The Middle East Journal of Anesthesiology is a publication of the Department of Anesthesiology of the American University of Beirut, founded in 1966 by Dr. Bernard Brandstater who coined its famous motto:

“For some must watch, while some must sleep” (Hamlet-Act. III, Sc. ii).

and gave it the symbol of the poppy flower (*Papaver somniferum*), it being the first cultivated flower in the Middle East which has given unique service to the suffering humanity for thousands of years. The Journal’s cover design depicts The Lebanese Cedar Tree, with’s Lebanon unique geographical location between East and West. Graphic designer Rabi Moukalled

The Journal is published three times a year (February, June and October) The volume consists of a two year indexed six issues. The Journal has also an electronic issue accessed at www.aub.edu.lb/meja

The Journal is indexed in the Index Medicus and MEDLARS SYSTEM.

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\(^*\) Train-of-four
\(^1\) Post tetanic counts
\(^2\) Second twitch


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OBITUARY

AUB MOURNS PROFESSOR EMERITUS
ANIS BARAKA

Baraka was awarded the Merit Award Decoration and the Lebanese Citizenship by the President of the Republic of Lebanon in 2000 (in picture Baraka with former Lebanese health minister Karam Karam)

The American University of Beirut mourns the passing away of one of the main founders and pioneers in Anesthesiology in Lebanon and the region, and a longtime colleague and friend of the University, Dr. Anis Baraka.

Professor Emeritus Anis Baraka is an internationally renowned anesthesiologist. He was Professor and Chairman of the Department of Anesthesiology at AUB for more than 30 years (1976-2007), before he was appointed as Professor Emeritus. Dr. Baraka was also Emeritus Editor-In-Chief of the Middle East Journal of Anesthesiology (MEJA). With several international awards and over five hundred publications in areas covering muscle relaxants, obstetric and cardiac anesthesia, as well as anesthesia for children, Dr. Baraka has receive wide international recognition.

He was the Vice-President of the World Federation of Societies of Anesthesiologists and was their representative at the Regional Commission of the United Nations. He was the President of the Arab Board of Anesthesia and Intensive Care as well as the Honorary President of the 8th Pan Arab Congress. He chaired the Committee on Education and Scientific Affairs of the World Federation of Societies of Anesthesiologists and the Examination Committee of the Arab Board of Anesthesia and Intensive Care. He also worked with Arab countries to help establish The Arab Board of Anesthesia and Intensive Care of which he became the Chairman of its Examination Committee.
Born in Fayoum in Egypt in 1930, Dr. Baraka received an MBBCh (Bachelor of Medicine, Bachelor of Surgery) degree in (1953) and completed his residency in 1957 in Anesthesiology at Cairo University. He then did a research fellowship in 1963 at the University of Liverpool and followed it with a residency in 1964 at the National Health Hospital, London.

His long association with AUB started when he joined the University as an Instructor in 1965 and was promoted to an Assistant Professor in 1966, an Associate Professor in 1971, and a full time Professor in 1976. He served as Chairperson of the Department of Anesthesiology for the period of 1976-2007. He was appointed as Professor Emeritus in 2008.

Dr. Baraka served AUB for more than 42 years. The period where he took over the Department of Anesthesiology at AUBMC in 1974 is referred to by his colleagues and department as the “Period of Growth and Development” and “unprecedented excellence”. In a recount of the “HISTORY OF ANESTHESIA IN LEBANON and AT AUB”, authors Fouad Salim Haddad, MD, FACA, DABA Clinical Associate, Department of Anesthesiology, and Musa Khalil Muallem, MD, DA Professor of Anesthesiology, describe Dr. Anis Baraka’s unique contributions. “His warm leadership, pedagogical capabilities, extraordinary ability of clinical research, voluminous publications, fortitude stamina, tenacity and devotion exhibited during the Lebanese civil war, and his worldwide travels, and the various honorary awards he received, doubtless placed the Department of Anesthesiology, the American University of Beirut and Lebanon on the “Anesthesia Map of the World,” they wrote. “Dr. Baraka promoted the prestige of the specialty, increased its market demand, and gained world-wide recognition of the training at his Department.” Dr. Baraka is credited to having shouldered uninterrupted and committed clinical service at operation rooms during the civil war.

