and was subsequently operated for the removal of same.

The patient was playing near her house in afternoon when she felt sudden pain in head, severe in intensity along with minimal bleeding from scalp on left side. There were no episodes of loss of consciousness, vomiting, seizures or any other neurological deficit in the child. The parents of the child took her to a nearby hospital where she was advised an x-ray and CT scan of head to determine the cause of bleed and to rule out any intracranial pathology. The CT scan and x-ray (Figure 1) to the surprise of everyone demonstrated presence of foreign body (bullet) in left occipital lobe. The bullet was most probably fired in air and had entered the brain of child on its way down to earth while she was playing in open. She was referred to our institution where it was decided upon to operate on the patient.

Detailed preanesthetic checkup was done. She was conscious and oriented to time, place and person. There were no neurological deficits or any other positive neurological findings.

The patient was shifted to OT and multipara

Authors

1 – Department of Anaesthesia, PGIMER, Chandigarh

2 – Department of Anaesthesia, Government Medical College, Jammu

Address of Correspondence

Dr Summit DevBloria, 3245/15D, Chandigarh, India- 160015

E-mail : summitbloria13@gmail.com, Phone - +91-7508984022

monitors were applied. The patient was induced with Inj Fentanyl 40 mcg iv, Inj Propofol 50 mg iv and Inj Atracurium 10 mg iv. She was intubated with a cuffed 5.5 mm ID endotracheal tube and surgery was started.

During the surgery, the surgeons found a small gap in parietal bone large enough for a small bullet to pass and also the duramater underneath this area showed a small rent. The bullet was retrieved from her brain with help of microscope and c-arm intraoperatively. The duration of surgery was around 4 hours and the child was extubated at the end of surgery. The post op course of the patient remained uneventful and she was discharged on fourth postoperative day.

DISCUSSION

After detail literature search it was found that this is the first case report of a projectile bullet entering into the cerebrum of a paediatric patient and causing no neurological deficit in the patient. The patient was operated only to prevent the possibility of formation of cerebral abscess and to confirm the presence of bullet inside the cerebrum since the history given by the patient was in no way suggestive of a fire arm injury. Also, bullets left in body can be a source of lead and can manifest as lead toxicity.^{1,2}

Bullet injury to brain normally presents as an emergency with high mortality rates. Also, the prognosis of a penetrating brain injury is said to be worse as compared to closed head injury.³ We presume that our patient was hit by a bullet which was fired in air and was probably on its way down to earth and therefore our patient had no sequelae of bullet injury to brain, primarily because of the low velocity of projectile bullet on its way back to earth. Firing in air with firearms remains a common occurrence in north India during wedding ceremonies and often leads to disastrous results. Despite the efforts of law enforcement agencies,

these injuries unfortunately continue to be frequently encountered in large trauma centres as well as in large community emergency departments.⁴ Bullet injuries to brain are currently considered as most severe type of bullet injuries with survival rates of only 7 - 15%.⁵ It has been said that about 90% the victims die before prior to reaching at the hospital care, and for those who survive and make it to the hospital, further about 50% die in the emergency.^{6,7} Our patient was lucky to have managed to escape a bullet injury to brain without showing any symptoms or suffering any deficits. Had the bullet penetrated around 1 inch more into the brain, it would have reached the region of brainstem and could have caused life threatening injuries.

REFERENCES

- 1 Bronvin S: Etiologie de la colique de plomb. *Union Med* 1867;3:89
- 2 Ellis C: A case of probable lead poisoning, resulting fatally from a bullet lodged in the knee joint twelve years previously. *Boston Med Surg J* 1874;91:472
- 3 Part 2. Prognosis in penetrating brain injury. *J Trauma*. 2001;51: S44-86
- 4 Esposito DP, Walker JP. Contemporary management of penetrating brain injury. *Neurosurg Q*. 2009;19:249-54
- 5 Selden BS, Goodman JM, Cordell W, Rodman GH, Jr., Schnitzer PG. Outcome of self-inflicted gunshot wounds of the brain. *Ann Emerg Med*. 1988;17(3):247-53
- 6 Shaffrey ME, Polin RS, Phillips CD, Germanson T, Shaffrey CI, Jane JA. Classification of civilian cranio-cerebral gunshot wounds: a multivariate analysis predictive of mortality. *J Neurotrauma*. 1992;9: Suppl 1:S279-85.
7. Cavaliere R, Cavenago L, Siccardi D, Viale G. Gunshot wounds of the brain in civilians. *Acta Neurochir (Wien)*. 1988;94(3-4):133-6.

TITLE OF THE ARTICLE: THE EFFECT OF POSITIVE END EXPIRATORY PRESSURE (PEEP) ON INTRAOCULAR PRESSURE (IOP) IN POSTSURGICAL MECHANICALLY VENTILATED PATIENTS

Abu Nadeem¹, Rahul Gupta², Syed Moied Ahmed³, Muazzam Hassan⁴

ABSTRACT

Inappropriate modes and poor application of mechanical ventilation may worsen lung injury. Over the years, ventilator strategies changed and introduction of PEEP has revolutionized the mechanical ventilation, especially in ARDS patients. Despite the clear benefits of this therapeutic tool in improving severely compromised gas exchange, there are dangers related to its administration. It increases intrathoracic pressure and impedes venous return into the chest or specifically restricts cardiac filling, decreases cardiac output particularly if the patient is hypovolemic, increases CVP, increases intracranial pressure leading to compromise of cerebral perfusion pressure and may even contribute to barotrauma. These adverse effects of PEEP are increased manifold when higher PEEP are used as in cases of acute lung injury (ALI) and ARDS. However, the relationship between PEEP and IOP is conflicting. Intra Ocular Pressure (IOP) must be maintained within

this normal range to ensure constant corneal curvature and a proper refractive index of the eye. Therefore it is justified to monitor IOP when patient is being subjected to high levels of PEEP during mechanical ventilation. The authors hereby aimed to evaluate the correlation of PEEP on IOP in terms of magnitude and rate of rise, in mechanically ventilated patients.

Key words: PEEP; IOP; ARDS

INTRODUCTION

Poor application of mechanical ventilation may worsen lung injury and increase mortality. Until the 1990s mechanical ventilation (MV) strategy involved the use of relatively high tidal volumes (to reduce atelectasis) in the range of 10 to 15 mL per kilogram of body weight, but over the years ventilatory strategies changed and introduction of PEEP has revolutionized the mechanical ventilation, especially in ARDS patients. Briel and colleagues¹ who showed that, among patients with “moderate to severe ARDS,” higher PEEP

-
- 1 Assistant Professor, Department of Anaesthesiology & Critical Care, J.N. Medical College, Faculty of Medicine, Aligarh Muslim University, Aligarh, India.
 - 2 Consultant, Department of Critical Care, Al Rashid Hospital, UAE.
 - 3 Professor, Department of Anaesthesiology & Critical Care, J.N. Medical College, Faculty of Medicine, Aligarh Muslim University, Aligarh, India.
 - 4 Assistant Professor, Department of Anaesthesiology & Critical Care, J.N. Medical College, Faculty of Medicine, Aligarh Muslim University, Aligarh, India.

Corresponding Author

Prof. Syed Moied Ahmed Department of Anaesthesiology.
J.N. Medical College, AMU, Aligarh 202002, India
E-mail- sma99@rediffmail.com

was associated with a clinically and statistically significant reduction in mortality but recently it has been challenged by various studies. However, despite the clear benefits of this therapeutic tool in improving severely compromised gas exchange, there are dangers related to its administration. It increases intrathoracic pressure and impedes venous return into the chest or specifically restricts cardiac filling, decreases cardiac output particularly if the patient is hypovolemic², increases CVP, increases intracranial pressure leading to compromise of cerebral perfusion pressure³ and may even contribute to barotrauma. These adverse effects of PEEP are increased manifold when higher levels of PEEP are used as in cases of acute lung injury (ALI) and ARDS.

Intra Ocular Pressure (IOP) must be maintained within this normal range to ensure constant corneal curvature and a proper refractive index of the eye. A deep inspiration may decrease IOP by up to 5 mm of Hg, while BP fluctuations, changes in body position, and plasma oncotic pressure changes account for the minor fluctuations in IOP.⁴ If the negative intrathoracic pressure generated by deep inspiration, can make IOP fall by up to 5 mm of Hg, then the positive intrathoracic pressure produced by PEEP might increase IOP. Increased IOP can lead to glaucoma which may ultimately lead to loss of vision. However, the relationship between PEEP and IOP is conflicting. Therefore it is justified to monitor IOP when patient is being subjected to high levels of PEEP during mechanical ventilation.

The aim of this study was to evaluate the correlation of PEEP on IOP in terms of magnitude and rate of rise, in mechanically ventilated patients.

MATERIALS AND METHODS

A prospective observational study was conducted in the Intensive Care Unit of the department of Anaesthesiology. The study was approved by the

departmental board of studies. Thirty adult patients (age ranging between 20 – 50 years) of either sex admitted to the ICU for mechanical ventilation were selected. Written informed consent was obtained from the patients relatives before commencement of the study.

Patients were taken up for study in the order they came to ICU. They were excluded from the study on the basis of following criteria:

1. Patients on spontaneous respiration.
2. Patients with major cardiac disorder.
3. Patients with major respiratory disorder.
4. Patients with any known intraocular pathology.
5. Patients with IOP > 22 mm of Hg.
6. Pregnant patient

Before the commencement of the study all the patients were relaxed with a bolus dose of 0.1mg/kg of vecuronium bromide, sedated with a bolus dose of 2.0 mg/kg of propofol followed by infusion at the rate of 2.0 mg/kg/hour throughout the observation period. Analgesia was obtained with a bolus dose of fentanyl of 2mcg/kg followed by infusion of 1-2 mcg/Kg/hr. Patients were infused with ringer's lactate at the rate of 2 ml/kg/hour throughout the study. No colloids and blood were transfused to the patient during the study period. All the observations were done in supine position.

All the patients with normal CVP (6-8 cm of H₂O) were mechanically ventilated on Hamilton C2 (Hamilton Medical) in controlled mode, with a respiratory rate of 12 breaths per minute, tidal volume of 8 ml per kg and inspiratory to expiratory ratio of 1 : 2.5 and a plateau pressure of < 30 cm of H₂O. The patients were ventilated with these ventilatory settings for at least 30 minutes before the initiation of observation.

At zero PEEP the IOP was recorded followed by successive observations at 10 minutes. Observations at zero PEEP were taken as baseline values. Subsequently the PEEP was increased to 2 cm, 4 cm, 6 cm, 8 cm, 10 cm and

12cm of H₂O and the respective value of IOP was observed after 10 minutes in each level of PEEP.

The gradual increase in PEEP was stopped when -

1. The BP fell by greater than 20% of baseline values OR
2. SpO₂ fell below 90% OR
3. CVP increased to > 20 cm of H₂O, whichever was earlier and the case was excluded from the study and a new case was included in its place.

CVP, MABP and SpO₂ measurements were done through the multichannel monitor Datex Ohmeda Multichannel Monitor S/5.

TECHNIQUE FOR MEASURING INTRAOCULAR PRESSURE (IOP)

IOP was measured using a SCHIOTZ TONOMETER. Patient was in supine position. Tonometer was kept on the cornea. Deflection of its indicator immediately occurs. The deflection value was matched with a chart of standard values of IOP. Mean arterial BP & SpO₂ were recorded from Datex Ohmeda multichannel monitor. MAP (mean airway pressure) and MABP (mean arterial blood pressure) were recorded from Hamilton C2 ventilator.

STATISTICAL ANALYSIS

- All the statistical analysis was done using SPSS version 17.
- Pearson correlation test
- It was used to calculate relationship between

the variables.

- Pearson correlation coefficient is a measure of linear association between two variables.
- The values of Pearson correlation coefficient range from -1 to +1.
- The sign of the correlation coefficient indicates the direction of the relationship (positive or negative).
- The absolute value of the correlation coefficient indicates the strength, with larger absolute values indicating stronger relationships.
- The significance of each correlation coefficient is also displayed in the correlation table.
- The significance level (or p-value) is the probability of obtaining results as extreme as the one observed. It is considered to be significant when it is < 0.05.
- Paired samples T test
- It compares the means of two variables that represent the same group at different times (e.g. before and after an event) or related groups.

OBSERVATIONS AND RESULTS

This prospective study was conducted in the intensive care unit, of Department of Anaesthesiology & Critical Care, Jawaharlal Nehru Medical College, AMU, Aligarh.

The study was conducted on 30 patients of either sex, ageing between 20- 50 yrs, requiring mechanical ventilatory support following abdominal surgery.

Table 1: Age Distribution of Cases.

Age groups	No. of patients	Percentage
20-30 yrs.	12	40 %
31- 40 yrs.	11	36.7 %
41-50 yrs.	7	23.3 %
TOTAL	30	100 %

The above table shows the age distribution of study population. Total 30 patients were studied between 20 – 50 yrs of age. Twelve patients were between 20-30 yrs of age (40% of study

population), 11 patients were between 31-40 yrs of age (36.7% study population) and 7 patients were between 41- 50 yrs of age (23.3% of study population).

Table 2: Gender distribution of patients.

Gender	No. of patients	Percentage
Male	22	73 %
Female	8	27 %
Total	30	100 %

The above table shows that out of total 30 patients included in this study 8 were females (27% of

study population) and 22 were males (73% of study population).

Table 3: Distribution of cases studied as trauma Vs non- trauma.

Type of case	no. of cases	Percentage
Trauma	6	20 %
Non-trauma	24	80 %
Total	30	100 %

The above table shows that of the total 30 cases studied, 24 were due to non- traumatic causes and 6 were of traumatic origin.

Table 4: Etiological distribution of cases

Indication	No. of cases	Percentage
Perforation peritonitis	18	60 %
Acute intestinal obstruction	6	20 %
Blunt trauma abdomen	3	10 %
Gunshot abdomen	2	6.7 %
Stab injury abdomen	1	3.3 %
Total	30	100 %

Above table shows the etiological distribution of cases. Out of the 30 cases, 18 cases were due to perforation peritonitis (60% of study population), 6 cases were due to acute intestinal obstruction

(20% of study population), 3 cases were due to blunt trauma abdomen (10% of study population), 2 cases were due to gunshot abdomen (6.7% of study population) and 1 case was due to stab injury abdomen (3.3% of study population).

Table 5: Observed baseline values of IOP.

Parameters	Baseline values at 10 min.	Baseline values at 20 min.
IOP	8.3 + /-2.1 mm of Hg	8.5+/-2.0 mm of Hg

The above table shows the baseline values of the IOP at 10 minutes and then at 20 minutes of observation period. These are the values observed when the PEEP value is kept at 0 cm of water and these IOP was recorded first at 10 minutes and then at 20 minutes.

Baseline values of IOP were found to be 8.3 +/- 2.1 mm of Hg at 10 minutes of observation and 8.5 +/- 2.0 mm of Hg at 20 minutes of observation.

Table 6: Mean values of IOP calculated against the increasing values of PEEP at 10 minutes of observation.

PEEP (cm of H2O)	N	Mean value of IOP (mm of Hg)			Std. deviation
		STARTING POINT	AFTER 10 TH MIN.	p- VALUE	
0	30	8.0	8.3		2.1
2	30	8.3	8.5	0.764	2.1
4	30	8.5	8.7	0.050	1.8
6	30	8.7	9.0	0.023	1.8
8	30	9.0	10.9	0.001	2.0
10	30	10.9	11.7	0.0001	2.3
12	30	11.7	13.2	0.0001	2.3
Total	210 (n)	9.3	10.04		2.05

- N = total no. of patients observed against the each values of PEEP
- p-value is significant at < 0.05 level.
- n = total no. of observations observed against the each values of PEEP.

The above table shows the mean values of IOP at 10 minutes of observation period against the increasing values of PEEP. The mean value of IOP at 10 minutes was found to be 10.04 +/- 2.05 mm of Hg.

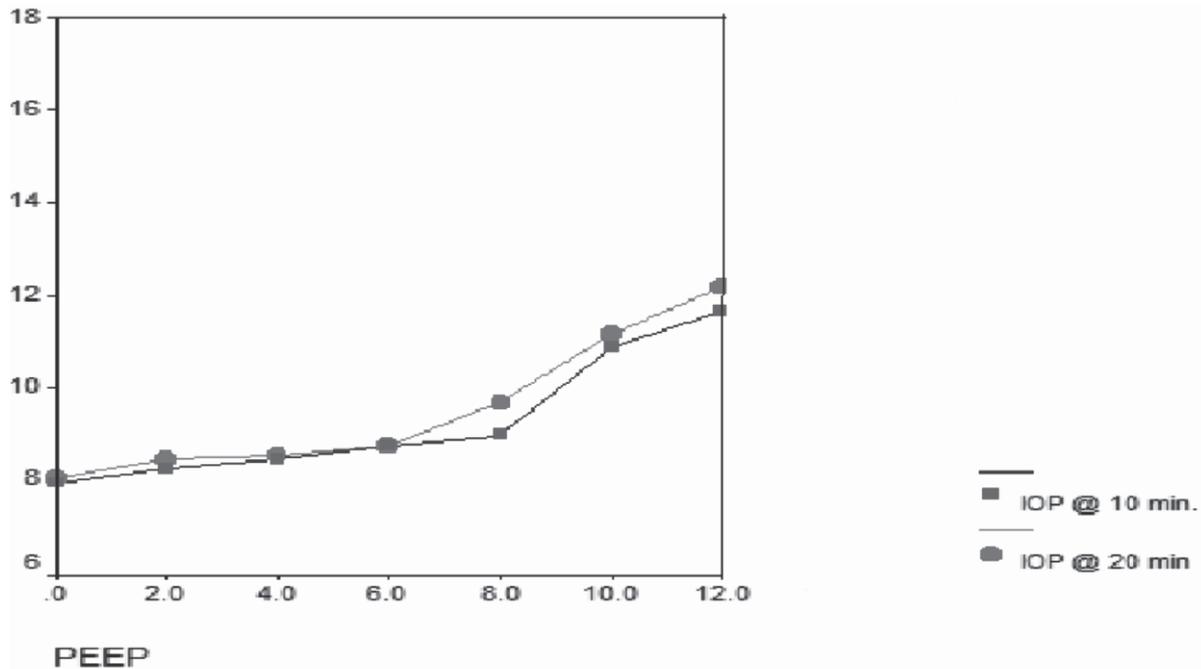
In the above table p-value was generated using paired t test. p- value was calculated between the

baseline value of IOP and the different values of IOP observed against the different values of PEEP.

It shows that the mean values of IOP started rising significantly from PEEP of 8 cm of H₂O onwards compared to its baseline value at 10 minutes of observation period (p<0.001).

Maximum value of IOP achieved on 12 cm of H₂O of PEEP was 13.2 +/- 2.3 mm of Hg at 10 minutes of observation. Rate of rise in IOP was linear but variable throughout the study period.

Figure 1: Scatter diagram showing the values of IOP observed with the values of PEEP at 10 minutes and at 20 minutes of observation.



The rate of rise in IOP at 10 minutes in relationship to increasing values of PEEP is seen in the above figure. This figure depicts that the value of IOP started rising significantly from 8 cm of H₂O PEEP onwards (p<0.001).

The rate of rise in IOP at 20 minutes, in relationship to increasing values of PEEP is seen in the figure 1. This figure depicts that the value of IOP started rising significantly from 8 cm of H₂O PEEP onwards (p<0.0001).

Table 6: Correlation of IOP with PEEP at 10 minutes of observation

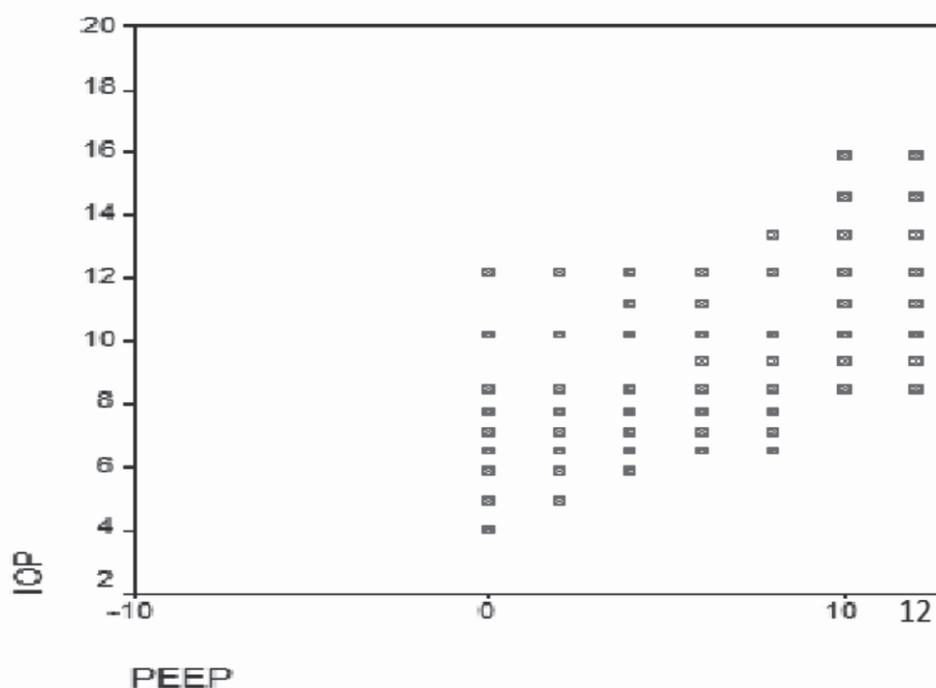
		IOP	PEEP
IOP	Pearson correlation coefficient	1	0.727
	Significance (2 tailed)	.	0.0001
	N	210	
PEEP	Pearson correlation coefficient	0.727	1
	Significance (2 tailed)	0.0001	.
	N	210	

- p- value is significant at <0.05.
- N = total no. of observations of IOP for 30 patients observed against different values of PEEP at 10 minutes

Pearson correlation test was applied between the

PEEP and IOP at 10 minutes of observation. Both were found to be positively correlated (Pearson correlation coefficient = 0.727). The relationship between the two variables was found to be highly significant ($p < 0.0001$). The value of IOP rose significantly from 8 cm of H₂O of PEEP onwards ($p < 0.001$).

Figure 2: Scatter diagram showing the various values IOP plotted against the values of PEEP at 10 minutes of observation.



The above scatter diagram shows the relationship between PEEP and IOP at 10 minutes of observation period. In this graph we can see that both the variables are positively correlated so that

with increase in values of PEEP the values of IOP also increased. The increase was more pronounced from 8 cm of H₂O of PEEP onwards (p<0.001).

Table 7: Mean values of IOP calculated against the increasing values of PEEP at 20 minutes of observation.

PEEP (cm of H ₂ O)	N	Mean value of IOP (mm of Hg)			Std. deviation
		STARTING POINT	AFTER 20 TH MIN.	p-VALUE	
0	30	8.1	8.5		2.0
2	30	8.5	8.6	0.728	1.9
4	30	8.6	8.8	0.20	1.6
6	30	8.8	9.7	0.072	1.8
8	30	9.7	11.2	0.0001	2.0
10	30	11.2	12.2	0.0001	2.1
12	30	12.2	14.3	0.0001	2.1
Total	210 (n)	9.6	10.5		1.93

- N = total no. of patients observed against the each values of PEEP
- p-value is significant at < 0.05 level.
- n = total no. of observations observed against the each values of PEEP.

The above table shows the mean values of IOP at 20 minutes of observation period against the increasing values of PEEP. The mean value of IOP at 20 minutes was found to be 10.5 +/- 1.93

mm of Hg.

In the above table p-value was generated using paired-t-test. p-value was calculated between the baseline value of IOP and the different values of IOP observed against the different values of PEEP.

It shows that the mean values of IOP started rising significantly from PEEP of 8 cm of H₂O onwards compared to its baseline value at 20 minutes of observation period (p<0.0001).

Maximum value of IOP achieved on 12 cm of H₂O of PEEP was 14.3 +/- 2.1 mm of Hg at 20 minutes

of observation. Rate of rise in IOP was linear but variable throughout the study period.

Table 8: Correlation between IOP and PEEP at 20 minutes of observation.

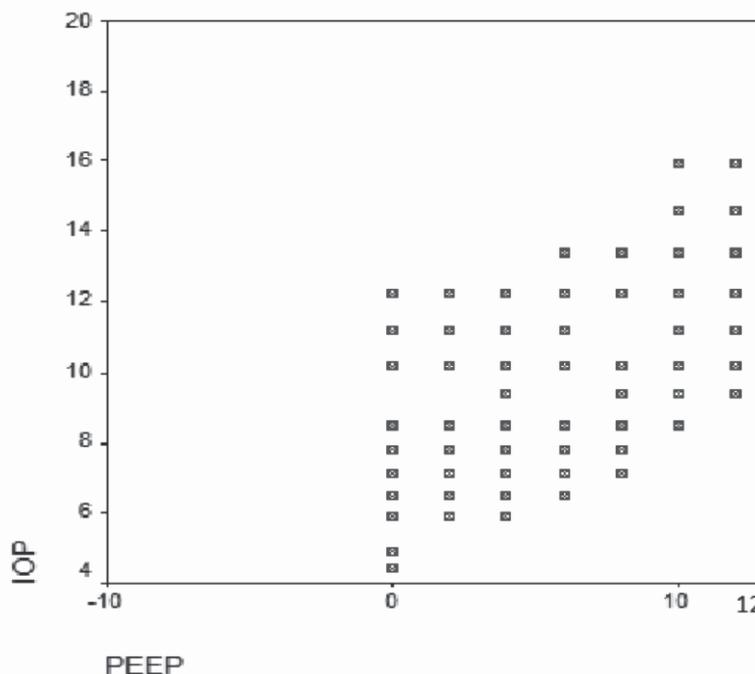
		IOP	PEEP
IOP	Pearson correlation coefficient	1	0.778
	Significance (2 tailed)	.	0.0001
	N	210	
PEEP	Pearson correlation coefficient	0.778	1
	Significance (2 tailed)	0.0001	.
	N	210	

- p- value is significant at < 0.05.
- N = total no. of observations of IOP for 30 patients observed against different values of PEEP at 20 minutes

PEEP and IOP at 20 minutes of observation. Both were found to be positively correlated (Pearson correlation coefficient = 0.778). The relationship between the two variables was found to be highly significant (p<0.0001).

Pearson correlation test was applied between the

Figure 3: Scatter diagram showing the values of IOP plotted against the values of PEEP at 20 minutes of observation.



The above shown scatter diagram shows the relationship between PEEP and IOP at 20 minutes of observation period. In this graph we can see that both the variables are positively correlated so that with increase in values of PEEP the values of IOP also increased. This increase is more pronounced from 8 cm of H₂O of PEEP onwards ($p < 0.0001$).

DISCUSSION

Thirty mechanically ventilated post-abdominal surgery adult patients of both genders, between 20- 50 yrs of age group were included into the study.

In patients who have hypoxemic respiratory failure, one of methods widely used to improve oxygenation is through the use of PEEP (refers to the pressure in the airway at the end of passive expiration), in an attempt to recruit and stabilize lung. Improvement of oxygenation in patients with acute respiratory failure using PEEP was described forty years ago⁵. In the 1970s it was demonstrated that intraoperative use of PEEP reduced ARDS development⁶ and the use of early prophylactic PEEP reduced the incidence of ARDS⁷. Other studies demonstrated that the use of certain amount of PEEP reduced the intensity of lung injury from different aggressions, as Dreyfuss et al. showed in 1988 with the reduction of edema and preservation of the normal structural aspect of alveolar epithelium using high levels of PEEP^{8,9}. However, other studies have refuted this effect. Pepe et al. conducted a trial where they found that the early application of PEEP in high-risk patients had no effect on the incidence of ARDS¹⁰. The PEEP given to mechanically ventilated patients has many favorable effects namely it stabilizes and recruits lung, increases functional residual capacity (FRC), raises lung compliance, improves arterial oxygenation, reduces the risk of O₂ toxicity by lowering FiO₂ requirements, etc. but there are also many unfavorable effects of PEEP, namely it increases intrathoracic pressure and impedes venous return into the chest or specifically restricts cardiac filling, decreases cardiac output particularly if the patient is hypovolemic¹¹, increases CVP, increases intracranial pressure

leading to compromise of cerebral perfusion pressure and may even contribute to barotrauma, strategy of mechanical ventilation that places limits on airway pressure and tidal volume has been recommended for patients with the acute respiratory distress syndrome.¹²⁻¹⁴ This recommendation is based on the observation that mechanical ventilation, although life-sustaining, can cause marked lung injury in both animals¹⁵⁻¹⁷ and humans¹⁸ if lung over distention occurs. These adverse effects of PEEP are increased manifold when higher levels of PEEP are used as in cases of ARDS.

These adverse effects of PEEP contribute to increased morbidity and mortality of ICU patients. Thus it is recommended that after each adjustment of PEEP a complete assessment of pulmonary function, pressure volume relationships, oxygenation, and hemodynamics is performed¹⁹. The goal of titration for ideal PEEP will be defined as the level of PEEP that allows the lowest FiO₂ while maintaining adequate oxygenation and avoiding adverse effects.

Therefore, in our study all post abdominal surgery mechanically ventilated patients, between 20- 50 year were put on ventilator and ventilated with volume assist control mode. They were then subjected to progressively increasing values of PEEP starting from 0 cm of H₂O to 12 cm of H₂O of PEEP in the increments of 2 cm of H₂O i.e. 0 cm, 2 cm, 4 cm, 6 cm, 8 cm, 10 cm, and 12 cm of H₂O of PEEP. Against each value of PEEP, the values of IOP were recorded first after 10 minutes and then after 20 minutes of setting the PEEP. The values observed at 0 cm of H₂O of PEEP were taken as the baseline values for each parameter at 10 minutes and at 20 minutes.

There are certain limitations in this study. But we have tried to take as much measures as possible to minimize this biasness. In our study IOP was to be measured from the Schiotz tonometer. For measurement of IOP an assistant was used who was blinded to the objectives of study.

We conducted this study with the aim of

evaluating the effect of increasing values of PEEP on IOP in terms of magnitude and rate of rise, in mechanically ventilated patients.

Intraocular pressure usually increases with age and is genetically influenced²⁰. IOP could be raised more in 41- 50 yrs of age group compared to other groups.

INTRAOCULAR PRESSURE

Pressure within the eyeball is called intraocular pressure. Normally it ranges from 11- 21 mm of Hg. Values in excess of 25 mm of Hg are considered pathological²¹. IOP must be maintained within this normal range to ensure constant corneal curvature and a proper refractive index of the eye. A diurnal variation of 2-3 mm of Hg is observed in normal IOP recordings with higher recordings noted in early morning²².

In the present study, values of IOP were observed against the progressively increasing values of PEEP at 10 minutes and then at 20 minutes interval. Baseline values of IOP observed at 10 minutes was 8.3 +/- 2.1 mm of Hg and at 20 minutes value was 8.5 +/- 2.0 mm of Hg (table 5). These observations were followed by increase in values of IOP along with increase in values of PEEP. The correlation between different values of PEEP and IOP at 10 minutes of observation was found to be positively correlated ($r= 0.727$) and at 20 minutes ($r= 0.778$) with a highly significant correlation ($p< 0.0001$).

The finding of our study is in accordance to result of Nimagadda et al²³, Spapen et al²⁴, Teba et al²⁵ and Sohn et al²⁶. They observed that IOP and PEEP are positively correlated whereas other authors like Trikha et al²⁷, Cheong et al²⁸, K. Kokkins et al²⁹ evaluated a negative correlation of IOP with PEEP.

CONCLUSION

The correlation between different values of PEEP and IOP both at 10 minutes and at 20 minutes of observation was found to be positively correlated with a highly significant correlation ($p< 0.0001$) in

both the cases. The value of IOP started rising significantly from 8 cm of H₂O of PEEP onwards both at 10 minutes and 20 minutes of observation. Rate of rise in IOP was linear but variable throughout the study period.

Therefore it was seen that application of PEEP has a positive correlation with intraocular pressure (IOP). Thus when PEEP of more than 8 cm of H₂O is applied, or when PEEP is applied to patients who are prone to develop raised IOP or having raised IOP, should undergo regular monitoring so that any increase in these parameters could be prevented at an early stage. This would subsequently prevent the morbidity associated with their inappropriate increase.

REFERENCES

1. Briel M, et al. Higher vs lower positive end-expiratory pressure in patients with acute lung injury and acute respiratory distress syndrome: systematic review and meta-analysis. *JAMA*. 2010;303:865–873.
2. MR pinsky Cardiovascular Issues in Respiratory Care, CHEST, Volume 128, Issue 5, Supplement 2 Pages 547S–604S (November 2005)
3. Marik, et al. Management of acute intracranial hypertension: a review for clinicians. *Journal Emergency Medicine*, 1999; 17(4): 711–719.
4. Aboul-Eish E. Physiology of the eye pertinent to anesthesia. *Int Ophthalmol Clin*. 1973 Summer;13(2):1-20.
5. Ashbaugh DG, Bigelow DB, Petty TL, Levine BE. Acute respiratory distress in adults. *The Lancet*, Saturday 12 August 1967.
6. Schmidt GB, O'Neill WW, Kotb K, Hwang KK, Bennett EJ, Bombeck CT. Continuous positive airway pressure in the prophylaxis of the adult respiratory distress syndrome. *Surg Gynecol Obstet*. 1976;3(4):613–618.
7. Weigelt JA, Mitchell RA, Snyder WH 3rd. Early positive end-expiratory pressure in the adult respiratory distress syndrome. *Arch Surg*. 1979;3(4):497–501.
8. Dreyfuss D, Soler P, Basset G, Saumon G. High inflation pressure pulmonary edema. Respective effects of high airway pressure, high tidal volume, and positive end-expiratory

- pressure. *Am Rev Respir Dis.* 1988;3(5):1159–1164.
9. Ruiz-Bailén M, Fernández-Mondéjar E, Hurtado-Ruiz B, Colmenero-Ruiz M, Rivera-Fernández R, Guerrero-López F, Vázquez-Mata G. Immediate application of positive-end expiratory pressure is more effective than delayed positive-end expiratory pressure to reduce extravascular lung water. *Crit Care Med.* 1999;3(2):380–384.
 10. Pepe PE, Hudson LD, Carrico CJ. Early application of positive end-expiratory pressure in patients at risk for the adult respiratory-distress syndrome. *N Engl J Med.* 1984;3(5):281–286.
 11. Pinsky MR, Desmet J-M, Vincent JL. Effect of positive end-expiratory pressure on right ventricular function in humans. *Am Rev Respir Dis* 1992; 146: 681–7.
 12. Slutsky AS. Mechanical ventilation. *Chest* 1993;104:1833-1859[Erratum, *Chest* 1994;106:656.]
 13. Slutsky AS. Consensus conference on mechanical ventilation -- January 28-30, 1993 at Northbrook, Illinois, USA. Part I. *Intensive Care Med* 1994;20:64-79[Erratum, *Intensive Care Med* 1994;20:378.]
 14. Feihl F, Perret C. Permissive hypercapnia: how permissive should we be? *Am J Respir Crit Care Med* 1994;150:1722-1737.
 15. Webb HH, Tierney DF. Experimental pulmonary edema due to intermittent positive pressure ventilation with high inflation pressures: protection by positive end-expiratory pressure. *Am Rev Respir Dis* 1974;110:556-565.
 16. Dreyfuss D, Basset G, Soler P, Saumon G. Intermittent positive-pressure hyperventilation with high inflation pressures produces pulmonary microvascular injury in rats. *Am Rev Respir Dis* 1985;132:880-884.
 17. Parker JC, Hernandez LA, Longenecker GL, Peevy K, Johnson W. Lung edema caused by high peak inspiratory pressures in dogs: role of increased microvascular filtration pressure and permeability. *Am Rev Respir Dis* 1990;142:321-328.
 18. Rouby JJ, Lherm T, Martin de Lassale E, et al. Histologic aspects of pulmonary barotrauma in critically ill patients with acute respiratory failure. *Intensive Care Med* 1993;19:383-389
 19. Varon. Practical guide to the care of the critically ill patient. St. Louis (MO): Mosby-Yearbook Inc, 1994: p. 13–21.
 20. Pardianto G et al. Intraocular pressure measure on normal eyes, in *Mimbar Ilmiah Oftalmologi Indonesia*, 2005; 2: 80.
 21. Donlon JV. Anesthesia for ophthalmic surgery. In: *Anesthesia*. Eds. Miller RD. first edition. Churchill Livingstone, New York, 1981, p. 1265-86.
 22. Varma R., Hwang L.-J., Grunden J.W., Bean G.W. Inter-visit IOP range: an alternative parameter for assessing intraocular pressure control in clinical trials. *Am J Ophthalmol.* 2008;145:336–342.
 23. U R Nimmagadda, et al. Positive end-expiratory pressure increases intraocular pressure in cats. *Critical Care Medicine.* 1991 Jun;19(6); 79-81.
 24. Spapen, et al. Bedside evaluation of intraocular pressure in critically ill patients, ventilated at different levels of positive end-expiratory pressure. *Acta Anesthesiology Belgium*, 1993; 44(2): 39-43.
 25. Teba, et al. Intraocular pressure during mechanical ventilation with different levels of positive end-expiratory pressure. *Critical Care Medicine*, 1993 Jun; 21(6): 867-870.
 26. Sohn et al. Effect of positive end expiratory pressure on intraocular pressure in the critically ill and mechanically ventilated patients. *Korean journal of critical care*, 1997; 12(2): 151- 158.
 27. Trikha A, Venkatraman, Madan, Kaul HL. Effect of positive end expiratory pressure on human intraocular pressure. *Journal of Anesthesiology Clinical Pharmacology*, 1996 Apr.; 12(2): 103-105
 28. Cheong MA, et al. Intraocular Pressure during Mechanical Ventilation with Positive End-Expiratory Pressure under General Anesthesia. *Korean Journal Anesthesiology*, 1998 May; 34(5): 998-100.
 29. Kokkinis K, et al Positive end-expiratory pressure does not increase intraocular pressure in patients with intracranial pathology. *Critical Care*, 2001, 5(Supple 1): P.27.

EVALUATION OF THE EFFICACY OF DIFFERENT CONCENTRATIONS OF LEVOBUPIVACAINE WITH DEXMEDETOMIDINE FOR ULTRASOUND GUIDED SUPRACLAVICULAR BRACHIAL PLEXUS BLOCK.

Farah Nasreen¹, Shoaib Parvez², Hammad Usmani³, Nazia Tauheed⁴

ABSTRACT

Background: Supraclavicular brachial plexus block is a routinely performed technique for surgeries of arm and forearm. Decreasing the concentration of local anaesthetic drug without compromising block characteristics increases the margin of safety of brachial plexus block. In this randomized double blind study, we evaluated the efficacy of two different concentrations of levobupivacaine viz 0.375% and 0.25% with dexmedetomidine for ultrasound guided supraclavicular brachial plexus block (SBPB).

MATERIAL AND METHODS:

Sixty ASA Grade I and II patients in the age group of 18-60 years scheduled for upper limb surgery, were randomly divided into two groups: Group I received SBPB with 30 ml levobupivacaine 0.375% with dexmedetomidine 1µg/kg. Group II received SBPB with 30 ml Levobupivacaine 0.25% with dexmedetomidine 1µg/kg. Onset and

duration of sensory and motor blockade, duration of analgesia, patient satisfaction score, and hemodynamic parameters were observed in both the groups.

RESULTS:

Onset of sensory and motor blockade was 13.3 ±1.97 mins and 16 ±3.2 mins in group I, while it was 17.8±2.34 mins and 22.8±1.92 mins in group II, respectively. The difference was statistically significant ($P < 0.05$). The duration of motor block was significantly lesser in group II (819 ± 109.6 mins) as compared to group I (1207±110 mins). The requirement of rescue analgesics between the two groups was comparable during first 24 hrs (p value >0.05). Group II patients had significantly better patient satisfaction score than group I patient

CONCLUSION:

Both the concentrations of levobupivacaine with

1) Farah Nasreen, Assistant Professor, Dept of Anaesthesiology, Jawaharlal Nehru Medical College, A.M.U., Aligarh., U.P., India

2) Dr Shoaib Parvez, Junior Resident, Dept of Anaesthesiology, Jawaharlal Nehru Medical College, A.M.U., Aligarh., U.P., India

3) Dr Hammad Usmani, Professor, Dept of Anaesthesiology, Jawaharlal Nehru Medical College, A.M.U., Aligarh., U.P., India

4) Dr Nazia Tauheed, Assistant Professor, Dept of Anaesthesiology, Jawaharlal Nehru Medical College, A.M.U., Aligarh., U.P., India

Address for correspondence:

Dr. Farah Nasreen

Department of Anaesthesiology,
JNMCH, A.M.U., Aligarh., U.P., India.

Mobile No:- +91 9897067670

Email:- kazmifarah@gmail.com

dexmedetomidine can be effectively used for ultrasound guided supraclavicular brachial plexus. Although, the onset time of sensory and motor blockade is significantly reduced using a higher concentration of levobupivacaine i.e. 0.375%, there is early return of motor functions and subsequently better patient satisfaction with 0.25% levobupivacaine.

KEY WORDS:

Levobupivacaine, Dexmedetomidine, supraclavicular brachial plexus block.

INTRODUCTION

Supraclavicular brachial plexus block has been widely used for surgeries including arm, forearm and hand. Although bupivacaine is one of the most commonly used local anaesthetic for central and peripheral nerve blocks, the potential for cardiotoxicity has led to the development of interest in levobupivacaine, a safer alternative in this respect^{1,2}. In brachial plexus blocks where larger doses of local anaesthetics are administered, levobupivacaine is preferred due to greater margin of safety.³

Use of ultrasound in brachial plexus block has revolutionized the technique as direct visualisation of nerve structures and real time control of local anaesthetic administration leads to reduction in overall volume of anaesthetics and consequent overdose risk.^{4,5}

Addition of adjuvants to local anaesthetic in brachial plexus block increases its efficacy. The ability of dexmedetomidine to reduce the requirement of local anaesthetic and analgesics is increasingly being used in perioperative period. When combined with local anaesthetic for brachial plexus block, dexmedetomidine has been found to effectively reduce the concentration required for the block along with the improved block characteristics⁶⁻⁸. Studies have shown that addition of dexmedetomidine lowers the concentration of local anaesthetic for supraclavicular brachial plexus block.^{9,10} However, there is relative scarcity of literature on the use of

dexmedetomidine as adjuvant to lower concentrations of levobupivacaine in supraclavicular brachial plexus block.