A mentor of hundreds of anesthesiologists who lead positions in Lebanon, the region, and abroad today, Dr. Baraka has received recognition for his invaluable and long-standing services and contributions. He was awarded the Merit Award Decoration and the Lebanese Citizenship by the President of the Republic of Lebanon in 2000. He was also awarded the First Rank Education Award from the Ministry of Education in Lebanon in 1990; the First Prize Award of Clinical Medical Sciences at AUB (1987-1988 and 1991-1992); the Shield of the Lebanese Order of Physicians in 1998; the AUB Alumni Association Distinguished Alumni Award in 2006; the Honorary Fellowship of the Royal College of Anesthetists; and the International Commission of the Ralph Waters Prize in 1990.

“Dr. Baraka was a close friend and trusted colleague of my own father, the late Raja Khuri, who always spoke with respect and admiration of the great Anis Baraka’s devotion to his patients, his students, and his field of anesthesia,” said Dr. Fadlo Khuri. “He was a genuine leader in the medical field, not only in Lebanon but in the Arab world and beyond, a gentle man always willing to help others and able to manage the most complicated of cases with grace, with humility, and with great skill… The great Dr. Baraka will be mourned by all who knew him at AUB.”

Dr. Baraka is survived by his wife Aziza, one daughter Huda, and three sons Hesham, Tarek, and Khaled.
EDITORIAL

PERIMORTEM CESAREAN SECTION

When maternal cardiac arrest occurs before 24 weeks of gestation, the purpose of cardiopulmonary resuscitation (CPR) is to resuscitate the mother. If she is resuscitated, it is likely that pregnancy will proceed. Emergency delivery of the fetus is not likely to improve the maternal chances of survival. In contrast, at or beyond 24 weeks of gestation, delivery of the fetus may actually improve maternal survival by decreasing aorto-caval compression with a consequent improvement of venous return and cardiac output. In addition, chest compression will be more effective once the gravid uterus is evacuated, and the functional residual capacity of the lung will increase with a consequent increase of maternal oxygenation and resuscitation efforts.\(^1\,2\).

During the tragic years of Lebanon 1975-1990, a large number of casualties resulted in serious head injuries; one fifth of all casualty admissions to the American University of Beirut Medical Center was patients with skull injuries associated with penetrating brain damage. Craniotomy when feasible, was found preferable to the accepted technique of craniectomy. The level of consciousness has an important bearing on prognosis. In the seriously head-injured pregnant victims, perimortem Cesarean delivery of the near or the full-term fetus was attempted in order to save the fetus.

Perimortem Cesarean section may be indicated to save both the mother and the fetus during certain catastrophic complications such as anaphylactic reactions associated with anesthesia. The placenta plays an important role in protecting the fetus against drug-induced anaphylactic reactions in the parturient. The placental barrier will prevent crossing of the high molecular weight IgE antibodies from the mother to the fetus. Also, the high diamine oxidase of the maternal decidua will catalyse the oxidative deamination of histamine and other related endogenous amines released during anaphylaxis. Emergency Cesarean section can save the fetus, and provide optional conditions for saving the mother.

Emergency delivery of the fetus by Cesarean section can also optimize the hemodynamics in the pregnant cardiac patients presenting after cardiopulmonary bypass (CPB) with refractory hemodynamic deterioration and/or persistent fetal distress. It may be also advisable to consider Cesarean section before CPB if the gestational age is greater than 28 weeks and fetal maturity is reached, in order to maximize the chances of favorable maternal and fetal outcome.