The present study was thus designed to compare the efficacy of 0.25% levobupivacaine with dexmedetomidine to 0.375% levobupivacaine with dexmedetomidine under ultrasound guidance for supraclavicular brachial plexus block in terms block characteristics, overall patient satisfaction score and side effects.

MATERIAL AND METHODS

Following approval by the Board of Studies, Department of Anesthesiology, and Institutional Ethics committee, the study was conducted in the Department of Anesthesiology, J N Medical College and Hospital AMU Aligarh. Sixty patients, ASA Physical Status I and II aged between 18–60 years, weight 40–70 kg, undergoing upper limb surgery were included in this prospective randomized double blind study after a written informed consent.

Patients with severe cardiorespiratory, renal or hepatic disease; pregnancy; patients with peripheral neuropathy; coagulopathy; infection at the site of block and patients with known allergy to local anesthetic were excluded. The patients were randomly allocated to two groups of 30 each and brachial plexus block was performed under ultrasound guidance, in-plane technique.

Group I received 30 ml of Levobupivacaine 0.375% with dexmedetomidine at dose of 1 µg/kg of body weight and **Group II** received 30 ml of Levobupivacaine 0.25% with dexmedetomidine at dose of 1 µg/kg of body weight. Drug was prepared beforehand by personnel not involved in the study and handed over to the team performing the block.

Baseline heart rate, blood pressure, and oxygen saturation were recorded. An intravenous line with 18-gauge intravenous cannula secured in the unaffected limb and Ringer's Lactate infusion was started.

Sensory block was assessed by blunt tip needle test over C₅-T₁ dermatomes and graded as: Grade 0: sharp pain felt, Grade 1: dull pain felt, Grade 2: no pain felt. Motor block assessment was done and graded on a four-point scale; i.e. Grade 0: Full flexion /extension movement in hand and arm against resistance, Grade 1 – movement against gravity but not against resistance, Grade 2 – flicker of movement in hand but not in arm, Grade 3 – no movement (complete motor block).

All patients in each group were independently observed for:

A) Onset time of sensory block; Time interval between end of local anaesthetic administration and complete loss of pain sensation (Grade 2)

B) Duration of analgesia; Time from administration of drug to appearance of pain, requiring analgesic (NRS >3)*. Pain was assessed on a rating scale, zero representing no pain and 10 meaning worst possible pain. Injection tramadol 2mg/kg intravenous infusion was given as rescue analgesic when the pain score was more than 3.

C) Onset time of motor block was defined as a time interval between end of local anaesthetic administration and appearance of motor block Grade 2.

D) Duration of motor block; Time interval from complete motor block to recovery of complete motor function of hand and forearm (Grade 0)

E) Overall satisfaction of patient was evaluated 24 hours after surgery using five point satisfaction scale; 1 = very dissatisfied, 2 = dissatisfied, 3 = uncertain, 4 = satisfied, 5 = very satisfied

F) Heart rate, non-invasive blood pressure and oxygen saturation were measured immediately after administration of drug, 5 min, 10 min, 20 min, 30 min and then at intervals of every fifteen minutes till the completion of the operation.

G) Complication or side effects as a result of the procedure such as bradycardia (HR < 50 bpm), hypotension (decrease in baseline BP by > 20 %), hypertension (rise in baseline BP > 20 %) nausea, vomiting, and hypoxemia (SpO₂ < 90%) convulsions, pneumothorax, pleuritis, jerky movements, Horner's syndrome, hypersensitivity reaction.

STATISTICAL ANALYSIS

Statistical analysis performed done using Graph Prism Pad Software Inc. Parametric data (age, weight, timings) were analyzed using Unpaired t test. Non parametric data were analyzed using the Fisher's exact test.

RESULTS

In the present study, 60 patients were divided into two groups of 30 each, group I receiving 0.375 % levobupivacaine with dexmedetomidine (1 µg/kg body weight) and group II receiving 0.25 % levobupivacaine with dexmedetomidine (1 µg/kg body weight), {total volume of drug was diluted to 30 ml}.

The two study groups were similar in terms of their demographic profile (table 1). The minor differences observed were statistically insignificant (p value > 0.05). The mean onset time of sensory block in group I was 13.3 ± 1.97 mins whereas it was 17.8 ± 2.34 mins in group II (table 2, figure 1). The difference was statistically significant (p value < 0.05). The mean onset time of motor block in group I was 16 ± 3.2 mins and in group II, it was 22.8 ± 1.92 mins (table 2, figure 2). On comparison, the difference was statistically significant (p value < 0.05). The difference between the two study groups in terms of duration of analgesia (table 2) was not statistically significant (p value > 0.05). The duration of motor block was significantly lesser in group II (819 ± 109.6 mins) as compared to group I (1207 ± 110 mins) [table 2 , figure 3]. The requirement of rescue analgesics between the two groups was comparable during first 24 hrs (p value > 0.05) [table 2]. Group II patients had significantly better patient satisfaction score than group I patient (p value < 0.05) [table 3]. The baseline

haemodynamic parameters, pulse rate, blood pressure, SpO₂ variation during and after block was seen to be similar in both the study groups with no statistically significant difference. One patient in group I had vomiting, two patients in

both the groups were sedated intraoperatively and two hours postoperatively but there was no sign of respiratory depression. None of the patients in group I and group II had other complications like bradycardia and hypotension.

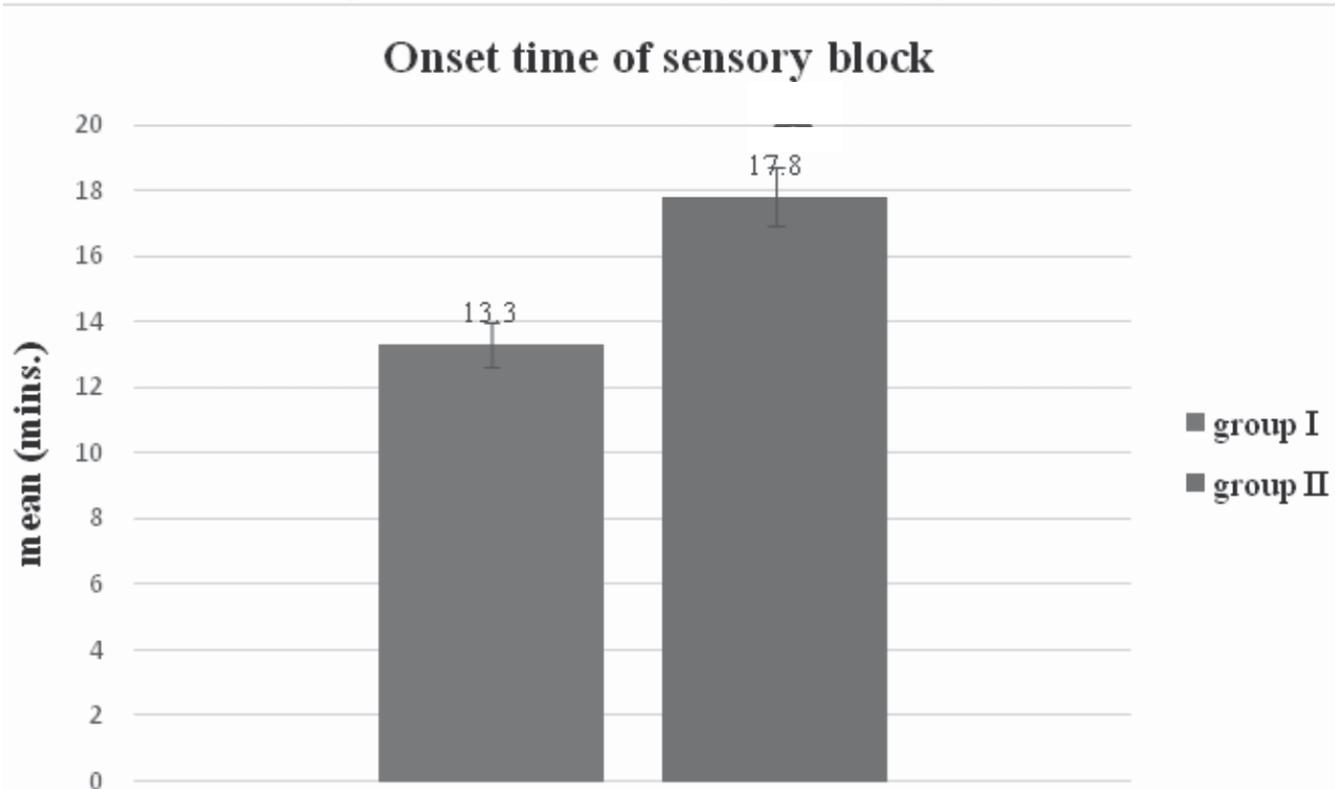
Table 1: Demographic profile

Parameter	group I (n=30)	group II (n=30)	p value
age (years)	33±13	0.88
weight (kg)	60±9.78	60.3±6.16	0.894
Male : Female	21:9	19:11	0.7487

Table2: Block characteristics

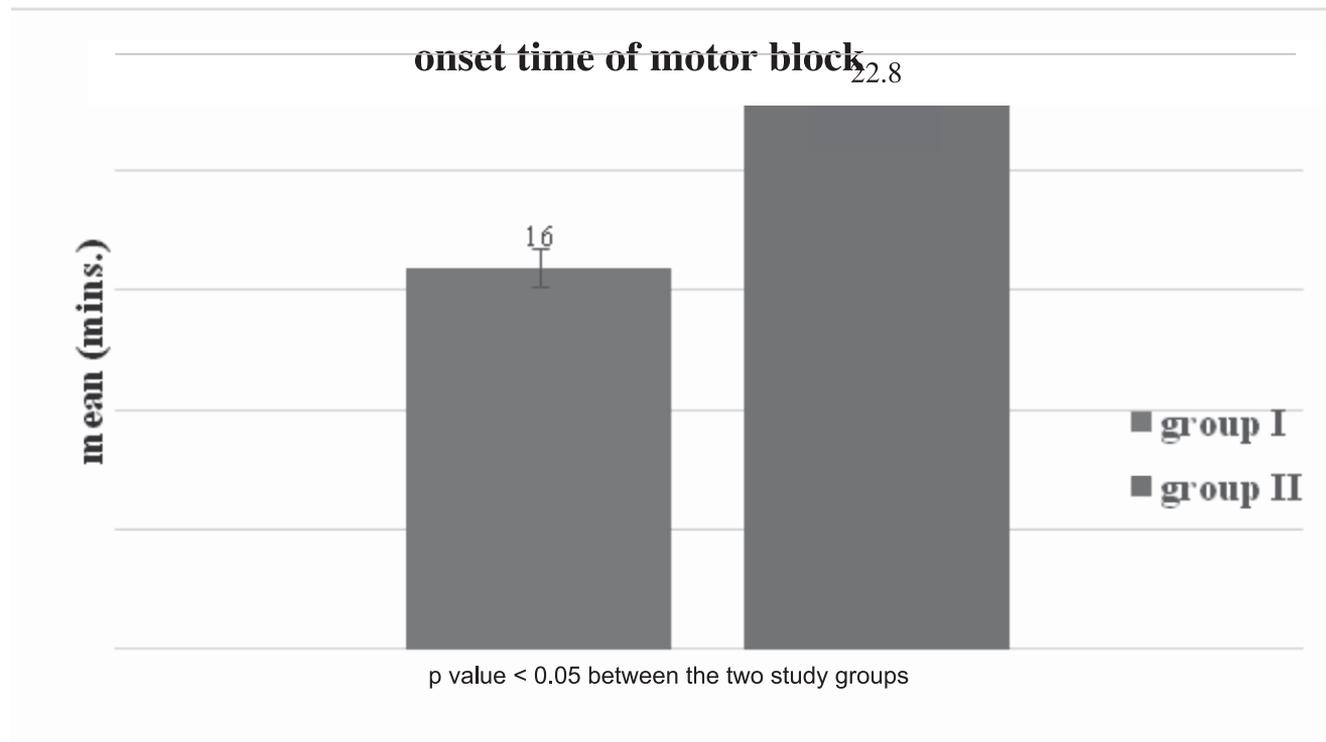
Table 2: The characteristics of block			
	Group 1 (n = 30)	Group 11(n = 30)	P value
	Mean ± SD	Mean ± SD	
Onset time of sensory block(mins)	13.3 ± 1.97	17.8 ± 2.34	<0.0001
Onset time of motor block(mins)	16 ± 3.2	22.8 ± 1.92	<0.0001
Duration of analgesia (mins)	851 ± 139	789 ± 108	> 0.05
Duration of motor block (mins)	1207 ± 200	819 ± 109.6	<0.0001
Total number of rescue analgesics	2±0.60	2.2±0.47	>0.05

Figure 1: Onset time of sensory block in study groups



p value <0.05 between the two study groups

Figure 2: Onset time of motor block



p value < 0.05 between the two study groups

Figure 3: Mean duration of motor block

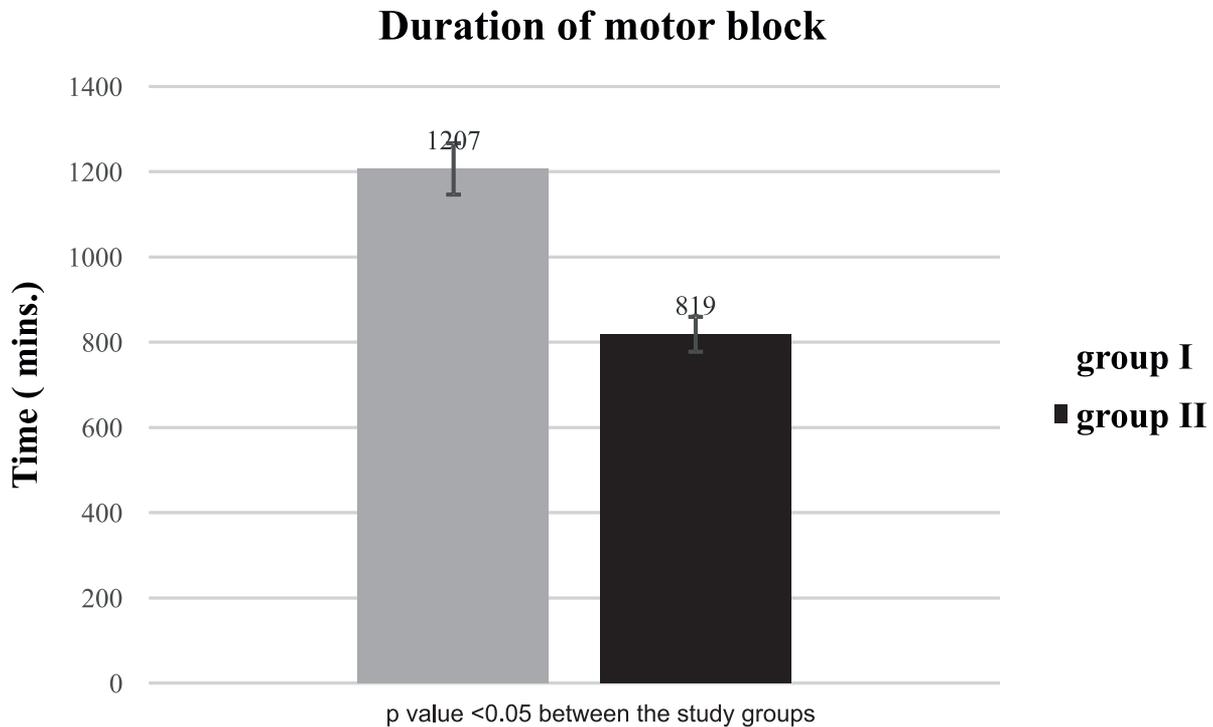


Table 3: Comparison of patient satisfaction score between study groups

	group I	group II	P value
Mean	3.96	4.83	<0.0001
SD	0.65	0.37	

DISCUSSION

In this randomised double-blind study, two different concentrations of levobupivacaine with dexmedetomidine were compared for ultrasound guided supraclavicular brachial plexus block. It was observed that the mean onset time for sensory and motor blockade was shorter with a higher concentration of levobupivacaine (0.375%) with dexmedetomidine as compared to the lower concentration (0.25%). The duration of analgesia was however, comparable in both the groups. The duration of motor block was less with the lower concentration of levobupivacaine (0.25%), which might have led to an overall better patient satisfaction score.

In brachial plexus block, where large doses of

local anaesthetics are used, reduction in total dose of local anaesthetic has advantage of reducing the risk of local anaesthetic toxicity. Secondly with the lower doses, there is early return of motor activity and better patient satisfaction score.

Baskan et al (11) compared the onset time and quality of posterior approach interscalene brachial plexus block produced by 0.25% levobupivacaine and 0.25% bupivacaine and proved the efficacy of 0.25% levobupivacaine in posterior approach interscalene brachial plexus block. They observed similar motor and sensory block onset times and qualities and concluded that both drugs provide an equally comfortable anaesthesia and analgesia for shoulder surgery.

Cox et al (12) compared bupivacaine and levobupivacaine in brachial plexus block. They observed that 0.25% levobupivacaine had slower onset and shorter duration of action and lower overall success rate compared to 0.5% levobupivacaine, although this difference was not found to be statistically significant. The present study also shows a slower onset and shorter duration of action with 0.25% levobupivacaine. The overall patient satisfaction was, however found to be better with this concentration and a statistically significant difference was found. Role of dexmedetomidine as adjuvant to local anaesthetics in brachial plexus block has been validated in several studies.^{9,13-15}

Studies have shown that addition of dexmedetomidine lowers the concentration of local anaesthetic for supraclavicular brachial plexus block.^{9,10} The ability of dexmedetomidine to reduce the requirement of local anaesthetic and analgesics has been increasingly used in the perioperative period.

Addition of dexmedetomidine to local anaesthetic in brachial blocks significantly prolonged the duration of analgesia and motor blockade. Dexmedetomidine in clinically effective doses lacks respiratory depression^{16,17} but maintains its analgesic properties that may make it useful and safe adjunct in many diverse clinical applications. An early onset of sensory block with higher concentration of levobupivacaine was seen in this study, keeping the dose of dexmedetomidine constant in both the groups.

Kim et al¹⁸ compared 0.375% levobupivacaine with 0.5% levobupivacaine for ultrasound guided axillary brachial plexus block and showed equivocal results without clinically significant difference compared to 0.5% levobupivacaine. They have demonstrated the average elapsed time to be ready for surgery was 26 mins, whereas, in this study the onset of motor block with 0.375% levobupivacaine was 16 mins. This shorter onset time of motor block could be attributed to the addition of dexmedetomidine with local anaesthetic drug.

Effect of addition of dexmedetomidine (100 µg) to levobupivacaine (0.5%) was studied by Esmoglu et al¹⁹ for axillary brachial plexus block. They concluded that addition of dexmedetomidine shortens the onset time of both sensory and motor block. A similar study by Kaygusuz et al²⁰ also demonstrated a short sensory block onset time with the addition of dexmedetomidine (1 µg/kg).

Patients in both the groups achieved adequate duration of surgical analgesia during the perioperative period. Although the duration of analgesia was longer with 0.375% levobupivacaine than 0.25% levobupivacaine, the difference was statistically insignificant.

However, such findings were in contrast to the study of Hickey et al²¹ who demonstrated that 0.25% concentration of levobupivacaine for brachial plexus is not sufficient to achieve surgical anaesthesia because of slow onset and a high rate of inadequate block.

The addition of dexmedetomidine with 0.25% levobupivacaine could have led to the enhanced analgesic efficacy of supraclavicular brachial plexus block in this study.

Palsule et al⁹ conducted a study to evaluate the effect of dexmedetomidine as an adjuvant to 0.25% bupivacaine in supraclavicular block (SCB) and concluded that adding dexmedetomidine (1 µg/kg) to bupivacaine (0.25%) during supraclavicular BPB shortens sensory and motor block onset time, increases the sensory and motor block duration, and prolongs the duration of postoperative analgesia without any significant side effect.

Biswas et al²² evaluated the effect of combining dexmedetomidine with levobupivacaine with respect to duration of motor and sensory block and duration of analgesia and demonstrated that addition of dexmedetomidine to levobupivacaine 0.5% prolongs the duration of motor and sensory block and extends the duration of analgesia.

Nallam et al²³ conducted a study to evaluate the effect of adding different doses dexmedetomidine (50 µg and 100 µg) to 0.5% levobupivacaine and found a significantly prolonged duration of analgesia with the higher dose.

Other studies have also demonstrated that the duration of sensory and motor blockade could be prolonged with dexmedetomidine as adjuvant to levobupivacaine in brachial plexus block.^{21,24,28}

Williams et al²⁴ conducted a prospective study to assess the quality, safety, and execution time of supraclavicular block of the brachial plexus using ultrasonic guidance and neurostimulation in comparison with a supraclavicular technique that used anatomical landmarks and neurostimulation. Authors found that ultrasound guidance allowed statistically and clinically significant reductions in procedure times and provided better block quality than a neurostimulator-guided subclavian perivascular approach.

Kaygusuz et al²⁰ have also shown that adding dexmedetomidine to levobupivacaine in axillary BPB increases the sensory and motor block duration and time to first analgesic use, and decreases total analgesic use with no side effects. The prolongation of duration of sensory and motor block with dexmedetomidine as an adjuvant to bupivacaine in brachial plexus block was also confirmed by Gandhi et al.²⁵

In another study, Haramritpal et al²⁶ evaluated the effect of addition of dexmedetomidine to varying concentrations of levobupivacaine (0.5% and 0.25% levobupivacaine) for supra clavicular brachial plexus block. In this study, they demonstrated that the addition of dexmedetomidine to levobupivacaine can significantly decrease the concentration of levobupivacaine required for surgical anaesthesia, shortens the sensory and motor block onset time, reduces the offset time for motor block, prolongs the duration of postoperative analgesia and provides comparable overall satisfaction scores among patients. Reduction in

total levobupivacaine dose also increases the safety margin of the block.

In this study, the duration of motor block was significantly shorter with 0.25% levobupivacaine [819 minutes] as compared to 0.375% [1207 minutes]. Reduction in the concentration of levobupivacaine from 0.375% to 0.25% might have led to early return of motor function.

The present study also shows a trend towards better satisfaction score with lower concentration of levobupivacaine. The inability to use the affected limb due to prolonged motor block has been shown to reduce patient satisfaction in other studies also.^(27,28) Moreover, prolonged motor block hampers the assessment of neurological function after surgical procedures which is not desired by the surgeons.

Dexmedetomidine may lead to side effects such as hypotension and bradycardia with increased dosage along with its effects such as sedation and anxiolysis. In this study, two patients from both the study group remained sedated for two hours postoperatively but arousable without any sign of respiratory depression.

Ultrasound guided technique could have led to better precision and hence we could not find procedure related complications like pneumothorax, Horner's syndrome, vascular puncture etc.

One patient in group I had one episode of vomiting. Nausea and vomiting were not seen in group II patients.

There are some limitations to our study. First, it was a monocentric study and small sample size was chosen. Larger randomized controlled trials may be required to validate the findings of our study. Second, follow up period in our study was too short (24 hrs). Long term follow up may be needed to look for neurological complications.

CONCLUSION

To conclude, the present study suggests that levobupivacaine in concentrations of 0.375% and 0.25% with dexmedetomidine can be effective in producing sensory & motor blockade when administered for supraclavicular brachial plexus block under ultrasound guidance. Although, the onset time of sensory and motor blockade is significantly reduced using a higher concentration of levobupivacaine i.e. 0.375%, there is early return of motor functions and subsequently better patient satisfaction and better assessment of post-surgical recovery of functions with 0.25% levobupivacaine.

REFERENCES

1. Foster RH, Markham A. Levobupivacaine. *Drugs*. 2000;59(3):551–579.
2. Butterworth JF, Mackey DC, Wasnick JD, Morgan GE, Mikhail MS, Morgan GE. Morgan and Mikhail's clinical anesthesiology. [Internet]. 2013 [cited 2018 Nov 1]. Available from: <http://accessmedicine.mhmedical.com/book.aspx?bookId=564>
3. Clinical comparisons of 0.5% and 0.375% levobupivacaine for ultrasound-guided axillary brachial plexus block with nerve stimulation [Internet]. [cited 2018 Nov 1]. Available from: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3272524/>
4. Koscielniak-Nielsen ZJ. Ultrasound-guided peripheral nerve blocks: What are the benefits?: Ultrasound for peripheral nerve blocks. *Acta Anaesthesiol Scand*. 2008 May 12;52(6):727–37.
5. Wadhwa A, Kandadai SK, Tongpresert S, Obal D, Gebhard RE. Ultrasound Guidance for Deep Peripheral Nerve Blocks: A Brief Review. *Anesthesiol Res Pract*. 2011;2011:1–6.
6. Kaur H, Singh G, Rani S, Gupta K, Kumar M, Rajpal A, et al. Effect of dexmedetomidine as an adjuvant to levobupivacaine in supraclavicular brachial plexus block: A randomized double-blind prospective study. *J Anaesthesiol Clin Pharmacol*. 2015;31(3):333.
7. Singh A, Mahindra M, Gupta R, Bajwa SS. Dexmedetomidine as an adjuvant to levobupivacaine in supraclavicular brachial plexus block: A novel anesthetic approach. *Anesth Essays Res*. 2016;10(3):414.
8. Agarwal S, Aggarwal R, Gupta P. Dexmedetomidine prolongs the effect of bupivacaine in supraclavicular brachial plexus block. *J Anaesthesiol Clin Pharmacol*. 2014;30(1):36.
9. Palsule V, Shah A, Kanzariya H. Dexmedetomidine in supraclavicular block: Effects on quality of block and analgesia. *Indian J Pain*. 2017;31(1):28.
10. Biswas S, Das R, Mukherjee G, Ghose T. Dexmedetomidine an adjuvant to levobupivacaine in supraclavicular brachial plexus block: A randomized double blind prospective study. *Ethiop J Health Sci*. 2014 Jul 31;24(3):203.
11. Baskan S, Taspinar V, Ozdogan L, Gulsoy KY, Erk G, Dikmen B, et al. Comparison of 0.25% levobupivacaine and 0.25% bupivacaine for posterior approach interscalene brachial plexus block. *J Anesth*. 2010 Feb;24(1):38–42.
12. Cox CR, Checketts MR, Mackenzie N, Scott NB, Bannister J. Comparison of S(-)-bupivacaine with racemic (RS)-bupivacaine in supraclavicular brachial plexus block. *Br J Anaesth*. 1998 May;80(5):594–8.
13. Singh A, Mahindra M, Gupta R, Bajwa SS. Dexmedetomidine as an adjuvant to levobupivacaine in supraclavicular brachial plexus block: A novel anesthetic approach. *Anesth Essays Res*. 2016;10(3):414.
14. Agarwal S, Aggarwal R, Gupta P. Dexmedetomidine prolongs the effect of bupivacaine in supraclavicular brachial plexus block. *J Anaesthesiol Clin Pharmacol*. 2014;30(1):36.
15. Ali H, Hassanin MB, Eliwa HH, Rabiey MAE. Ultrasound Guided Supraclavicular Brachial Plexus Block. :12.
16. Hall JE, Uhrich TD, Barney JA, Arain SR, Ebert TJ. Sedative, amnestic, and analgesic properties of small-dose dexmedetomidine infusions. *Anesth Analg*. 2000 Mar;90(3):699–705.
17. Belleville JP, Ward DS, Bloor BC, Maze M. Effects of Intravenous Dexmedetomidine in Humans I. Sedation, Ventilation, and Metabolic

- Rate. *Anesthesiol J Am Soc Anesthesiol.* 1992 Dec 1;77(6):1125–33.
18. Kim W, Kim YJ, Kim J-H, Kim DY, Chung RK, Kim CH, et al. Clinical comparisons of 0.5% and 0.375% levobupivacaine for ultrasound-guided axillary brachial plexus block with nerve stimulation. *Korean J Anesthesiol.* 2012;62(1):24.
 19. Esmoğlu A, Yegenoglu F, Akin A, Turk CY. Dexmedetomidine Added to Levobupivacaine Prolongs Axillary Brachial Plexus Block: *Anesth Analg.* 2010 Dec;111(6):1548–51.
 20. Kaygusuz K, Kol IO, Duger C, Gursoy S, Ozturk H, Kayacan U, et al. Effects of Adding Dexmedetomidine to Levobupivacaine in Axillary Brachial Plexus Block. *Curr Ther Res.* 2012 Jun;73(3):103–11.
 21. Hickey R, Rowley CL, Candido KD, Hoffman J, Ramamurthy S, Winnie AP. A comparative study of 0.25% ropivacaine and 0.25% bupivacaine for brachial plexus block. *Anesth Analg.* 1992 Oct;75(4):602–6.
 22. Biswas S, Das R, Mukherjee G, Ghose T. Dexmedetomidine an adjuvant to levobupivacaine in supraclavicular brachial plexus block: A randomized double blind prospective study. *Ethiop J Health Sci.* 2014 Jul 31;24(3):203.
 23. Nallam DSR. Supraclavicular brachial plexus block: Comparison of varying doses of dexmedetomidine combined with levobupivacaine: A double-blind randomised trial. *Indian J Anaesth.* 2017;61(3):6.
 24. Williams SR, Chouinard P, Arcand G, Harris P, Ruel M, Boudreault D, et al. Ultrasound Guidance Speeds Execution and Improves the Quality of Supraclavicular Block: *Anesth Analg.* 2003 Nov;1518–23.
 25. Gandhi R, Shah A, Patel I. Use of dexmedetomidine along with bupivacaine for brachial plexus block. 2012;2(1):3.
 26. Kaur H, Singh G, Rani S, Gupta K, Kumar M, Rajpal A, et al. Effect of dexmedetomidine as an adjuvant to levobupivacaine in supraclavicular brachial plexus block: A randomized double-blind prospective study. *J Anaesthesiol Clin Pharmacol.* 2015;31(3):333.
 27. Fredrickson MJ, Price DJ. Analgesic effectiveness of ropivacaine 0.2% vs 0.4% via an ultrasound-guided C5-6 root/superior trunk perineural ambulatory catheter. *Br J Anaesth.* 2009 Sep;103(3):434–9.
 28. Fredrickson MJ, Wolstencroft PJ, Chinchawala S, Boland MR. Does motor block related to long-acting brachial plexus block cause patient dissatisfaction after minor wrist and hand surgery? A randomized observer-blinded trial. *Br J Anaesth.* 2012 Nov 1;109(5):809–15.

USE OF KETAMINE HYDROCHLORIDE NEBULISATION FOR ATTENUATION OF POST-OPERATIVE SORE THROAT

Bhavna c patel¹, Jayshree Thakkar², Gaurav Malviya³, Janak Bhalani⁴, Twinkle Patel⁵, Bipin Patel⁶

ABSTRACT

Background and Aims: Post-operative sore throat following general anaesthesia with endotracheal intubation occurs in more than 60% of patients. Many pharmacological and non-pharmacological modalities are used to attenuate it. According to our previous study Ketamine hydrochloride gargles are very effective to relieve radiotherapy induced throat pain. So, we aimed to study the effect of nebulized Ketamine to attenuate post-operative sore throat.

METHOD:

We conducted a prospective randomized trial. After written and informed consent, 60 patients belonging to ASA physical status I or II, in the age group of 18 to 60 years of either sex undergoing surgery under general anaesthesia with endotracheal intubation were enrolled. Patients were randomized into 2 groups. Study group received Ketamine hydrochloride 50 mg with 5 ml sterile water nebulisation for 5 minutes and control group without nebulisation. General anaesthesia was induced 5 minutes after completion of

nebulisation. Fluid management, anaesthesia and analgesia protocols were same in both groups. Hemodynamic monitoring was done pre nebulisation, postnebulisation, preinduction, postinduction and before incision. Incidence and severity of sore throat, cough and hoarseness of voice were assessed at 0,2,4,6,12 and 24 hours post-operatively and graded on a four point scale.

RESULTS:

Overall incidence of Post-operative sore throat was 60% (36 patients), 86.66% (26 patients) patients in control group and 33.33% (10 patients) in study group ($p < 0.0001$). Use of Ketamine nebulisation attenuates post-operative sore throat at 2 and 4 hour postoperatively ($p < 0.0001$). Moderate sore throat occurred in 18 patients (60%) in control group and none in study group.

CONCLUSION:

Nebulisation with Ketamine, 10min prior to induction and intubation, significantly attenuates the incidence and severity of post-operative sore throat, in early post-operative

Assistant Professor¹,

Professor²

Resident Doctor³⁻⁵

Professor and HOD⁶

Department of Anaesthesiology, Gujarat cancer & Research Institute,
Civil hospital campus, Asarwa, Ahmedabad-380013 Gujarat

Address of correspondence

DR. JAYSHREE M THAKKAR,

40/A, Yogeshwarnagar Society, Dharnidhar road,

H K Complex lane, Paldi, Bhattha,

Ahmedabad 380007

Mobile 9824500653

E mail: drjmthakkar@yahoo.com

period, without any adverse effects.

KEY WORDS: Ketamine, post-operative sore throat, Nebulisation

INTRODUCTION

Post-operative sore throat (POST) is one of the most undesirable subjective complaints following general anaesthesia with endotracheal intubation. According to study done by Mc Hardy FE and Chung F, it has an incidence of 21-65%¹. It has been postulated that the POST is due to inflammation of tracheal mucosa following endotracheal intubation¹. Many unavoidable factors are responsible for that. To overcome those, many studies have been done using various pharmacological and non-pharmacological methods but with variable success⁵⁻¹¹. Ketamine hydrochloride (HCL) is shown to be promising agent to reduce POST^{9,15-19}. We also studied Ketamine mouthwash and found it very effective for relief of throat pain and pain of radiation induced mucositis²². This study was undertaken with the need to evolve a suitable agent and method to bring down the incidence of sore throat following tracheal intubation. Primary aim of our study was to compare the incidence of POST in the group of patients with and without Ketamine nebulisation. Secondary objectives included comparison of the incidence of post-operative hoarseness of voice and post-operative cough, to evaluate the effect of nebulisation on the hemodynamic parameters and oxygen saturation and to study any untoward effect due to systemic absorption of the drug.

MATERIALS AND METHODS

This randomized study was conducted on 60 surgical patients after approval from hospital ethical committee. Verbal and written consent was taken. All patients belonged to age group from 18 to 60, ASA risk status I or II, and Mallampatti airway assessment score 1 or 2. All patients were undergoing elective surgeries under general anaesthesia, where endotracheal intubation was to be performed and preferably with comparable duration of surgeries. Patients with unpredicted difficult airway, who needed more than 2 attempts

at intubation and those with reactive airways, were excluded from the study.

Study was performed in two groups without disparity, control group and study group. Detailed pre-operative anaesthetic check-up was done before surgery. Patients were pre medicated with tab lorazepam 1mg orally in the night, the day before surgery.

Inside the OT room, after securing I V line with wide bore cannula, monitors for heart rate (ECG monitor), blood pressure (NIBP monitor) and Spo2% (pulseoxymeter) were attached to the patients and noted the same before nebulisation. Patients selected for study group were nebulised for about 5min with Ketamine HCL 50 mg in 5 ml sterile water using Omron compressor AIR pro (An atomic jet nebulizer). Dose was decided on the basis of results and safety of drug from existing literatures^{9, 22, 24}. All hemodynamic parameters were noted after nebulisation and before induction, plus after induction and before incision.

Induction was done after 5min. IV premedication in the form of Inj. Glycopyrolate 5-10 mcg/kg, Inj. Ondansetron 4mg and Inj. Fentanyl citrate 1-2 mcg/kg was given. Pre-oxygenation was done with 100% oxygen. Monitor for capnography was attached to the close anaesthesia circuit. Induction was performed with Inj. Propofol 1.5-2.5 mg/kg and Inj. Vecuronium bromide 0.1 mg/kg IV. IPPV was done with mask ventilation for 3 min. Intubation was done following a gentle and quick laryngoscopy (completed within 30sec) with low pressure high volume cuffed PVC Endotracheal tube (ETT). In male 8 mm and female 7mm, internal diameter ETT was used. ETT cuff was filled with minimal volume of room air required to prevent palpable leak. Tube position was confirmed with capnography and bilateral chest auscultation. Patients who required more than two attempts were excluded from the study. Anaesthesia was maintained with O₂+N₂O+Isoflurane and muscle relaxant Inj. Vecuronium bromide 0.02 mg/kg at every 30 min as increment dose. At the end of surgery,

before about 5-10 min, Ventilation with 100% O₂ was done. Reversal with Inj. Glycopyrolate 10 mcg/kg and Inj. Neostigmine 0.05-0.07 mg/kg I V. Tracheal Extubation was performed with gentle or pharyngeal suctioning under direct laryngoscopic vision.

Tramadol hydrochloride 100mg suppository was inserted for post-operative analgesia before reversal. Rescue therapy for pain was planned in the form of inj. Paracetamol 20mg/kg IV infusion. Post-operative sore throat, cough and hoarseness monitoring and grading were performed in the ICU by resident doctors, who were unaware of the pre-operative nebulisation. The response was noted at 0, 2, 4, 6, 12 and 24 hours in the questionnaire based on four point scales as described below

Grade Severity Post - operative sore throat / throat pain

- No sore throat at any time since operation
- Minimal -patient answered in the affirmative when asked about it
- Moderate -Patient complained of sore throat on his/her own
- Severe -patient is in obvious distress

Post-operative Cough

- No cough at any time since the operation
- Minimal
- Moderate
- Severe

Post-operative Hoarseness of voice

- No complain of hoarseness at any time since the operation
- Minimal-Minimal change in the quality of voice
- Moderate- Patient complains of change
- Severe-gross change of voice perceived by the observer

Rescue therapy for POST in patient with grade 3: With use of dispersible Aspirin 75 mg gargle²⁵, to be repeated as many number of times as needed. The number of times rescue therapy had been initiated for POST and pain were noted. Data were

analysed using Graph Pad Quick Calc: t-test calculator and Comparison of proportions calculator (MEDCALC software). P values < 0.05 were considered statistically significant.

RESULTS

Demographic data were almost similar in both the groups (Table 1). Majority of patients had Mallampatti scoring of 1 and ASA grade I and distribution was almost similar in both groups. Duration of surgery was ranging between 1 ½ hour to 2 ½ hours. Both groups were comparable with respect to attempts of intubation. Most of patients were intubated smoothly in 1st attempt. 6 patients in study group and 5 patients in control group required assistance. Volume of air required for endotracheal cuff inflation was comparable in both groups ranging from 5 to 7 ml. Air volume injected in the ETT cuff was decided, as to prevent palpable leak.

Statistically significant increase in heart rate (HR) and mean arterial pressure (MAP) was seen in study groups when pre nebulisation readings were compared with those of post nebulisation. (P= 0.02 and 0.0221). But as we took care for attenuation of pressure response at intubation by inj. Fentanyl citrate and inj. Propofol, change in hemodynamic were non-significant after induction and then throughout the surgery. (P= 0.7814 and 0.1416) (Table 2) We monitored spo₂ from beginning of nebulisation to the end of surgery. There was not any time fall in Spo₂%. No any other untoward events like ECG changes (ST-T changes or any type of arrhythmias), laryngospasm, convulsion, or involuntary movements were noted after Ketamine nebulisation. Very negligible delirium was noted in one patient after nebulisation but it was subsided when patient came out of anaesthesia at the end of surgery (Table 3).

The incidence of sore throat was assessed and noted at 0, 2, 4, 6, 12 and 24 hours. In such a small samples it could be erroneous to demonstrate statistical significance. So we compared the values by combining the incidence of nil with mild sore throat and compared moderate sore throat

separately. None of our patient from any group had severe sore throat as we conducted the study on patient, where no nasogastric tube insertion were required and intubation was done by senior resident.(mostly in 1st attempt and in few patient at 2nd attempt)

There was statistically significant reduction in the incidence of sore throat in study group after extubation as compared to control group ($p < 0.0001$). After 12 hour, study group had no sore throat at all, but few patients in control group had mild symptoms (Table 4).

Same way, there was significantly low incidence of hoarseness of voice ($P < 0.0001$) (Table 5) and

cough ($P < 0.0001$) (Table 6) in study group for 6 hours after extubation as compared to control group. After 6 hours, with permission of sips of water cough and hoarseness were relieved in all the patients.

Surgical pain relief was satisfactory in all the patients with Tramadol suppository. No any post-operative untoward effect of ketamine (e.g. headache, giddiness, residual sedation) was noted.