In conclusion, these three case reports show that perimortem Cesarean delivery can save the fetus, and may optimize the conditions for saving the mother. The first case report shows that perimortem Cesarean section in a patient with irreversible head injury saved the newborn,
but not the mother. In the second pregnant patient who suffered from cardiac arrest secondary to anaphylactic reaction, perimortem Cesarean section saved the fetus, and optimized the conditions for successful resuscitation of the mother. In the third cardiac patient undergoing CPB, Cesarean delivery of the fetus facilitated successful weaning from CPB.

Anis Baraka, MD, FRCA (Hon)  
Emeritus Professor of Anesthesiology  
American University of Beirut  
Beirut - LEBANON

References
THE NUMASK® IS AS EFFECTIVE AS THE FACE MASK IN ACHIEVING MAXIMAL PREOXYGENATION

Usharani Nimmagadda¹,², M. Ramez Salem¹,², Dimitry Voronov¹ and Nebojsa Nick Knezevic³

Abstract

**Background:** Preoxygenation before anesthetic induction is a widely accepted maneuver to increase oxygen reserves and delay desaturation during apnea. There is limited data regarding the use of the NuMask® in the perioperative setting, and no data as to its efficacy in achieving maximal preoxygenation. We hypothesize that the NuMask® may be a useful alternative to the face mask in achieving maximal preoxygenation.

**Methods:** After IRB approval, the NuMask® was compared with the classic face mask with respect to achieving maximal pre-oxygenation in 30 healthy volunteers using tidal volume breathing. All volunteers were tested for three periods of 5 minutes intervals and the following parameters were recorded every 30 seconds: inspired, and end-tidal oxygen concentration and end-tidal carbon dioxide concentration.

**Results:** The mean ETO₂ of ≥90% was achieved with both masks at 3.5 minutes (SD = 1.62 and 1.98 for facemask and NuMask® respectively) and thereafter the ETO₂ remained above 90%. There were no statistical differences noted in FiO₂ and ETO₂ between the face mask and the NuMask® in the same time periods. ETCO₂ values were also not statistically different between the two masks.

**Conclusions:** The study showed that the NuMask® is as effective as the classic face mask in achieving maximal pre-oxygenation during tidal volume breathing.

Introduction

Preoxygenation before anesthetic induction and tracheal intubation is a widely accepted maneuver intended to increase oxygen reserves, and thereby delay the onset of arterial oxyhemoglobin desaturation during apnea¹². In healthy adults breathing air, oxygen desaturation to 90% can occur in 1-2 min, whereas, with adequate preoxygenation it can be delayed up to 8 min during apnea³. Preoxygenation is particularly important when manual ventilation is undesirable, if difficulty with ventilation or tracheal intubation is anticipated and in patients with oxygen transport limitations⁴.

¹ MD, Department of Anesthesiology, Advocate Illinois Masonic Medical Center, Chicago, Illinois, USA.
² MD, Department of Anesthesiology, University of Illinois, College of Medicine.
³ MD, PHD, Department of Anesthesiology, Advocate Illinois Masonic Medical Center, University of Illinois, College of Medicine Chicago, Illinois, USA.

**Corresponding Author:** Usharani Nimmagadda, MD, Department of Anesthesiology, Advocate Illinois Masonic Medical Center, 836 W. Wellington Ave. Suite 4815, Chicago, IL 60657, Phone: 773-296-5403, FAX: 773-296-5088, Email: ushanimmi@hotmail.com
In 2003, the American Society of Anesthesiologists task force on the Management of the Difficult Airway, recommended “face mask preoxygenation before initiating management of the difficult airway” in their updated practice guidelines. In 2015, Difficult Airway Society intubation guidelines working group in United Kingdom, developed specific guidelines for management of unanticipated difficult intubation in adults. The guidelines include the statement that all patients should be preoxygenated before the induction of general anesthesia.

Typically in the operating room, preoxygenation is carried out with an oxygen flow of $\geq 7$ l/min delivered from a semiclosed circle absorber anesthetic system via face mask. The most common reason for the failure to achieve a fraction of inspired oxygen (FiO$_2$) close to 100% is a leak under the face mask due to the inability to obtain a tight seal. This may result from an improperly inflated cushion on the rim of the mask, improper mask size (too small or too large), presence of a large beard, sunken cheeks, presence of nasogastric tube or abnormal facial anatomy.

The shortcomings of various face masks and the problems associated with their use during difficult mask ventilation (DMV) has led to the development of newer airway devices. The NuMask® is an intraoral mask, which became available for anesthetic induction in 2006. It is marketed to be positioned behind the lips and in front of the gum line (similar to a snorkel mouth piece) and thus providing a different anatomical seal in comparison to the commonly used face mask.

There is limited data regarding the use of the NuMask® in the perioperative setting, and no data as to its efficacy in achieving maximal preoxygenation. We hypothesized that the NuMask® may be a useful alternative to the face mask in achieving maximal preoxygenation. This study compared the efficacy of preoxygenation using both the NuMask® and the face mask during tidal volume breathing (TVB).

**Methods**

After Advocate Healthcare IRB approval and registration with clinicaltrials.gov (NCT01865851), the efficacy of preoxygenation with the NuMask® was compared to the classic face mask in 30 consented, healthy volunteers. The study group mainly consisted of anesthesia residents and attendings. After being informed of the different steps in the study, the volunteers were given time to familiarize themselves with both the NuMask® (NuMask Inc, Woodland hills, CA) (Fig. 1A-B) and the classic face mask (Vital Signs adult mask with adjustable air cushion). The study was conducted in the supine position using a single anesthesia machine (Apollo® Dräger Medical Ag & Co, Germany). The following parameters were measured every 30 seconds: fraction of inspired oxygen (FiO$_2$), end-tidal oxygen (ETO$_2$), and end-tidal carbon dioxide (ETCO$_2$).
Each volunteer was tested for three separate, five minutes intervals using 100% oxygen at a fresh gas flow (FGF) of 7 l/min. Volunteers acted as their own controls by undergoing preoxygenation with both types of masks. When using the NuMask®, a nose clip was placed to guarantee that each volunteer was breathing only through the mouth. The volunteers were also given the option of closing their nostrils with their fingers (Fig. 1C). They were allowed to breathe room air for 5 minutes between each test period. After the study, each volunteer completed a three-item questionnaire: 1. which mask was more comfortable, 2. which mask would they prefer to be used on themselves if they were patients, and 3. which mask would they prefer to use on their own patients.

The volunteers were assigned into two groups using computer generated randomization numbers. Each volunteer in the first group was preoxygenated for five minutes in the following order: 1) face mask; 2) room-air break; 3) NuMask®; 4) room-air break; 5) face mask. Each subject in the second group was preoxygenated for five minutes in the following order: 1) NuMask®; 2) room-air break; 3) face mask; 4) room-air break; 5) NuMask®.

The sample size estimate for this study (n = 30) was determined to detect a difference in preoxygenation at $\alpha = 0.05$ and power = 0.90. Statistical analysis was performed using SPSS software (IBM SPSS Statistics 18, Chicago, IL). Student T-test was used to compare the two groups with respect to age, height, weight, FiO$_2$, ETO$_2$ and ETCO$_2$. A $p$ value less than 0.05 was considered to be statistically significant.

**Results**

The mean age, height and weight of the volunteers were 36.9 ± 9.5 years, 170 ± 8cm, and 70 ± 8 kg respectively. All volunteers completed the study protocol. After one minute of preoxygenation, ETO$_2$ rose to 76% with both masks (SD = 8.81 and 6.50 for facemask and NuMask® respectively). The mean ETO$_2$ of ≥ 90% was achieved with both masks at 3.5 minutes (SD = 1.62 and 1.98 for facemask and NuMask® respectively) and thereafter the ETO$_2$ remained above 90%. There were no statistical differences noted in FiO$_2$ and ETO$_2$ between the face mask and the NuMask® in the same time periods (Fig. 2A-B). ETCO$_2$ values were also not statistically different between the masks. Sixteen (53.3%) of the volunteers reported that the NuMask® was more comfortable than the face mask whereas fourteen (46.6%) reported the opposite. All volunteers stated that both masks were acceptable during preoxygenation. Twenty one (70%) of the volunteers stated that they would prefer the use of NuMask® for preoxygenation on themselves and on their patients, whereas, nine (30%) of the volunteers would still prefer the use of the face mask.
Discussion