DISCUSSION

Sore throat is a common post-operative

Table 1: Demographic Data

	Control group	Study group
Age (Years)	54.6+/-7.9	53.8+/-6.2
Sex F/M	29/1	29/1
Weight (Kg)	49.6+/- 15.4	50.8+/-14.2

Shows comparison of demographic data

Table 2: Comparison of hemodynamic changes

	Pre nebulisation	Post nebulisation	Pre induction	Post induction	Before incision
Heart rate [Mean +/- SD]					
Control	84.11+/-9.18	84.08+/- 9.19	84.73+/-11.63	81.10+/-6.69	77.86+/-6.86
Study	84.16+/-10.47	90.40+/-9.84	91.53+/-10.50	82.57+/-8.82	78.40+/-7.83
Mean Arterial Pressure [Mean +/- SD]					
Control	94.20+/-8.88	95+/-9.	97+/-8.86	91.23+/-8.09	88.23+/-4.99
Study	95+/-9.6	100.23+/-7.49	100.20+/-6.20	90.57+/-5.82	86.33+/-4.89
P VALUE					
	Pre nebulisation study Vs Post nebulisation study	Post induction Study Vs Post induction Control	Before incision study Vs Before incision control	Pre nebulisation study Vs Post induction Study	
HR	0.02	0.4710	0.7814	0.5248	
MAP	0.0221	0.7155	0.1416	0.0348	

Shows comparison of hemodynamic values at different intervals

Table: 3 Incidence of untoward effects

	Number of patients	
	Control group	Study group
ECG changes (arrhythmias, ST-T Changes)	0	0
Delirium	0	1
Laryngospasm	0	0
Convulsion	0	0
Involuntary movement	0	0
Nystagmus	0	0
Cynosis	0	4
Post-operative headache/giddiness	0	0

Shows incidence of untoward effects of systemically absorbed ketamine, after nebulisation and in immediate post-operative period

Table 4: Comparison of incidence & severity of post-operative sore throat

Time	Severity [Grade]	Control group		Study group		
		Number of patients	Percentage	Number of patients	Percentage	P Value
0 hour	0	4	13.33	20	66.66	<0.0001
	1	8	26.66	10	33.33	
	2	18	60	0	0	
	3	0	0	0	0	
2 hour	0	6	20	22	73.33	<0.0001
	1	8	26.66	8	26.66	
	2	16	53.33	0	0	
	3	0	0	0	0	
4 hour	0	8	26.66	26	86.66	<0.0001
	1	6	20	4	13.33	
	2	16	53.33	0	0	
	3	0	0	0	0	

6 hour	0	12	40	30	100	<0.0001
	1	8	26.66	0	0	
	2	10	33.33	0	0	
	3	0	0	0	0	
12 hour	0	22	73.33	30	100	0.0026
	1	8	26.66	0	0	
	2	0	0	0	0	
	3	0	0	0	0	
24 hour	0	30	100	30	100	—
	1	0	0	0	0	
	2	0	0	0	0	
	3	0	0	0	0	

Shows comparison of incidence and severity of sore throat at different intervals

Table 5: Comparison of incidence & severity of post-operative Hoarseness

Time At	Severity [Grade]	Control group		Study group		
		Number of patients	Percentage	Number of patients	Percentage	P Value
0 hour	0	12	40	26	86.66	0.0002
	1	18	60	4	13.33	
	2	0	0	0	0	
	3	0	0	0	0	
2 hour	0	14	46.66	30	100	<0.0001
	1	16	53.33	0	0	
	2	0	0	0	0	
	3	0	0	0	0	
4 hour	0	14	46.66	30	100	<0.0001
	1	16	53.33	0	0	
	2	0	0	0	0	
	3	0	0	0	0	
6 hour	0	30	100	30	100	—
	1	0	0	0	0	
	2	0	0	0	0	

	3	0	0	0	0	
12 hour	0	30	100	30	100	—
	1	0	0	0	0	
	2	0	0	0	0	
	3	0	0	0	0	
24 hour	0	30	100	30	100	—
	1	0	0	0	0	
	2	0	0	0	0	
	3	0	0	0	0	

Shows comparison of incidence and severity of hoarseness of voice at different intervals

Table 6: Comparison of incidence & severity of post-operative Cough

Time	Severity [Grade]	Control group		Study group		P Value
		Number of patients	Percentage	Number of patients	Percentage	
0 hour	0	4	13.33	30	100	<0.0001
	1	20	66.66	0	0	
	2	6	20.00	0	0	
	3	0	0	0	0	
2 hour	0	10	33.33	30	100	<0.0001
	1	18	26.66	0	0	
	2	2	06.66	0	0	
	3	0	0	0	0	
4 hour	0	18	26.66	30	100	<0.0001
	1	12	40.00	0	0	
	2	0	0	0	0	
	3	0	0	0	0	
6 hour	0	30	100	30	100	—
	1	0	0	0	0	
	2	0	0	0	0	
	3	0	0	0	0	
12 hour	0	30	100	30	100	—
	1	0	0	0	0	
	2	0	0	0	0	
	3	0	0	0	0	
24 hour	0	30	100	30	100	—
	1	0	0	0	0	
	2	0	0	0	0	
	3	0	0	0	0	

Shows comparison of incidence and severity of cough at different intervals

complication occurring most often following tracheal intubation for surgical procedures, which results in pathological changes, trauma and nerve damage¹. Careful insertion technique and size of endotracheal tube is paramount importance in the prevention of airway trauma and POST². So, in our study, intubation and extubation was performed by senior resident and done smoothly in first attempt with some assistance in few patients. Though, Jackson et al considered the experience of person performing intubation as significant for POST³, Monroe et al and Endomwonyi et al found no correlation between POST and skill of anesthesiologist⁴.

Many pharmacological non-pharmacological measures to attenuate POST are studied and found effective. Losar et al⁵ found reduction of POST with new endotracheal tube with narrow cuff by reducing the area of cuff in contact with tracheal mucosa⁵. Betamethasone gel⁶, gargling with sodium azulence sulfonate⁷, dexamethasone⁸, magnesium nebulization^{9,10}, benzydamine hydrochloride¹¹, magnesium lozenge¹², budesonide inhalation¹³, gabapentin¹⁴, etc are different pharmacological modalities studied and used for attenuation of POST.

Ketamine, NMDA receptor antagonist is studied many times and has been shown to be promising agent to reduce POST^{9, 15-19}. It is involved in anti-nociceptive and anti-inflammatory cascade^{15, 18}. It diminishes the expression of inducible nitric oxide synthetase²⁰, serum C - reactive protein and interleukin 6 and 10²¹. Pharmacological studies have shown that the low dose Ketamine has anti hyperalgesic and anti allodynic effect.

Many studies also recommend gargles as the method of distribution of drug¹⁵⁻¹⁸. We studied Ketamine mouthwash for the relief of post radiation throat pain²² and found it very effective. In this study we decided to use nebulisation for ensured and effective distribution of drug all over the pharynx and up to the carina. Nebulisation prevents the user variability associated with gargling and confounded the issue of taste of the medications⁹.

We used Omron compressor AIR pro, an atomic jet nebulizer for the study. Vinita and Sukanya used wall mounted oxygen driven nebulization²³. Deposition of aerosols in the mouth and upper airway probably reduces incidence and severity of POST due to topical effect of Ketamine which attenuates local inflammation²⁴.

We assessed the effect of Ketamine nebulisation and compared with control group where we didn't use any nebulisation. Comparison with other drug or normal saline may hamper our intention to prove the incidence of POST is there or not in routine practice, just with use of lubrication of cuff. In our study, there was significant decrease in the incidence of POST seen at 0, 2, and 4 hrs which is in agreement with previous studies^{9, 15-19}. There was no incidence of POST at 6, 12 and 24 hours in ketamine nebulisation group. This could be due to persistent local effect of Ketamine at that time. Even there were only mild symptoms in control group after 6hrs. Possible explanation is no nasogastric tube, short duration surgery and smooth intubation and gentle extubation.

There was significant decrease in the incidence of post-operative hoarseness with Ketamine nebulisation. In fact, in control group also, symptoms subsided completely after permission of sips of water orally. As we selected the patients undergoing surface surgery and didn't put nasogastric tube, didn't find very high incidence of hoarseness of voice in any group. However, In a study, Gojendra et al found that significant reduction in hoarseness occurred only after 24hrs though there was reduction of incidence at 0, 2, 4 hrs following ketamine gargles. Author has not given any reasoning for this observations¹⁸. Sunil Rajan and George Jacobe have found very significant decrease in incidence in Ketamine nebulisation group for 24hrs. They also compared magnesium sulphate nebulisation with Ketamine nebulisation and found the later a better agent for attenuation of POST⁹.

Our observation didn't found a single incidence of post-operative cough in Ketamine group and found significant difference in control group,

although it was mild in all patients. Possible explanation is same, no nasogastric tube, short duration surgery and smooth intubation. Position of the tube was optimal- cuff below the level of vocal cords and above the carina. Measures were taken to prevent laryngospasm or bronchospasm, for e.g. gentle suctioning and smooth extubation without bucking.

In our study, there was significant increase in HR and MAP following Ketamine nebulisation, as other previous studies^{9, 24, 25}. That rise in HR and MAP subsided as we induce patient with proper measures taken to attenuate the pressure response to laryngoscopy and intubation. After the intubation and before incision all the patients in both the groups were hemodynamically stable without any significant difference in HR and MAP and were so, throughout the surgery and post-operatively.

Limitations of our study were that the sample size was small as we rigorously excluded the patient whose safety may be compromised in the unlikely events of systemic absorption of the nebulised drug. One more limitation was not measuring the serum Ketamine and Nor-ketamine levels to rule out the systemic effect. However study done by Chan et al showed lower serum levels of Ketamine and Nor-ketamine, which were not significant to produce any systemic effects¹⁷. Plus we did not use formal sedation scale as; at the beginning of the study we did not found residual sedation in any patient.

Conclusion: Pre-operative Ketamine nebulization is very effective for attenuation of incidence and severity of POST, hoarseness of voice and cough during early post-operative period in patients receiving GA with tracheal intubation, with reversible hemodynamic changes and without any significant side effects.

REFERENCES

(1) McHardy F E, Chung F. Postoperative sore throat: cause, prevention and treatment, *Journal of association of Anaesthetist of Great Britain and Ireland*, 1999 volume 54, issue 5, pp444–453.

(2) Al-Qahtani AS, Messahel FM, Quality improvement in anesthetic practice—incidence of sore throat after using small tracheal tube, *Middle East J Anesthesiol*, 2005, vol. 18, pp no.179-83

(3) Jackson M, Olevson D, Nissan V. Endotracheal tube size and sore throat following surgery, *Acta Anaesthesia scand* 2010;54:2, 147-55

(4) Monroe MC, Gravenstein N, Saga – Rumley S. Post-airway in orotracheally intubated patients. *Anesth Analg*. 1990;70:512–6

(5) Loeser EA, Bennett GM, Orr DL, Stanley TH. Reduction of post operative sore throat with new endotracheal tube cuffs. *Anesthesiology*. 1980;52:257–9

(6) Sumathi PA, Shenoy T, Ambareesha M, Krishna HM. Controlled comparison between betamethasone gel and lidocaine jelly applied over tracheal tube to reduce postoperative sore throat, cough, and hoarseness of voice. *Br J Anaesth* 2008;100:215-8

(7) Ogata J, Minami K, Horishita T, et al. Gargling with sodium azulesulfonate reduces the post operative sore throat after intubation of the trachea. *Anesth Analg*. 2005;101:290–3

(8) Thomas S, Beevi S. Dexamethasone reduces the severity of postoperative sore throat. *Can J Anaesth* 2007;54:897-901

(9) Rajan S, Malayil GJ, Varghese R, Kumar L. Comparison of Usefulness of Ketamine and Magnesium Sulfate Nebulizations for Attenuating Postoperative Sore Throat, Hoarseness of Voice, and Cough. *Anesthesia, Essays and Researches*. 2017;11(2):287-293. doi:10.4103/0259-1162.181427.

(10) Gupta SK, Tharwani S, Singh DK, Yadav G. Nebulized magnesium for prevention of postoperative sore throat. *Br J Anaesth*. 2012;108:168–9

(11) Nimmaanrat S, Chokkijchai K, Chanchayanon T. Efficacy of benzydamine hydrochloride dripping at

- endotracheal tube cuff for prevention of postoperative sore throat. *Journal of the Medical Association of Thailand* 2013;96:1331–7
- (12) Borazan H, Kececioglu A, Okesli S, Otelcioglu S. Oral magnesium lozenge reduces postoperative sore throat: A randomized, prospective, placebo-controlled study. *Anesthesiology* 2012;117:512-8.
- (13) Chen YQ, Li JP, Xiao J. Prophylactic effectiveness of budesonide inhalation in reducing postoperative throat complaints. *Eur Arch Otorhinolaryngol* 2014;271:1667-72
- (14) Lee JH, Lee HK, Chun NH, So Y, Lim CY. The prophylactic effects of gabapentin on postoperative sore throat after thyroid surgery. *Korean J Anesthesiology* 2013;64:138-42
- (15) Canbay O, Celebi N, Sahin A, Celiker V, Ozgen S, Aypar U. Ketamine gargle for attenuating postoperative sore throat. *Br J Anaesth* 2008;100:490-3
- (16) Shrestha SK, Bhattarai B, Singh J. Ketamine gargling and postoperative sore throat. *JNMA J Nepal Med Assoc.* 2010;50:282–5
- (17) Chan L, Lee ML, Lo YL. Postoperative sore throat and ketamine gargle. *Br J Anaesth.* 2010;105:97
- (18) Gojendra R, Eshwori L, Yanang KP, et al. Prophylactic ketamine gargle to reduce post-operative sore throat following endotracheal intubation. *J Med Soc.* 2012;26:175–9
- (19) Rudra A, Ray S, Chatterjee S, Ahmed A, Ghosh S. Gargling with ketamine attenuates the postoperative sore throat. *Indian J Anaesth.* 2009;53:40-43
- (20) Helmer KS, Cui Y, Dewan A, Mercer DW. Ketamine / Xylazine attenuates LPS-induced iNOS expression in various rat tissues. *J Surg Res.* 2003;112:70–8
- (21) Hirota K, Lambert DG. Ketamine: New uses for an old drug? *Br J Anaesth.* 2011; 107: 123–6
- (22) Joshi G, Taneja P, Patel BC, Patel BM. A Comparative study of ketamine, Diclofenac (dispersible) and lignocaine mouthwash for pain relief in radiation induced mucositis. *Indian journal of pain* 2011; 25: 29-31
- (23) V Ahuja, S Mitra. Nebulized ketamine decreases incidence and severity of post-operative sore throat. *Indian Journal of Anaesthesia* 2015, 59(1), 37–42.
- (24) Bhagyashree A, Shruthi J. 'Comparison of ketamine nebulisation with ketamine gargle in attenuating postoperative sore throat', *Indian Journal of Clinical Anaesthesia* 2016, volume 3, issue 3; 347-351
- (25) Agarwal A, Nath SS, Goswami D. An evaluation of the efficacy of aspirin and benzydamine hydrochloride gargle for attenuating postoperative sore throat, *Anesthesia Analogue*, 2006, Oct, 103(4), 1001-3.

USE OF TRANEXAMIC ACID TO REDUCE INTRAOPERATIVE BLEEDING IN CRANIOTOMY FOR MENINGIOMA PATIENTS

AhsanKhaliqu Siddiqui¹, Rajesh Raman², Zia Arshad³, Hemlata⁴, Satish Varma⁵, Ahmad Suhaeb Hashmi⁶

ABSTRACT

BACKGROUND:

Intraoperative blood loss is always a concern to anaesthesiologist. Blood loss in neurosurgery may cause major complication require blood transfusion. The purpose of this study was to assess the effect of tranexamic acid (TXA) on intraoperative and postoperative blood loss and other benefit of tranexamic acid on output of meningioma surgery.

MATERIAL AND METHOD:

This study is a prospective, randomized and double-blinded study conducted in department of Neurosurgery, King George Medical University, and Lucknow, India from January 2017 to January 2018. A total of 100 patients aged 15-75 years, with American Society of Anaesthesiologists physical Status 1 and 2 scheduled to undergo elective craniotomy for meningioma excision were enrolled. Patients were divided into two groups. Each group received either 2 gram of

tranexamic acid in 50 ml normal saline or 50 ml normal saline with placebo just after induction of anaesthesia. We observed intra and postoperative blood loss, blood transfusion and duration of surgery, postoperative complications like nausea, vomiting, thromboembolic complications and postoperative stay in hospital.

Results: The intraoperative blood loss was significantly decreased. Need for blood transfusion also decreased in tranexamic group. This decreased blood loss caused decreased postoperative complications and stay in hospital.

CONCLUSION:

There is a significant reduction in the total amount of blood loss in TXA group causing reduction in intraoperative transfusion requirement and less postoperative complications and stay in hospital.

KEYWORDS:

Intraoperative blood loss; neurosurgery; meningioma; tranexamic acid (TXA)

-
- Author –**
- 1. Dr. Ahsan Khaliq Siddiqui**, Associate Professor, Department of Anesthesiology and ICU, King George Medical College, Lucknow, UP, India
 - 2. Dr. Rajesh Raman**, Assistant Professor, Department of Anesthesiology and ICU, King George Medical College, Lucknow, UP, India (Corresponding Author)
 - 3. Dr. Zia Arshad**, MD, Associate Professor, Department of Anesthesiology and ICU, King George Medical College, Lucknow, UP, India
 - 4. Dr. Hemlata**, Assistant Professor, Department of Anesthesiology and ICU, King George Medical College, Lucknow, UP, India
 - 5. Dr. Satish Varma**, Assistant Professor, Department of Anesthesiology and ICU, King George Medical College, Lucknow, UP, India
 - 6. Dr. Ahmad Suhaeb Hashmi**, MBBS final year student, King George Medical College, Lucknow, UP, India

INTRODUCTION—

Meningiomas are usually benign tumors arising from the meninges of the brain and spinal cord. They represent about one-third of all primary brain tumors. With the help of modern surgical equipment and skin holding clip, blood loss in meningiomas is not a major issue. But sometimes blood loss is causing complication in neurosurgery that requires transfusion of multiple units of blood.¹ Tranexamic acid is used to treat or prevent excessive blood loss from trauma, surgery, and in various medical conditions including hemophilia and heavy menstrual bleeding. In other words Tranexamic acid is an antifibrinolytic. It works by preventing blood clots from breaking down too quickly. This helps to reduce excessive bleeding during various surgeries and dental extractions in haemophiliacs.^{2, 3} Tranexamic acid can be used as local or as general fibrinolytic. As local fibrinolytic, tranexamic acid can be used in prophylaxis and treatment in patients at high risk of pre and post-operative haemorrhage following prostatectomy, conisation of the cervix, surgical procedures. For general fibrinolysis, tranexamic acid is used in haemorrhagic complications in association with thrombolytic therapy or haemorrhage associated with disseminated intravascular coagulation with predominant activation of the fibrinolytic system. Recently its indication has been extended to decrease blood loss in various type of surgeries with expected more blood loss i.e. spinal surgeries, gynaecological surgeries, oncosurgeries, orthopedic surgeries specially arthroplasty, cardiac surgery. Recently the use of tranexamic acid has been extended to Neurosurgery. Meningiomas usually grow inward, causing pressure on the brain or spinal cord. They can also grow outward, towards the skull, causing it to thicken. Most meningiomas are noncancerous, slow-growing tumors. Some contain sacs of fluid (cysts), mineral deposits

(calcifications), or tightly packed bunches of blood vessels. These blood vessels may bleed some time profusely.

Tranexamic acid is frequently used following major trauma.⁴ Tranexamic acid comes in oral and intravenous forms. It should be given very slowly intravenously. Injections should not be administered by the intramuscular route. To achieve local fibrinolysis, the recommended standard dose is 5-10ml (500-1000mg) by slow intravenous injection (1 ml/min), three times daily. Following an initial intravenous injection, subsequent treatment may proceed by intravenous infusion. In spinal surgeries like scoliosis surgery, Tranexamic Acid could be used up to 4-5 gram. In such spinal surgeries, after giving 500-1000 mg bolus, further dose may be administered at a rate of 10-20 mg/kg body wt/hour throughout the surgery.

The efficacy and safety of Tranexamic acid in children undergoing surgery have not been fully established. In elderly patients there is no need to reduce dosage unless there is evidence of renal failure. Due to the risk of cerebral oedema and convulsions, intrathecal or intraventricular injection and intracerebral application are contra-indicated. In patients with a history of convulsion, tranexamic acid should not be administered. In case of haematuria of renal origin, there is a risk of mechanical anuria due to formation of a ureteral clot.

MATERIAL AND METHODS –

This study is a prospective, randomized and double-blinded study conducted in department of Neurosurgery, King George Medical University, Lucknow, UP, India from January 2017 to January 2018 after obtaining the ethics committee approval from King George Medical University Ethics

Committee. After obtaining written informed consent, we took 100 patients in age group from 15-75 years, belonging to American Society of Anaesthetist 1 and 2 physical status of either sex, admitted for elective intracranial meningioma excision surgery. Patients with hepatic and renal disorders, with bleeding diathesis/abnormal coagulation parameters (abnormal prothrombin time [PT], platelet counts), patient on aspirin or any other anticoagulants and patients undergoing intracranial vascular surgeries and patients with haemoglobin less than 10 gram% were excluded from the study. Demographic data such as sex, age and weight were noted. Patients were randomly divided into two groups by computer generated list with 50 patients in each group. A 20 gauge cannula was placed in a dorsal vein of the non-dominant hand in pre surgical room. All the patients were premedicated with intravenous midazolam 0.10 mg/kg body weight. Fifteen minutes after premedication the patients were taken to the operating room. In the operating room all standard monitors including blood pressure (BP), oxygen saturation (SpO₂), and ECG (HR and rhythm) were applied. Anaesthesia was induced with fentanyl 2 mg/kg, propofol 2–2.5 mg/kg body weight and rocuronium was used for relaxation. Endotracheal tube was inserted after loss of consciousness and the lungs were ventilated to maintain the end-tidal carbon dioxide partial pressure between 30-35 mmHg. Anaesthesia was maintained in both groups with sevoflurane in Oxygen and Air. It is our standard protocol to insert a CVP line in right internal Jugular vein with help of ultrasound and Arterial line in non-dominant hand were inserted after induction of anaesthesia and intubation.