The current study demonstrated that the NuMask® is as effective as the classic face mask in achieving maximal preoxygenation in healthy volunteers. With the use of either mask, an $ETO_2$ of 90% or higher was achieved in 3.5 minutes (SD = 1.62 and 1.98 for facemask and NuMask® respectively). In half the volunteers, preoxygenation with the NuMask® was repeated and in the other half, preoxygenation was repeated with the face mask. The reason for repeating the cycle was to assess whether a true difference existed between the two preoxygenation methods and we found no differences. We used a FGF flow of 7 l/min because, previous studies have shown that FGF of 7 l/min using semiclosed circle absorber system results in minimal nitrogen rebreathing. Consistent with other investigations, we used $ETO_2$ of 90% as the endpoint in defining maximal preoxygenation. Anesthesia attendings and residents were chosen for the study because of their availability, and also because they are in a better position to evaluate the use of both masks.

The presence of a leak under the face mask can lead to decreased FiO₂ and ineffective preoxygenation. The fact that both masks in our study were found to be effective in achieving maximal preoxygenation implies that with the use of either mask, the leak was prevented. This is not surprising since our volunteers had normal facial anatomy and the masks were used properly. In the general population, the incidence of DMV is about 5%, whereas the incidence of impossible mask ventilation has been estimated to be 0.15%. In both groups, the presence of a beard has been found to be an independent risk factor. It is conceivable that patients who are at high risk for developing leak under the face mask would benefit from the use of the NuMask® because, it provides a different anatomical seal. Furthermore, in some patients, the NuMask® may have the advantage of attenuating the feeling of discomfort, anxiety and claustrophobia that may occur with the use of a standard face mask, since the NuMask® occupies only the mouth, leaving the rest of the face free. In conclusion, the current study found that the NuMask® is as effective as the classic face mask in achieving maximal preoxygenation during TVB.

Acknowledgements

The authors would like to thank the volunteers, without whom this study could not have been possible.
References

Effect of Induced Acute Mild Arterial Hypertension on Postoperative Analgesic Requirements After Laparoscopic Ovarian Cystectomy: A Randomized Double Blinded Study

Atef K Salama* and Nasr M Abdalla**

Abstract

Objective: To evaluate the effectiveness of inducing acute hypertension during laparoscopic ovarian cystectomy on postoperative nalbuphine analgesic requirements.

Methods: This randomized clinical trial involved 90 women scheduled for elective laparoscopic ovarian cystectomy in the department of obstetrics and gynecology, Cairo University. Patients were randomly allocated into one of two treatment groups. The Hypertension Group had their systolic arterial blood pressure raised and maintained at 20-30% above baseline using ephedrine increments. In the Control Group, the systolic arterial blood pressure was maintained at 20-30% below baseline under the effect of increments of 25 µg fentanyl. The patients were observed in the post-anesthesia care unit for 24 hours to assess the total postoperative nalbuphine consumption, VAS score for pain, hemodynamics and postoperative nausea and vomiting.

Results: The total dose of nalbuphine used in the hypertension group was significantly lower than that in the control group (p < 0.001). The VAS score was significantly lower in the hypertension group on arrival to PACU and during the period between 1 and 6 hours postoperatively.

Conclusion: This study demonstrates that pharmacologically induced mild acute intraoperative hypertension significantly reduces postoperative nalbuphine consumption and pain scores following laparoscopic ovarian cystectomy. Trial registration in Pan African Clinical Trial Registry: identification number for the registry is PACTR201508001247179

Key words: analgesia, hypertension, laparoscopic ovarian cystectomy

Introduction

The goals of laparoscopic procedures are to minimize tissue trauma, improve cosmetic results and reduce postoperative pain which consequently decreases hospital stay. Recovery of the patient’s full function is enhanced by good quality postoperative analgesia. Opioids are commonly used postoperative analgesics, however, they have many undesirable effects. Nalbuphine, an opioid agonist-antagonist was produced to provide analgesia without these undesirable side effects.

* Atef Kamel Salama: corresponding author; lecturer of Anesthesiology, Surgical ICU and Pain management Department, Faculty of Medicine, Cairo University, Cairo, Egypt. Address: Anesthesiology, Surgical ICU and Pain management department, Faculty of Medicine, Cairo University, Cairo, Egypt. Tel: +201001155851. E-mail: atef.kamel@kasralainy.edu.eg

** Nasr Mahmoud Abdalla: Lecturer of Anesthesiology, Surgical ICU and Pain management Department, Faculty of Medicine, Cairo University, Cairo, Egypt. Tel: +201113325025. E-mail: sief.nasr@yahoo.com
Understanding the pathophysiology of pain is a key for optimal management of postoperative pain. In fact, pathophysiology of pain perception involves complex mechanisms and several pathways. In healthy individuals, the cardiovascular control system shares numerous central and peripheral neurotransmitters, anatomic nuclei and projections with the antinociceptive systems.

Several animal studies described the association between acute or chronic hypertension with behavioral hypoalgesia. For example, the responses of two types of dorsal horn neurons involved in nociceptive transmission were more delayed and less intense in spontaneously hypertensive rats compared to Wistar-Kyoto rats.

In humans, the same hypertension-associated hypoalgesia have been reported in response to different painful stimuli. That is, in acute pain models, blood pressure correlates negatively with the perception of the intensity of painful stimuli and positively with the pain threshold.

In healthy normotensive individuals, raised resting blood pressure has been shown to be associated with hypoalgesia. Likewise, presurgical resting systolic BP is inversely associated with acute postsurgical pain intensity.

Many studies reported inverse associations between blood pressure and prevalence of chronic low back pain, headache and migraine. Some studies suggested that hypoalgesia may precede hypertension in normotensive persons with a family history of hypertension.

This study was designed to evaluate the effectiveness of inducing acute hypertension during laparoscopic ovarian cystectomy on postoperative nalbuphine analgesic requirements.

Methods

This randomized clinical trial involved 90 women scheduled for elective laparoscopic ovarian cystectomy in the department of obstetrics and gynecology, Cairo University during the period from August 2015 to November 2015. All patients were 20-50 years with physical status I-II according to the American Society of Anesthesiologists (ASA) classification. The study was approved by the institutional review board of Cairo University. A written informed consent was obtained from each participant. The trial was registered in Pan African Trial Registry with identification number for the registry is PACTR201508001247179.

Exclusion criteria were history of chronic hypertension, a baseline arterial pressure ≥140/90 mmHg after admission to the hospital, chronic pain, drug abuse, any known cerebrovascular disease, obesity (body mass index ≥35), use of any analgesic drugs and/or drugs acting on the central nervous system, known pregnancy, or known adverse effects to the study drugs.

The patients did not receive any premedication and fasted for at least 8 hours before surgery. In the operating room and before induction of anesthesia, standard monitors (noninvasive arterial pressure measure, electrocardiogram [ECG], and pulse oximeter) were applied. Arterial blood pressure and heart rate were automatically registered every 3 minutes. Anesthesia was induced using fentanyl 2 μg/kg and propofol 2 mg/kg intravenously. Atracurium 0.5 mg/kg was given to facilitate orotracheal intubation. Mechanical ventilation was adjusted to maintain the end-tidal CO₂ at 30-35 mm Hg. All patients were ventilated with 100% O₂ throughout surgery. Anesthesia was maintained with isoflurane 1%.