Identical 50 ml syringes containing either 2 gram of Tranexamic Acid in 50 ml Normal

Saline (NS 0.9%) or 50 ml NS only were prepared according to study designed. Syringes were prepared and concealed by an anaesthesia resident not involved in any other part of the study. Another anaesthesiologist blind to both groups and drug syringes allocation was responsible for application of the concealed syringes and recording all data. All 100 patients were randomly divided into two groups by computer generated list with 50 patients in each group. Group T (Tranexamic group) received 2 gram of Tranexamic Acid in 50 ml 0.9% normal saline and Group C (Control group) received only 0.9% Normal Saline 50 ml. The anaesthetic technique was standardized for all patients. Throughout the Surgery in all patients' blood pressure was maintained within 20 % of their baseline value in all patients. Blood loss was assessed by collection of blood in suction and weighting the surgical sponges used in surgery. Post-operative blood loss was assessed by seeing the blood accumulated in drain in first 24 hours postoperatively. We assessed the total intraoperative and post-operative blood loss, post-operative nausea and vomiting and postoperative stay in hospital.

STATISTICAL ANALYSIS–

Patients' demographic, clinical and laboratory parameters were recorded. The number of patients and their demography, clinical parameters included for this study were expressed as the mean - + standard deviation and analysed by one way analysis of variance (ANOVA) test. Student's t-test was used for comparison of normally distributed data, while Mann-Whitney U-test was used for data which did not achieve normality.

Data were tested for normal distribution using the Kolmogorow-Smirnov test. All statistical analysis was carried out at 5% level of

significance and the p value of <0.05 was considered significant and if p value was > 0.05, it will be considered that there were no statistically significant differences between the two groups. Statistical analysis was carried out using SPSS statistical software version 16.

RESULT

Fifty patients in each group completed the study. There were no significant difference between both groups with respect to the demographic data and position of patients during surgery as shown in table 1. Table 2 is showing comparison between duration of surgery, total blood loss, post-operative stay in hospital, and number of patients required blood transfusion.

The total blood loss in the group T (Tranexamic Acid group) was 469+ 117.75 ml which is much less than the blood loss in

Control group (Group C) where the blood loss was 672+184.37 ml. Duration of surgery was also significantly decreased in group T with comparison to group C. In group T, duration of operation was 4.10+0.72 hours whereas 4.66+0.78 hours. The post operation stay in hospital was also less in group T when compare it to group C, 6.44+1.65 days in group-T and 8.48 days in group-C, which is also significant. Total number of patients required blood transfusion whether intra-operative or postoperative in group T was also significantly less than Control group.

In table-3 we compare postoperative complications in terms of postoperative blood loss in drain, number of patients developed Nausea and Vomiting, Seizer activity, thromboembolic complications and post-operative mortality within 48 hours of operation. We found that there is no significant deference in both group.

Table 1 - Patient characteristics in each group. Age and weight data are expressed in Mean±SD

	Group T	Group C	p value
Age (Yr.)	50.1±14.62	49.44±14.36	0.820 (p>0.05)
Weight (KG)	68.7±16.98	68.54± 16.22	0.961 (p>0.05)
Male /Female	28/22	32/18	p > 0.05
ASA status (I&II)	40/10	40/10	p > 0.05
Position during Surgery (Supine/ prone)	38/12	41/9	

ASA- American Society of Anaesthesiologists, SD – Standard deviation

Table 2 – Comparison between duration of surgery, total blood loss, post-operative stay in hospital, and number of patients who required blood transfusion (data are in Mean±SD)

	Group T	Group C	p value
Total blood loss (ml)	469 ± 117.75	672±184.37	P < .001
Duration of Surgery (hours)	4.10 ± 0.72	4.66 ± 0.78	P < .001
Post op. stay in hospital (Days)	6.44±1.65	8.84±2.26	P < .001
No. of patients required transfusion	7	12	

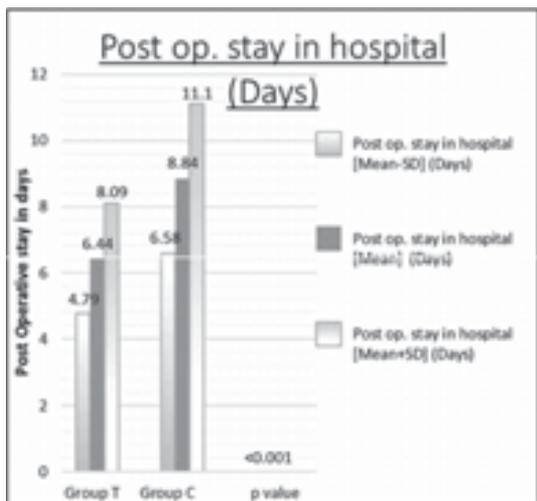
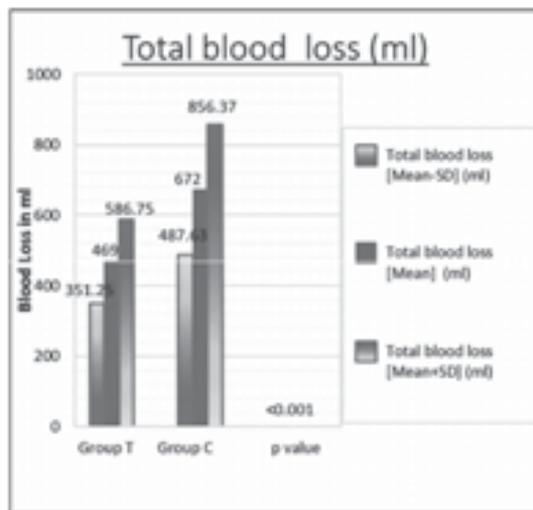
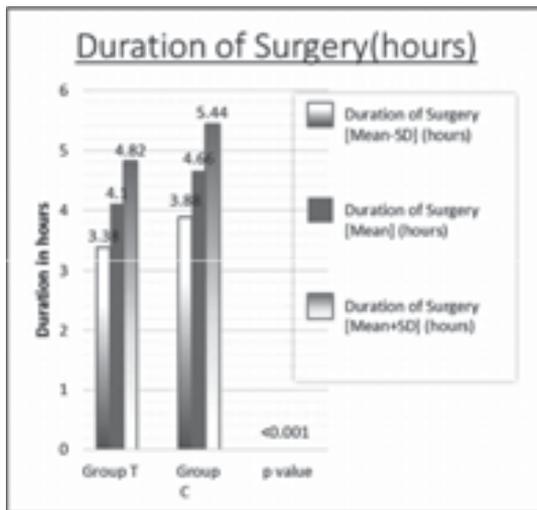


Table 3 - Post operative complication and mortality in 48 hours.

	Group T	Group C
Post-operative blood loss	not significant	not significant
Patients develop Nausea/ vomiting post - operative	12	14
Seizure activity	4	4
Thromboembolic Complications	Nil	Nil
Post-operative mortality within 7 days	2	3

DISCUSSION –

We anaesthetists are always trying to decrease intraoperative blood loss by using various techniques like decreasing the mean blood pressure, controlling the depth of anesthesia and using adequate relaxation. We know that the transfusion of homologous blood and blood products are exposing the patients to risks of infectious disease transmission, transfusion reaction, and immunosuppression.^{5,6} Furthermore, replacement of massive intraoperative bleeding with crystalloids and packed erythrocytes during the surgery can dilute the coagulation factors and further increase surgical bleeding.⁷

Several scientific studies to reduce blood loss and transfusion requirements have been done.^{8,13} However, none of these scientific research and strategies are free of complications. Hemodilution and controlled hypotension may compromise tissue oxygen delivery during rapid blood loss.¹⁴

Here, the purpose of our study was to assess the effectiveness of tranexamic acid, an antifibrinolytic drug, on intraoperative and

post-operative blood loss and blood transfusion in patients undergoing craniotomy for meningioma (tumor) excision. We observed that the intravenous administration of tranexamic acid caused significant decrease in intraoperative and postoperative blood loss. This decreased blood loss is responsible for less intraoperative and postoperative blood transfusion, decrease duration of surgery and postoperative complications like postoperative nausea and vomiting and less postoperative stay in hospital. We know that tranexamic acid (Trans 4 amino methyl cyclohexane carboxylic acid), an antifibrinolytic drug, inhibits the conversion of inactive plasminogen to the active proteolytic enzyme plasmin by competitively blocking of high affinity lysine binding site of plasminogen.¹⁵ This prevents plasmin from binding to fibrinogen and fibrin structures after clot formation and decrease oozing and blood loss from operative site.

Previous studies are showing that tranexamic acid is found to decrease blood loss significantly in major orthopaedic surgeries. Four relevant prospective,

randomised studies have shown a reduction of about 50% in both the postoperative blood loss and the need for blood transfusion on the first postoperative day in patients who received prophylactic tranexamic acid when operated on for a total knee replacement.¹⁶

In Spinal surgeries, studies have shown a significant reduction in intraoperative bleeding. The requirement for blood transfusion when they used tranexamic acid, aminocaproic acid, aprotinin, and recombinant activated factor VII just preoperative or intraoperatively, tranexamic acid was showing better results.¹⁷ In spine surgery, e.g. scoliosis correction with posterior spinal fusion using instrumentation, to prevent excessive blood loss tranexamic acid was found very effective.¹⁸

The safety and efficacy of the antifibrinolytic, tranexamic acid in elective neurosurgical procedures is not well known. Complex skull base neurosurgery has the potential for increased intraoperative blood loss and coagulation near eloquent cranial structures should be minimized. Mebel D et al. Published a study in 1999 on complex skull base neurosurgery and use of tranexamic acid. The primary objective was to determine the relationship between the use of tranexamic acid and transfusion at our institution. Their results demonstrate that tranexamic acid use is associated with reduced transfusion rates in their study population, with no apparent increase in seizure or thrombotic complications. The author emphasized the need for further randomized clinical trials to evaluate the efficacy and safety of tranexamic acid on perioperative blood loss during complex skull base neurosurgery.¹⁹

The clinical randomization of an

antifibrinolytic in significant haemorrhage (CRASH-2) trial in potential head injury patients, published in 2010, assessed the effect of early administration of tranexamic acid to adult patients with trauma with or without risk of significant haemorrhage within 8 hours of injury. This trial showed significant reduction of all-cause mortality with no increase in vascular occlusive events.²⁰

To quantify the effect of TXA on intracranial haemorrhage, the CRASH-2 Intracranial Bleeding Study evaluated 270 adult patients with TBI (traumatic brain injury) out of 20,211 trauma patients recruited in the CRASH-2 trial.²¹ There was a reduction in intracranial haemorrhage growth, ischemic lesions and mortality in TXA allocated patients, but these results were statistically insignificant showing neither moderate benefits nor harmful effects of TXA in traumatic brain injuries (TBI) patients. Results of ongoing CRASH-3 will reliably determine the effectiveness of early administration of TXA in TBI patients.²² In surgical corrections of craniosynostosis in children it reduces the need for blood transfusions. In another study, the aim of the study is to estimate clinical effectiveness of fibrinolysis inhibitor, Tranexamic Acid in neurosurgical patients with intracranial tumors. To study hemostasis: APPT, PT index, TT, fibrinogen, ATIII activity, factor XII-derived fibrinolysis, spontaneous euglobulinolysis. In this study, the use of Tranexamic Acid caused significant decrease of fibrinolytic activity and bleeding reduction from the wound. The duration of surgical haemostasis in the tranexamic acid group is significantly lower than in the control group. Drainage blood loss was lower in the main group than in the control group. Thus Tranexamic acid decreases the risk of intraoperative blood loss in the patients with brain tumors.

In another study, Novikov V Iu and Kondrat'ev AN estimated the clinical effectiveness of Tranexamic Acid in neurosurgical patients with intracranial tumors. Tranexamic Acid injection during diffuse bleeding from small vessels led to quick and visible bleeding reduction. Thus Tranexamic Acid decreases the risk of intraoperative blood loss in the patients with brain tumors.²³

In terms of intravenous thromboembolic complications during and after the TKA operation, a short-term use of TXA can significantly decrease blood loss and blood transfusion with no increasing risk for venous thrombosis.²⁴ The author investigated the effect of treatment with TXA, on blood loss, blood transfusion requirements and blood coagulation. Coagulation profile was examined (bleeding time, platelet count, prothrombin time (PT), activated partial thromboplastin time (aPTT), plasminogen, beta-thromboglobulin and fibrinogen). Fibrinolysis was evaluated by measurement of concentrations of D-dimer and fibrinogen degradation products (FDP). Total blood loss in the TXA group was significantly less during surgery. Postoperative packed cell volume values were higher in the TXA group despite fewer blood transfusions. Postoperative concentrations of plasminogen were decreased significantly in the tranexamic acid group ($P < 0.001$). Platelet count, PT, aPTT, bleeding time, beta-thromboglobulin, fibrinogen and FDP concentrations did not differ between groups, but D-dimer concentrations were increased in the control group. Thromboembolic complications were similar in both groups.²⁵

When the safety and efficacy of tranexamic acid (TXA) in total knee arthroplasty (TKA) and total hip arthroplasty (THA) was evaluated in a meta-analysis for total blood

loss, the incidence rate of deep vein thrombosis (DVT) and pulmonary embolisms (PE) was not significant and the number of patients requiring at least 1 unit of red blood cell following surgery was also significantly less. It suggests that the use of TXA reduced the risk of blood loss and the need for allogeneic blood transfusion significantly, without apparent increased risk of DVT or PE complications.²⁶ In a systematic review and meta-analysis study of randomised controlled trials evaluating the effect of tranexamic acid (TXA) upon blood loss and transfusion in primary total knee replacement, Subgroup analysis of high-dose (> 4 g) TXA showed a plausible consistent reduction in blood transfusion requirements. The current evidence from trials does not support an increased risk of deep-vein thrombosis or pulmonary embolism due to TXA administration.²⁷ Keeping in mind this meta-analysis in our study we have chosen 2 gram of TXA as our study dose. For thrombotic risks of TXA use in non-cardiac surgery more studies and clinical trials are needed. Patients with any hypercoagulable risk factors, including HIV infection or any prior thrombotic history in which TXA use is being considered, should prompt a discussion among the perioperative physicians involved.²⁸ Hence, TXA use in this context is still an area of uncertainty, and its thrombogenic risks are yet to be studied as a primary outcome in any large prospective trial to date.

CONCLUSION –

Significant reduction in the total amount of blood loss in TXA group is responsible for significant reduction in intraoperative blood transfusion requirement.

REFERENCES –

1. Vel R, Udipi BP, Prakash MVSS, Adinarayanan S, Mishra S, Babu L. Effect of low dose tranexamic acid on intra-operative blood loss in neurosurgical patients. *Saudi J Anaesth.* 2015 Jan-Mar; 9(1): 42–48.
2. Melvin JS, Stryker LS, Sierra RJ. Tranexamic Acid in Hip and Knee Arthroplasty. *The Journal of the American Academy of Orthopaedic Surgeons* 2015; 23: 732–40.
3. Tengborn L, Blombäck M, Berntorp E. Tranexamic acid: an old drug still going strong and making a revival. *Thrombosis research* 2015. 135 (2): 231–42.
4. Binz S, McColleston J, Thomas S, Miller J, Pohlman T, Waxman D, Shariff F, Tracy R, Walsh M. CRASH-2 Study of Tranexamic Acid to Treat Bleeding in Trauma Patients: A Controversy Fueled by Science and Social Media. *Journal of blood transfusion* 2015: 874–920.
5. Marcucci C, Madjdpour C, Spahn DR. Allogeneic blood transfusions: Benefit, risks and clinical indications in countries with a low or high human development index. *Br Med Bull.* 2004; 70:15–28.
6. Soldan K, Barbara J. The risks of infection transmission by blood transfusion in England. *J Clin Pathol.* 1999; 52:405–8.
7. Murray DJ, Pennell BJ, Weinstein SL, Olson JD. Packed red cells in acute blood loss: Dilutional coagulopathy as a cause of surgical bleeding. *Anesth Analg.* 1995; 80:336–42.
8. Fearon JA, Weinthal J. The use of recombinant erythropoietin in the reduction of blood transfusion rates in craniosynostosis repair in infants and children. *Plast Reconstr Surg.* 2002; 109:2190–6.
9. Meneghini L, Zadra N, Aneloni V, Metrangolo S, Faggini R, Giusti F. Erythropoietin therapy and acute preoperative normovolaemic haemodilution in infants undergoing craniosynostosis surgery. *Paediatr Anesth.* 2003; 13:392–6.
10. Dahmani S, Orliaguet GA, Meyer PG, Blanot S, Renier D, Carli PA. Perioperative blood salvage during surgical correction of craniosynostosis in infants. *Br J Anesth.* 2000; 85:550–5.
11. Deva AK, Hopper RA, Landecker A, Flores R, Weiner H, McCarthy JG. The use of intraoperative autotransfusion during cranial vault remodeling for craniosynostosis. *Plast Reconstr Surg.* 2002; 109:58–63.
12. Hans P, Collin V, Bonhomme V, Damas F, Born JD, Lamy M. Evaluation of acute normovolemic haemodilution for surgical repair of craniosynostosis. *J Neurosurg Anesthesiol.* 2000; 12:33–6.
13. Rosenblatt MA. Strategies for minimizing the use of allogeneic blood during orthopedic surgery. *Mt Sinai J Med.* 2002; 69:83–7.
14. Kuppurao L, Wee M. Perioperative cell salvage. *Contin Educ Anaesth Crit Care Pain.* 2010; 10:104–8.
15. Dunn CJ, Goa KL. Tranexamic acid: A review of its use in surgery and other indications. *Drugs.* 1999; 57:1005–32.
16. Nielsen RE, Husted H. Tranexamic acid reduces blood loss and the need of blood transfusion after knee arthroplasty. *Ugeskr Laeger* 2002 ; 164(3):326–9
17. Willner D, Spennati V, Stohl S, Tosti G, Aloisio S, Bilotta F. Spine Surgery and Blood Loss: Systematic Review of Clinical Evidence. *Anesth Analg.* 2016 ; 123:1307–1315.

18. Sethna NF, Zurakowski D, Brustowicz RM, Bacsik J, Sullivan LJ, Shapiro F. Tranexamic acid reduces intraoperative blood loss in paediatric patients undergoing scoliosis surgery. *Anesthesiology* 2015;102:727-32.
19. Mebel D, Akagami R, Flexman AM. Use of Tranexamic Acid Is Associated with Reduced Blood Product Transfusion in Complex Skull Base Neurosurgical Procedures: A Retrospective Cohort Study. *Anesth Analg*. 2016; 122:503-8.
20. CRAHS-2 Collaborators, Roberts I, Shakur H, Afolabi A et al. The importance of early treatment with tranexamic acid in bleeding trauma patients: an exploratory analysis of the CRASH-2 randomised control trial. *Lancet* 2011; 377:1096-101.
21. CRASH-2 Collaborators, Intracranial Bleeding Study. Effect of tranexamic acid in traumatic brain injury: A nested randomised, placebo controlled trial (CRASH-2 Intracranial Bleeding Study). *BMJ* 2011; 343:d3795.
22. Dewan Y, Komolafe EO, Mejía-Mantilla JH, Perel P, Roberts I, Shakur H. CRASH-3-tranexamic acid for the treatment of significant traumatic brain injury: Study protocol for an international randomized, double-blind, placebo-controlled trial. *Trials* 2012; 13:87.
23. Novikov V Iu, Kondrat'ev AN, Driagina NV, Nazarov RV. Using of tranexamic acid (Tranexam) for prevention and correction of coagulopathy during brain tumors removal [Article in Russian] *Anesteziol Reanimatol*. 2011 Jul-Aug; (4):61-6.
24. Zhongguo Xiu Fu Chong Jian Wai Ke Za Zhi. Clinical comparative studies on effect of tranexamic acid on blood loss associated with total knee arthroplasty. 2007 Dec; 21(12):1302-4.
25. Jansen AJ1, Andreica S, Claeys M, D'Haese J, Camu F, Jochmans K. Use of tranexamic acid for an effective blood conservation strategy after total knee arthroplasty. *Br J Anaesth*. 1999 Oct; 83(4):596-601.
26. Wei Z, Liu M. The effectiveness and safety of tranexamic acid in total hip or knee arthroplasty: a meta-analysis of 2720 cases *Transfus Med*. 2015 Jun; 25(3):151-62.
27. Alshryda S1, Sarda P, Sukeik M, Nargol A, Blenkinsopp J, Mason JM. Tranexamic acid in total knee replacement: a systematic review and meta-analysis. *J Bone Joint Surg Br*. 2011 Dec; 93(12):1577-85.
28. Gerstein NS, Brierley JK, Culling MD. Left ventricle thrombus after tranexamic acid for spine surgery in an HIV-positive patient. *Spine J*. 2016 Feb; 16(2):e77-82.

PREOPERATIVE HYPOGLYCAEMIA UNAWARENESS (HU) IN TYPE - 2 DIABETES MELLITUS: A CASE REPORT

Lakesh Anand¹, Manpreet Singh², Jasveer Singh³, Dheeraj Kapoor⁴

The phenomenon of hypoglycemia unawareness (HU) is defined at the onset of neuroglycopenia before the appearance of autonomic warning symptoms or as the failure to sense a significant fall in blood glucose below normal levels (70 mg/dl).^{1,2} Patients with moderate (41-70 mg/dl) or severe (40 mg/dl) hypoglycaemia have been found to have a higher risk of death; even one episode of hypoglycaemia is associated with higher mortality.³

Perioperative HU has a higher risk for severe hypoglycemia and its associated morbidity and mortality so should be managed carefully. We describe a Type-2 diabetic patient found to be HU with fasting blood glucose (FBG) of 10-12 mg/dl.

CASE REPORT

A 63 years female patient weighing 78 kg was scheduled for elective lumbar spine surgery (Discectomy at L5-S1 level). She had a history of diabetes mellitus since last 10 years and Parkinsonism for last 3 years. She was on oral

hypoglycemic agent (OHA) Tab Trigulin (glimpiride 2mg, pioglitazone 15mg and metformin hydrochloride 500mg) before breakfast and Tab Syndopa (L-dopa 100 mg plus carbidopa 10 mg) once daily. She had refused for any other significant systemic illness.

On the first pre-anaesthesia assessment, she had normal physical and systemic examination; routine hematologic and biochemical examination except the diabetic status (FBS 210 mg/dl and glycated haemoglobin [HbA1c] 8.5%). Clinical diagnostic tests of diabetic autonomic neuropathy including (heart rate variability, orthostatic hypotension and Valsalva maneuver) were negative. Being her elective surgery she was referred to physician for control blood sugar. She was advised to take Tab Trigulin BD (before breakfast and before dinner).

After 15 days she was admitted for surgery with fairly controlled blood sugar (FBS 90-100

Authors 1 : Professor

Authors 2-4 : Associate Professor

Affiliation : Department of Anaesthesia and Intensive Care,
Govt. Medical College and Hospital, Sector 32 , Chandigarh

Address for Correspondence

Dr Manpreet Singh

Department of Anaesthesia and Intensive Care,
Govt. Medical College and Hospital, Sector 32 , Chandigarh
Email: manpreetdawar@gmail.com

and PP 140-160 mg/dl) with following advise 1) Nil per orally after mid night) Omit morning dose of OHA (Tab Trigulin), 3) Tab Alprazolam (0.25 mg) and Tab Ranitidine (150 mg) HS and 6.30 AM with a sip of water, 4) Random blood glucose (RBG) monitoring 6 hourly.

The first RBS at 5:30 pm was 100 mg/dl. As per instructions patient had evening OHA (Tab Trigulin) before dinner at 9:00 PM. The RBS at 11:30 PM was 195 mg/dl. On the day of surgery her FBG at 6:00 am was 68 mg/dl and the serum electrolytes were normal. She was shifted to the pre-operative area lying on bed for elective surgery.

On examination in the pre-operation area the she was conscious, oriented to time, place and person and responding to verbal commands. She was afebrile and vital parameter includes pulse rate 80 beats/min, blood pressure 110/70mmHg, and oxygen saturation (SpO₂) on room air 98%. Systemic examination of cardiovascular system and respiratory system were within normal limits.

Considering the morning 6 am FBG of 68 mg/dl, repeat FBS was ordered at 9.00 am which came out to be 10 mg/dl (Accu-Chek). This was a strange for us that without the clinical symptoms and signs how could be FBS is too low. To confirm the blood sugar, a repeat blood sample of patient and control sample of other patient (with glucometer reading 118 mg/dl concealed) were sent to the central laboratory. The laboratory reports of blood sugar were 12 mg/dl and 110 mg/dl (Reflotron Plus[®] Roche, Boston UK) for patient and control respectively. Surgery was postponed and 100 ml of 20% glucose (20 g) was given intravenously.⁴ Subsequently, her husband revealed that midnight RBS was 195 mg/dl, to avoid morning cancelation of surgery; ignorantly one Tab Trigulin was given in the night. The diagnosis of hypoglycaemia

unawareness in type-2 diabetes mellitus was made.

DISCUSSION

Hypoglycemia is usually defined as plasma glucose level less than 70 mg/dl.⁵ This patient had the very low BG value 10-12 mg/dl without any neurogenic or neuroglycopenic symptoms. Continuing general anaesthesia without treating hypoglycaemia could have been disastrous. Plasma glucose below this threshold (60–69 mg/dl), the brain becomes neuroglycopenic. Since the brain is permanently dependent on glucose as major fuel, stimulate the novel counter-regulatory mechanisms to quickly increase glucose levels to protect the human body from the adverse consequences of hypoglycemia. Counter-regulatory response to hypoglycemia includes inhibition of the endogenous insulin secretion and stimulation of glucagon, catecholamines (norepinephrine, epinephrine), cortisol and growth hormone secretion, which all together stimulate hepatic glucose production and cut down glucose utilization in peripheral tissues, increasing in this way plasma glucose levels. As glycaemia comes down, the activation of the autonomic nervous system leads to neurogenic (anxiety, palpitations, sweating, tingling, trembling, etc.), or neuroglycopenic symptoms (irritability, drowsiness, dizziness, blurred vision, difficulty with speech, confusion, feeling faint) which allows the perception of hypoglycaemia.^{1,6}

MECHANISMS OF HU

The risk of HU with anti-hyperglycemic agents is an important limiting factor in the management of type-1 and type 2 diabetes mellitus. While HU is more common in type-1 diabetes, the incidence is high in type-2 diabetic patients who use insulin particularly patients with longer duration of diabetes. The

underlying aetiology of HU in diabetes is a complex interaction between hyperinsulinemia and compromised physiologic and behavioural responses to falling glucose levels. Pancreatic dysfunction also causes loss of normal therapeutic response to hypoglycaemia, a reduction in circulating insulin in type-2 diabetes and an increase in glucagon secretion. In type-1 and advanced type-2 diabetes, the third defence against hypoglycemia is increase in adrenomedullary sympathoadrenal epinephrine secretion, which is also compromised, causing the syndrome of defective glucose counter-regulation.^{1,7} Diminished increase in epinephrine, also called hypoglycemia-associated autonomic failure (HAAF), is largely responsible for defective glucose counter-regulation. HAAF can result in recurrent hypoglycemia and lowering of glycemic threshold that typically triggers sympathoadrenal response to hypoglycemia. This result in hypoglycemia without warning symptoms, or HU which increases the risk of severe hypoglycemia associated with substantial morbidity and mortality.^{7,8}

Though the aetiology of HU is multifactorial, in a setting of endogenous insulin deficiency possible mechanisms include chronic exposure to low blood glucose, antecedent hypoglycaemia, recurrent severe hypoglycaemia and the failure of counter-regulatory hormones. Clinically it manifests as the inability to recognise impending hypoglycaemia by symptoms, but the mechanisms and mediators remain largely unknown.⁹

Several medications associated with hypoglycaemia cited in the literature (fluoroquinolones, indomethacin, pentamidine, quinine, angiotensin

converting enzyme inhibitors [ACEIs], selective serotonin reuptake inhibitors (SSRIs), Beta blockers, ethanol, lithium, propoxyphene, and sulfamethoxazole) with different mechanism of action. It is important to take in to the consideration of concomitant therapy in the patient.¹⁰⁻¹²

CONSEQUENCES OF HU

Severe episodes of hypoglycemia or HU requiring the assistance of another have been shown to be associated with an increased risk of mortality. The HU is less common in type-2 diabetic patients. In a retrospective survey of subjects with insulin-treated type-2 diabetes showed that only 9.8% had HU estimated by a validated scoring system. However, in the patients with HU the incidence of severe hypoglycaemia was 17-fold higher those with normal hypoglycemia awareness.¹³

In several studies, using continuous glucose monitoring, asymptomatic hypoglycemia was detected in 47% and 56% of subjects with type-2 diabetes, treated with different treatment regimes. These findings suggest that HU may be more prevalent in type-2 diabetes than is appreciated. The use of continuous glucose monitoring in patients with type-2 diabetes can improve glycemic control, but other benefits include modification of diet and exercise, detection of unrecognized hypoglycemia and identification of hyperglycemia excursions.^{14,15}

Severe hypoglycemia, due to HU, was associated in type - 2 diabetic patients with cardiovascular and neurological complications. In patients with type-2 diabetes and coronary artery disease, severe hypoglycemia was associated with ischemic electrocardiogram changes and chest pain, and may account for sudden mortality.⁵ In a recent retrospective study in type-2 diabetes

subjects, the patients who have predictors for severe hypoglycemia were associated with an increased risk of cardiovascular disease, further supporting notion was that avoiding severe hypoglycemia may be important in preventing cardiovascular disease in this patient population.¹⁶ Behavioral changes, cognitive impairment, seizures, coma and mortality are well-known neurological complications of severe and prolonged hypoglycemia secondary to HU.¹⁷

Finally, a frequently problem in type-2 diabetes is nocturnal hypoglycemia. Undetected nocturnal hypoglycaemia often contributes to HU. Nocturnal hypoglycemia has been associated with cardiac arrhythmias resulting in sudden death.¹⁸ Our patient had the very low blood sugar value 10-12 mg/dl without any neurogenic/ neuroglycopenic symptoms or electrocardiographic findings. This could be explained by the adaptive response to HAAF.¹⁹

The goal to prevent HU is the complete avoidance of hypoglycemia, by optimising treatment (insulin treatment/OHA), blood glucose monitoring and of course the patient education. Commonly used antihypertensive, β -blockers alter the effects of epinephrine and can have potential effects on glucose homeostasis and the hypoglycemic counter-regulatory system. The notable concern regarding β -blockers is their potential effect on HU and blunting of the return to euglycemic levels after hypoglycaemia, through the suppression of all adrenergically mediated symptoms of hypoglycemia.¹¹

The development HU has been associated with use of SSRIs. The mechanism by which SSRIs might be associated with HU is

unknown, but it has been hypothesized that the effect could be mediated by an atypical presentation of serotonin syndrome that will lead to autonomic dysfunction. Accordingly, treatment with SSRIs may alter the perception of hypoglycemia, and should be used with caution in diabetic subjects with HU.¹²

PERIOPERATIVE HYPOGLYCEMIA

Patients with history of longer duration of diabetes, hypoglycemia, HU and autonomic neuropathy are at an increased risk for perioperative morbidity and mortality. Most conscious patients preserved their counter-regulatory response to hypoglycaemia, experience warning signs and symptoms of when blood glucose drops below the threshold level of 60–69 mg/dl. Ultimately, profound hypoglycemia may lead to brain death or cardiac arrhythmias and death.²⁰ Patients with poorly controlled or long-standing diabetes with HU may not experience neurogenic/neuroglycopenic symptoms. Hypoglycemic symptoms in elderly patients are often nonspecific and less obvious due to diminished autonomic responses.²¹ Hypoglycemic symptoms are abolished during general anaesthesia and sedation and severe hypoglycemia can only be detected by adequate glucose monitoring. Patients with HU can have serious intraoperative complication even during, peripheral and central neural blocking techniques and monitored anaesthesia care. In spite of well controlled diabetic in HU patients, blood glucose levels below 72 mg/dl should be treated promptly and blood glucose targets should be relaxed (72-180 mg/dl). This will provide sufficient time to manage HU and prevent symptoms of hypoglycemia. Perioperative hypoglycemia for a blood sugar (72-110 mg/dl) may be treated with 50 ml of 20% glucose and for hypoglycaemia less than

72 mg/dl a dose of 100 ml (20 g) should be given if venous access is available.⁴ Otherwise, 1 mg of glucagon may be administered subcutaneously. Blood glucose should be reassessed 15 minutes after treatment.²²

In diabetic patients with HU blood glucose targets should be relaxed but not abandoned. An HbA1c of between 6-7% represents the best compromise between the risk of severe hypoglycemia and that of developing complications. Glycemic goals should be individualized with some degree of safety particularly for patients with long duration of diabetes, patients who have a high risk of HU and severe hypoglycemia development, and/or subjects with multiple co-morbidities.²³

Preoperative HU is a complex, difficult-to-study phenomenon has a much greater risk of severe hypoglycaemia, with its attendant morbidity. Hence, optimal perioperative management of patients with HU is crucial. One of the key principles is minimal disruption of the surgical outpatient's treatment regimen. Anaesthesiologists, as leaders of the 'surgical home' model, are perfectly poised to aid in the identification of these patients, initiate treatment, and facilitate referrals for prevention and management of HU. Certainly, early identification coupled with timely intervention contributes to significant risk reduction.

REFERENCES

1. de Galan BE, Schouwenberg BJ, Tack CJ, Smits P. Pathophysiology and management of recurrent hypoglycaemia and hypoglycaemia unawareness in diabetes. *Neth J Med* 2006; 64: 269-279.
2. Moghissi E, Ismail-Beigi F, Devine RC. Hypoglycemia: minimizing its impact in

type 2 diabetes. *Endocr Pract* 2013;19: 526-535

3. Finfer S, Liu B, Chittock DR, Robyn N, Colin M, Imogen M et al. Hypoglycemia and risk of death in critically ill patients. *N Engl J Med* 2012;367:1108.18.
4. Barker P, Creasey PE, Dhatariya K, Levy N, Lipp A, Nathanson MH et al. Perioperative management of the surgical patient with diabetes 2015. *Anaesthesia* 2015;70:1427-1440.
5. Desouza CV, Bolli GB, Fonseca V. Hypoglycemia, diabetes, and cardiovascular events. *Diabetes Care* 2010;33:1389-1394.
6. White JR. The contribution of medications to hypoglycemia unawareness. *Diabetes Spectrum* 2007;20(2):77-80.
7. Oyer DS. The science of hypoglycemia in patients with diabetes. *Curr Diabetes Rev* 2013;9(3):195-208.
8. Cryer PE. Mechanisms of hypoglycemia-associated autonomic failure in diabetes. *N Engl J* 2013;369:362-372.
9. Martín-Timón I, Del Cañizo-Gómez FJ. Mechanisms of hypoglycemia unawareness and implications in diabetic patients. *World J Diabetes* 2015;6(7):912-26.
10. Murad M, Coto-Yglesias F, Wang A, Sheidaee N, Mullan R, Elamin M et al. Drug-induced hypoglycemia: a systematic review. *J Clin EndocrinolMetab* 2009;94(3):741-5.
11. Hirsch IB, Boyle PJ, Craft S, Cryer PE. Higher glycemic thresholds for symptoms during beta-adrenergic blockade in IDDM. *Diabetes* 1991;40:1177-1186.
12. Sawka AM, Burgart V, Zimmerman D. Loss of awareness of hypoglycemia

temporally associated with selective serotonin reuptake inhibitors. *Diabetes Care* 2001;24:1845-6.

13. Schopman JE, Geddes J, Frier BM. Prevalence of impaired awareness of hypoglycaemia and frequency of hypoglycaemia in insulin-treated type 2 diabetes. *Diabetes Res Clin Pract* 2010;87:64-68.
14. Chico A, Vidal-Ríos P, Subirà M, Novials A. The continuous glucose monitoring system is useful for detecting unrecognized hypoglycemia in patients with type 1 and type 2 diabetes but is not better than frequent capillary glucose measurements for improving metabolic control. *Diabetes Care* 2003;26:1153-1157.
15. Hay LC, Wilmshurst EG, Fulcher G. Unrecognized hypo- and hyperglycemia in well-controlled patients with type 2 diabetes mellitus: the results of continuous glucose monitoring. *Diabetes Technol Ther* 2003;5:19-26.
16. Goto A, Goto M, Terauchi Y, Yamaguchi N, Noda M. Association between severe hypoglycemia and cardiovascular disease risk in Japanese patients with type 2 diabetes. *J Am Heart Assoc.* 2016;5:e002875.
17. Marrett E, Radican L, Davies MJ, Zhang Q. Assessment of severity and frequency of self-reported hypoglycemia on quality of life in patients with type 2 diabetes treated with oral antihyperglycemic agents: A survey study. *BMC Res Notes* 2011;4:251.
18. Allen KV, Frier BM. Nocturnal hypoglycemia: clinical manifestations and therapeutic strategies toward prevention. *Endocr Pract* 2003;9:530-543.
19. Cryer PE. Hypoglycemia-Associated Autonomic Failure in Diabetes: Maladaptive, Adaptive, or Both? *Diabetes* 2015;64(7):2322-2323.
20. Cryer P. Hypoglycemia, functional brain failure, and brain death. *J Clin Invest* 2007;117(4):868-870.
21. Abdelhafiz A, Rodriguez-Manas L, Morley J, Sinclair A. Hypoglycemia in older people—a less well recognized risk factor for frailty. *Aging Dis* 2015;6(2):156-167.
22. Polderman J, van Wilpe R, Eshuis JH, Preckel B. Ambulatory anesthesia: optimal perioperative management of the diabetic patient. *Ambulatory Anesthesia* 2016;3:13-22.
23. Qaseem A, Vijan S, Snow V, Cross JT, Weiss KB, Owens DK. Glycemic control and type 2 diabetes mellitus: the optimal hemoglobinA1c targets. A guidance statement from the American College of Physicians. *Ann Intern Med* 2007;147:417-22.

USE OF LEFT MOLAR APPROACH TO LARYNGOSCOPY IN AN ADULT PATIENT WITH AN UNANTICIPATED DIFFICULT AIRWAY: A CASE REPORT.

*Dr Nishkarsh Gupta¹, Dr Rohini Dattatri¹, Dr Sachidanand Jee Bharti¹,
and Dr Anju Gupta²,*

ABSTRACT

Unanticipated difficult airway can be challenging for anaesthesiologists. Many new gadgets are available which may help us in managing such situations. Left molar laryngoscopy has been described as an alternative technique for intubation in patients with anticipated difficult airway. We have described use of left molar technique of laryngoscopy for intubation in an unanticipated difficult airway for the first time.

INTRODUCTION

An unanticipated difficult airway scenario can be a testing time for any anaesthesiologist. Nearly 50% of difficult airway could be unanticipated. Inability to secure airway and oxygenation can have a disastrous effect. A structured approach is essential for successful management in such a scenario. Algorithms have been described by difficult airway society (DAS) to manage difficult airway with emphasis on proper airway assessment, pre-operative planning, pre-oxygenation, maintaining oxygenation, minimising trauma from airway interventions.^{1,2} Various methods have been described to improve glottis view and facilitate intubation like optimal positioning, adequate muscle relaxation, optimal external laryngeal manipulation (OLEM), use of videolaryngoscope (VL), fiberoptic bronchoscope, use of alternate technique etc. Left

molar direct laryngoscopy approach has also been successfully tried in some anticipated difficult airway cases^{3,4}. We are describing a successful management of an unanticipated difficult airway using left molar laryngoscopy for the first time. A written informed consent was obtained from the patient for publication.

CASE REPORT

A 45 year female, case of carcinoma (Ca) ovary with diabetes mellitus on oral hypoglycemic agent was posted for cytoreductive surgery. Airway examination was equivocal with Mouth opening > 3 fingers breath, Mallampati grade -2, thyromental distance >3 fingers breath, upper lip bite test – class 1, normal neck movement, BMI – 24 and prayer's sign – negative.

In the operating room electrocardiogram, non invasive blood pressure and pulse oximeter were attached. A 18G intravenous (IV) cannula was secured. Patient was pre-oxygenated with 100% oxygen for 3 minutes and then premedicated with IV fentanyl 2mcg/kg. Propofol 2mg/kg was given IV and after confirming ability to ventilate, rocuronium 0.6mg/kg i.v was given. Three minutes later, midline laryngoscopy was attempted using size 3 Mackintosh laryngoscope blade. A Cormack Lehane (CL) grade 3b was observed. Application of OELM improved the CL

Institutional affiliations:

1 : Department of Onco-Anesthesiology and Palliative Medicine, AIIMS, Delhi, India

2: Department of Anesthesiology, Chacha Nehru Bal Chikitsalya, New Delhi, India

Corresponding author:

Nishkarsh Gupta

437 Pocket A, Sarita Vihar New Delhi, India

Email: drnishkarsh@rediffmail.com

Phone number: 0919013310014

grade to 3a but we could not negotiate the endotracheal tube through the glottis despite using a stylet. Meanwhile, an assistant was asked to arrange appropriate size supraglottic airway device (I-gel no 3 and 4, proseal LMA 3 and 4), VL and FOB as backup devices. We ventilated the patient with 100% oxygen before the next attempt till a saturation of >94% was obtained. Since the VL available on the floor was not working we decided to use a left molar approach to laryngoscopy in the second attempt.

The size 3 Macintosh laryngoscope blade was inserted from left side of oral cavity at a point above left molars and directed postero-medially along the groove between tongue and tonsil till glottis was visible. A CL grade 3a was obtained which improved to 2b with OLEM. We could insert a bougie into the glottis and an endotracheal tube (ETT) no 7.0 could be rail roaded over it. Thereafter, bilateral air entry was checked and correct placement of ETT was confirmed by continuous waveform capnography. Rest of the surgery was uneventful and the patient was shifted to ICU and was extubated the next day and discharged two days later.

DISCUSSION

Unanticipated difficult airway can be a nightmare for any anaesthesiologist. Bedside predictors of difficult airway may not be accurate. Many cases of predicted difficult airway could turn out to be easy and conversely some of the predicted easy intubations may turn to be unanticipated difficult airway. This reiterates that we must always be prepared for a difficult airway.

In an unanticipated difficult airway, plan A is to maximise the rate of a successful intubation in the first attempt by adequate preoxygenation and apnoeic oxygenation techniques, optimal positioning, adequate muscle relaxation, use of OLEM, or use of intubating aids like bougie, stylet, light wand, FOB and VL.¹ In case of failed intubation we should always be prepared for plan B which is maintaining oxygenation by a supraglottic airway device. In our case we followed the of DAS 2015 algorithm.² We had

adequately preoxygenated the patient, maintained optimal sniffing position with good neuromuscular relaxation. When difficult laryngoscopy was encountered we used OLEM to improve the view and also tried to guide a bougie for intubation. When we failed in our intubation attempt we called for help and arranged appropriate sized supra-glottic airway and other devices. Since, the VL on the floor was not in a working condition and mask ventilation and oxygenation was possible we planned for a second attempt with a different laryngoscopy approach i.e. left molar approach. This approach improved the CL grade but still intubation could have been difficult with this, so we used a bougie for intubation and succeeded in this attempt. Left molar intubation was first described by Yamamoto et al who concluded that a left molar laryngoscopy improved laryngoscopic view in difficult laryngoscopy.⁴ A comparison of right molar laryngoscopy, left molar laryngoscopy and conventional midline laryngoscopy showed that in difficult laryngoscopy scenario left molar approach improved the laryngeal view as well as provided the best intubating condition.^{5,6} Left molar approach has also been used successfully in anticipated difficult airway like intra-oral swellings, glossopalatal ankylosis, massive neurofibroma of face where conventional midline laryngoscopy and intubation might be difficult.^{7,8,9}

The left molar approach avoids the intrusion of maxillary structures, reduces the distance between the teeth and larynx obviating the need for alignment of oro-pharyngeal and laryngeal axes thereby improves the laryngoscopic view.⁴ The glottis view obtained can further be improved as it avoids the tongue which lies anterior to the laryngoscope blade. Another advantage is that it spares the incisor teeth and hence useful when the incisors are vulnerable.¹⁰ The disadvantage with this approach is that since the line of vision deviates laterally it is difficult to align the tip of endotracheal tube with the glottis aperture.⁷ So, a regular practice in routine cases is required and intubation aids like bougie or stylet may facilitate intubation.¹¹

Although it improves the glottis view the intubation could still be difficult, so we used a bougie to overcome this difficulty.

We conclude that in unanticipated difficult laryngoscopy, left molar direct laryngoscopy with OLEM could also be a saviour and be considered in anaesthesiologist's armamentarium.

REFERENCES

1. Freck C, Mitchell V.S, McNarry AF, et al. Difficult Airway Society 2015 guidelines for management of unanticipated difficult airway in adults. *Br J Anaesth* 2015;115:827-48
2. Wilson ME. Predicting difficult airway. *Br J Anaesth* 1991;71:333-34.
3. Bozdogon N, Sener M, Bilan A, Turkoz A. Does left molar approach to laryngoscopy make difficult intubation easier than the conventional midline laryngoscopy. *Eur J Anaesth* 2008;25:681-84.
4. Yamamoto K, Tsubokawa T, Ohmura S, Itoh H, Kobayashi T. Left molar approach improves the laryngeal view in patients with difficult laryngoscopy. *Anesthesiology* 2000;92:70-74.
5. Sharma S, Sehgal R, Kumar R, Sharma K, Aggarwal N. The left molar approach, right molar approach, midline approach for direct laryngoscopy and intubation using Macintosh blade. *J Anesth Clin Pharmacol* 2007;23:41-46.
6. P Raut, Patel R. Comparative study of molar approaches of laryngoscopy using macintosh versus flexitip blade. *Internet J Anesthesiol* 2006;12:1-8.
7. Potdar M, Patel RD, Dewoolkar LV. Molar intubation for intra-oral swellings: our experience. *Indian J Anaesth* 2008;52:861-65.
8. Batra YK, Rakesh SV, Menon P, Rao KLN. Successful airway management with left-molar laryngoscopy in glossopalatal ankylosis: a case report. *Acta Anaesth Belg* 2010;61:215-16.
9. Saini S, Bansal T. Anesthetic management of difficult airway in a patient with massive neurofibroma of face: utility of Rendell Baker Soucek mask and left molar approach for ventilation and intubation *J Anaesthesiol Clin Pharmacol* 2013;79:271-72.
10. Sato N, Shingu K. Another reason to choose left molar approach to laryngoscopy: to spare the incisor teeth. *Anesthesiology* 2002;96:1279.
11. Gupta A, Thukral S, Lakra A, Kumar S. A comparison of left molar direct laryngoscopy and the use of bonfils intubation fiberscope for tracheal intubation in a simulated difficult airway. *Can J Anesth* 2015;62:609-17.

GUIDELINES TO CONTRIBUTORS

Asian Archives of Anaesthesiology and Resuscitation (AAAR) was started in 1971 by initiative of late Prof. W.E. Spoerl of University of Western Ontario, London. He visited JIPMER, Pondicherry in 1970-71 and helped in starting this journal. Since then, AAAR was published under able guidance of (late) Prof. N.P. Singh continuously till date.

EDITORIAL POLICY

AAAR publishes original articles, review articles, special, articles, medical intelligence articles, case reports, technical communications editorials, book reviews and letters to the editor. All papers, after editorial scrutiny are peer reviewed by at least two referees. Acceptance is based on significance, originality and validity of the material presented.

SUMMARY OF REQUIREMENTS

Type or print out the manuscript double spaced, including title page, summary (abstract) and key words, text, acknowledgements, references, tables (each table complete with title and foot notes on a separate page) and legends for illustrations. Each of the above mentioned component of the manuscript should begin with a new page, maintaining the sequence. Illustrations must be of good quality, unmounted glossy prints, usually 1227 x 173 mm (5 x 7 in) but not larger than 203 x 254 mm (8 x 10 in). Manuscript should be submitted in CD in Microsoft Word format along with two hard copies (on paper as specified below) with a covering letter, as described under 'Submission of Manuscripts' and permission to reproduce previously published material or to use illustrations that may identify human subjects. From time to time the editor will request for 'Review Articles' on any particular topic. So, review articles may kindly be sent only on such requests. Authors should keep copies of everything submitted.

PREPARATION OF MANUSCRIPTS

Type or print out the manuscript on white bond paper preferably ISO A4 size with margins of at least 25 mm (1 in). Type or print on only one side of the paper using double spacing throughout. Number the pages consecutively in the upper right hand corner of each page beginning with the title page.

FORMAT, STYLE AND GRAMMAR:

The article is expected to be written in simple and small sentences. Due care need to be exercised by all the authors towards spelling, grammar and style of writing. The article needs to be written in 'past-participle passive voice' format.

Title page

The title page should carry:

- a) The Title of the article which must be concise, functional and informative. It must be accurate and not be misleading. Very short and cryptic titles are to be avoided as the words in the title may be used by electronic search engines to identify and categorise the paper.
- b) Name of each author typed in capitals across the title page immediately beneath the title of the article. A line should be drawn across the title page below the name(s) of author(s) in capitals.

Each author's a) highest academic qualification, institutional affiliation; b) name of department (s) and institution(s) to which the work should be attributed ; (c) name, address phone No. and email ID of author responsible for correspondence should be indicated.

AUTHORSHIP

All persons designated as authors should qualify for authorship. The order of authorship should be a joint decision of the co-authors. Each author should have participated sufficiently in the work to take public responsibility for the content. Authorship credit should be based only on substantial contributions to

- (a) conception and design or analysis and interpretation of data; and to
- (b) drafting the article or revising it critically for important intellectual content; and on
- (c) final approval of the version to be published. Conditions (a), (b) and (c) must all be met. Any part of an article critical to its main conclusions must be the responsibility of at least one author. Editor may ask the authors to justify the assignment of authorship.

SUMMARY AND KEY WORDS

The second page should carry the summary (abstract) preferably of not more than 300 words, summarizing the work systematically by disclosing context, objectives, design, setting, participants, interventions, main outcome measures, results and conclusions. The abstract should reflect the paper and describe the message succinctly and accurately. The format of the abstract may be based on the standard IMRAD structure (Introduction, Methods, Results And Discussion) of the paper below the summary, provide and identify as such, 3 to 5 key words that will assist indexers in cross indexing. Use terms from the medical subject headings (MeSH) list of Medline.

TEXT

The text of observational and experimental articles is usually but not necessarily divided into sections with headings viz., Introduction, Methods, Results and Discussion (IMRAD). Other types of articles such as case reports, reviews, editorials are likely to need other formats. Nevertheless, a fundamental structure is the basis of all scientific papers.

INTRODUCTION

Start on a new page stating clearly the question being answered in the study. To lead the reader to this point it is essential to review the relevant literature briefly. Do not include data or conclusions from the work being reported.

MATERIAL AND METHODS

Over all the Material and Methods should answer three fundamental questions viz: How the study was designed? How the study was carried out? How the data were analysed? Though brevity is desirable, describe the selection of the observational or experimental subjects (patients of laboratory animals, including controls) clearly justify/ explain the sample size. Identify the methods, apparatus (manufacturer's name and address in parenthesis) and procedures in sufficient detail to enable other workers to reproduce the results. Give references to established methods, including statistical methods; provide references and brief descriptions for methods that have been published but are not well-known; describe new or substantially modified methods, give reasons for using them and evaluate their limitations. Identify precisely all drugs or chemicals used, including generic name(s), dose(s), and route(s) of administration.

ETHICS

When reporting experiments on human subjects, indicate whether the procedures followed were in accordance with ethical standards of the responsible committee on human experimentation (institutional or regional) and with the Helsinki Declaration of 1975, as revised in 2002. Indicate whether institutions or the Indian Council of Medical Research's guidelines were followed. No manuscript can be sent for publication in two journals at same time and it will be considered as ethical misconduct. The copyrights will be provided only to that journal where it is published first.

LEGAL CONSIDERATIONS

Authors should avoid the use of names, initials and hospital numbers which might lead to recognition of a patient. A patient must not be recognizable in photographs unless written consent of the subject has been obtained. A table or illustration that has been published elsewhere should be accompanied by a statement that permission for reproduction has been obtained from the publishers.

STATISTICS

Input from a statistician should be sought at the planning stage of the study. The statistical methods with enough details to enable a knowledgeable reader with access to the original data to verify the reported results, should be incorporated. Give a brief note of how you arrived at the chosen sample size of your study. Give the exact tests used to analyse the data statistically and include an appropriate reference if the test is not well known. If computer software was used, give the type and version of the software. When possible, quantify findings and present them with appropriate indicators or measurement error or uncertainty (such as 95% Confidence Intervals). Avoid sole reliance on statistical hypothesis testing such as the use of p values, which fails to convey important quantitative information.

RESULTS

This section has to have two essential features: there should be an overall description of the major findings of the study; and the data should be presented clearly and concisely. Present your results in logical sequence in the text, tables and illustrations. Do not repeat in the text all the data in the table or illustrations; emphasise or summarise only important observations. It is worthwhile stating briefly what you did not find, as this may stop other workers in the area undertaking unnecessary studies.

DISCUSSION

It is difficult not to write a long and detailed analysis of the literature that you know so well. A rough guide to the length of 'Discussion', however is that it should not be more than one third of the total length of the manuscript (IMRAD) Emphasise and summarise the new and important findings of the study and the inferences that follow from them. Discuss possible problems with the methods used. Compare your results with previous work or relate your observations to other relevant studies. Discuss the scientific and clinical implications of your findings. Do not repeat in detail data or other material given in the 'introduction' or the 'Results' section. Discuss and analyse the limitations of your study, including suggestion for future work.

CONCLUSIONS

Link the conclusions with the goals of the study but avoid unqualified statements and conclusions not completely supported by your data.

ACKNOWLEDGEMENTS

They should be brief and should include reference to the source of technical help, material support and

financial assistance. Individuals named must approve their inclusion in the acknowledgements, before the paper is submitted.

REFERENCES

The references of the article are the foundation on which the work of the study is built. They provide the scientific background that justifies your study, including the methods used. AAAR follows 'Vancouver style' of quoting the references as superscripts in which references are numbered consecutively in the order in which they are first mentioned in the text. Identify references in text, tables, and legends by Arabic numerals in parentheses. References cited only in tables or in legends to figure should be numbered in accordance with a sequence established by the first identification in the text of the particular table or figure. Use the style of the examples below, which are based with slight modifications on the formats used by the U S National Library of Medicine in Medline database. The titles of journals should be abbreviated according to the style used in Medline. The references must be verified by the author(s) against the original documents. Restrict references to those that have a direct bearing on the work described, preferably less than 25 for general articles and 6 for short communications.

Examples of correct forms of references are given below.

A. Journals:

1. Standard journal article List all authors, but if number exceeds six, list only first three and add et al. Fery AM, Haynes AR, Owen KJ, Farrall M, Jack LA, Lai LY, et al. Predisposing locus for Alzheimer's disease on chromosome 21, *Lancet* 1989; 1: 352-5.
2. Organisation as author : The Royal Marsden Hospital Bonemarrow Transplantation Team. Failure of syngeneic bonemarrow graft without preconditioning in post- hepatitis marrow aplasia. *Lancet* 1977; 2: 742-4.
3. No author given : Coffee drinking and cancer of the pancreas (editorial). *BMJ* 1981; 283:628.

B. Books and other Monographs

1. Personal author(s): Colson JH, Armour WJ. Sports injuries and their treatment, 2nd rev. ed. London: S. Paul, 1986.
2. Editor(s), compiler as authors : Diener HC, Wilkinson M, editors. Drug-induced headache. New York: Springer Verlag, 1988.
3. Chapters in a book: Weinstein L, Swartz MN. Pathologic properties of invading microorganisms. In: Sodeman WA Jr, Sodeman WA, editors. Pathologic physiology: mechanisms of disease. Philadelphia: Saunders, 1974: 457-72.

C. Other published Material

Newspaper article: Rensberger B, Specter B, CFCs may be destroyed by natural process. *The Washington Post* 1989 Aug. 7; Sect. A:2 (Col.5).

D. Unpublished Material

Lillywhite HD, Donald JA. Pulmonary blood flow regulation in an aquatic snake. *Science*. In press or Personal Communication

E. Internet References

Complete Website address and the location to be mentioned.

Tables

Do not include tables in the text.

Type each table, double-spaced on a separate sheet.

Number tables consecutively in the order of their first citation in the text and put a brief title for each. Give each table a short abbreviated heading, Mention explanatory matter as well as explanations of all non-standard abbreviations used in the table, in footnotes and not in the heading. Identify statistical measures of variations such as standard deviation and standard error of the mean. Indicate approximate position of each table in relation to the subject matter of the text right hand margin of the appropriate page of the manuscript. If you use data from another published or unpublished source, obtain permission and acknowledge fully. Maximum tables allowed in any manuscript is as follows:

Maximum tables allowance	
General Article (excluding abstract)	6
Case Report	2
Brief Report	4
Technical Communication	5
Review Article	10
Medical Intelligence Article	6
Special Article	6
Editorial	1
Letter to the Editor	2

Illustrations (Figures)

Submit two complete sets of figures. Figures should be professionally drawn and photographed; free hand or typewritten lettering is unacceptable. Instead of original drawings, roentgenograms, and other material, send sharp, glossy, black and white photographic prints as mentioned earlier. Letters, numbers, and symbols should be clear and even throughout and of sufficient size that when reduced for publication each item will still be legible. Each figure should have a label pasted on its back indicating the number of the figure, author's name and top of the figure. Do not write on the back of figures or scratch or mark them by using paper clips. Figures should be numbered consecutively according to the order in which they have been first cited in the text. If a figure has been published, acknowledge the original source and submit written permission from the copyright holder to reproduce the material. Do not include these in the text. Indicate the appropriate position of each figure in relation to the subject matter of the text in the right hand margin of the appropriate page of manuscript.

Units of measurement

All measurements – length, height, weight and volume, etc. should be reported in metric units (metre, kilogram, or litre) or their decimal multiples. Temperatures should be given in degree Celsius. Blood pressure should be given in millimetres of mercury. All haematologic and clinical chemistry measurements should be reported in the metric system in terms of the International System of Units (SI).

Abbreviations and Symbols

Use only standard abbreviations. Avoid abbreviations in the title and abstract. The full term for which an abbreviation stands, for should precede its first use in the text unless it is a standard unit of measurement.

Correspondence

A. Letters to the editor include brief constructive comments concerning previously published articles or brief notations of general interest. The manuscripts must be double-spaced, and a title and two copies must be provided. Letters may be submitted at aaarjournal@gmail.com.

B. The editor may change, delete or modify in any way all items of correspondence. Maximum Word Allowance: When submitting your manuscript, please observe the maximum word count allowed for each type of submission; and the maximum allowance for figures, tables, and references (word count should reflect text only and must be listed in the cover letter):

Maximum word allowance

General Article (excluding abstract)	3000 words
Case Report	800 words
Brief Report	1000 words
Technical Communication	1500 words
Review Article	4000 words
Medical Intelligence Article	3000 words
Special Article	2000 words
Editorial	1500 words
Book Review	750 words
Letter to the Editor	200 words
Abstract	200 words
Implications	50 words

Non-textual Material Maximum Allowance

Figure and Tables No more than 3 each or a combination of 6 total. Do not duplicate data in tables and figures. References No more than 25 references per article, up to 40 references are acceptable.

Submission of manuscripts

Manuscripts (including tables, figures, photographs, etc.) accompanied by a covering letter should be signed by all the authors. The covering letter must provide an undertaking to the effect that (a) the article has not been published or submitted to or accepted for publication in any form in any other journal, (b) the authors vouch safe that the authorship of this article will not be contested by any one whose name (s) is/are not listed, (c) on acceptance the article will become copyright of AAAR (d) the sequence of the names of co-authors (e) the manuscript has been read and approved by all the authors, (f) name, address and the email ID of the corresponding author (responsible for communication). On final preparation, two hard copies and a soft copy (CD) of manuscripts should be mailed to retaining one copy with the corresponding author. A letter of acceptance or otherwise, will normally be sent to the author within 3 (three) months. Articles which are not accepted cannot be sent to the author unless accompanied by adequate postage stamps.

A completed checklist must accompany each manuscript submitted to Asian Archives of Anaesthesiology and Resuscitation. Check the manuscript before submission

General

1. Two complete sets of manuscripts (including tables) are submitted.

2. The manuscript can be sent through email 'aaarjournal@gmail.com':the complete.....references. the complete manuscript and a separate file containing only the title page, abstract, and references.
3. Manuscript is typed double-spaced, with ample, left , justified, margins.
4. Pages are numbered consecutively, starting with the title page.

Title Page

1. On the first page are typed the title, author name(s) and major degree(s), and affiliation(s).
2. The name, address, telephone and FAX numbers, and E-mail address of the corresponding author are to be given.
3. The manuscript title is no longer than 100 characters (letters and spaces) and does not contain any abbreviations.
4. A short title (no more than 30 characters) is provided at the bottom of page for use as a running foot.

Summary

- * An abstract is provided. For all kind of articles, this abstract is structured and limited to max.300 words.

References

1. References correspond to the specifications of the Uniform Requirements for Manuscripts Submitted to Biomedical Journals” promulgated by the International Committee of Medical Journal Editors.
2. References are identified in the text by superscript figures, eg., Miller.
3. Each reference is cited in the text. Those appearing in tables and figures should be cited in the text where the table or figure is mentioned.
4. References are numbered consecutively in the order in which they appear in the text. (Vancouver Style)
5. Unpublished data, personal communications, submitted manuscripts, statistical programs, papers presented at meetings, and non–peer-review publications are not listed in the bibliography.
6. The bibliography is typed double–spaced.
7. Abbreviations of Journal titles conform to those used in Index Medicus, National Library of Medicine.

Tables

1. Each table is typed on a separate sheet of paper with its title.
2. Tables are numbered with Arabic numerals.
3. Each table contains all necessary information in order that it may stand alone, independent of the text.
4. No table contains data that could be included in the text in several sentences.
5. Vertical lines are not used.
6. Irrelevant and extra tables must not be included

Figures

1. Each figure is cited in the text.
2. Two sets are submitted of glossy prints of sonographs, photomicrographs, radiographs, color illustrations, or any other figure that might not reproduce well.
3. Two sets of glossy prints of other figures are submitted.
4. Figures have been prepared with the journal column size in mind.
5. Letters and identifying marks are clear and sharp, and the critical areas of radiographs and photomicrographs are identified.

6. Legends and explanatory material appear in the accompanying caption and not on the figure itself.
7. Legends are typed together on one page. Legends for photomicrographs include information regarding stain and magnification.
8. Nothing is written on the back of the figures. An adhesive label, designating the top, with the first author's name and number of the figure, is attached firmly to the back of the illustration.
9. Figures are placed in a labeled envelope. No glue, paper clips or tape has been used on any