Using a table of random numbers generated by a computer, patients were randomly allocated into one of two treatment groups. In the Hypertension Group, the systolic arterial blood pressure was raised and maintained at 20-30% above baseline using ephedrine increments of 3 mg every 5 minutes starting immediately after intubation. The baseline pressure is defined as one blood pressure measurement taken in the preoperative setting after 30 minutes of rest in a seated position and before the patient is transported to the operating room. In the Control Group, the systolic arterial blood pressure was maintained at 20-30% below baseline under the effect of increments of 25 µg fentanyl. For patients whose systolic arterial blood pressure was found to be lower than the target of 20-30% below baseline, an ephedrine bolus of 3-5 mg was used to raise it to target.
Local infiltration of port sites with bupivacaine 0.5% was performed at the beginning of surgery. Every patient received ketorolac 60 mg IV, after induction of anesthesia as a preemptive analgesia and the intra-abdominal pressure secondary to the pneumoperitoneum was maintained at 15 mm Hg after primary trocar insertion. During skin closure, neuromuscular blockade was assessed and antagonized with neostigmine and atropine. Airway extubation was performed when the patient recovered spontaneous ventilation and became fully awake.

In both groups, patients were excluded if the targeted arterial blood pressure range was not be reached until 10 minutes after intubation and if ECG showed signs of ischemia (ST-segment depression or elevation and/or T-wave inversion) or any arrhythmia associated with hemodynamic instability. The patient was treated accordingly.

In the post-anesthesia care unit (PACU), Visual Analog Score (VAS) for pain were assessed every 15 minutes during the first 2 postoperative hours, then after 2, 6, 12, and 24 postoperative hours. Postoperative pain (VAS is ≥4) was treated with 5 mg nalbuphine IV bolus doses. When VAS was <4 a nalbuphine IV patient controlled analgesia (no base rate, 1 mg bolus, lockout 10 minutes) was started. Ketorolac 30 mg IV was administered every 8 hours. Cumulative nalbuphine consumption was registered.

Patients, medical staff (nurse, anesthesiologist, and surgeon), and investigators performing the postoperative assessments were blinded to group allocation during the entire study period.

The primary outcome measure was the total postoperative nalbuphine consumption. The secondary outcome measures were VAS score, hemodynamics and postoperative nausea and vomiting.

**Statistical Analysis**

A previous study found that intraoperative induction of acute mild hypertension reduced postoperative analgesic requirements 2 hours postoperatively by 3 mg with a pooled SD of 5 mg. Based on these results, a sample size of 45 cases in each group is required to elicit the difference at an alpha level of 0.05 and a power of the study of 80%.

Statistical analysis of the data was performed using IBM SPSS Statistics version 22 (IBM Corp., Armonk, NY). Numerical variables were presented as mean and standard deviation or median and range as appropriate. Qualitative data were expressed as frequency and percentage. The intergroup differences were compared using the independent-samples student t-test or Mann-Whitney test as appropriate. Chi-square test (Fisher’s exact test) was used to examine the relation between qualitative variables. All tests were two-sided. A p-value <0.05 was considered statistically significant.
Results

The two groups were comparable in age, BMI, duration of anesthesia and surgery. There was no significant difference between the two groups in diastolic blood pressure and heart rate. Systolic blood pressure was statistically higher in the control group ($p = 0.004$), however the blood pressure values were within the clinically accepted range. Within the control group, 17 patients needed a small dose (3-9 mg) of ephedrine for adjustment of blood pressure.

Figures 2 and 3 show the intraoperative systolic and diastolic blood pressure levels. In the hypertension group the systolic blood pressure was elevated by 22.6 ± 1.0% (range: 21.1 ± 23.8%). In the control group, systolic blood pressure was decreased by 22.1 ± 0.05% (range: 21.1 ± 22.9%) relative to the baseline values. Heart rate showed mild changes throughout the intraoperative period (Fig. 4).
Fig. 2
Changes of systolic blood pressure (SBP) during the intraoperative period

* Significant difference between the two groups (p < 0.05), Data are presented as mean ± SD

Fig. 3
Changes of diastolic blood pressure (DBP) during the intraoperative period

* Significant difference between the two groups (p < 0.05), Data are presented as mean ± SD
During the postoperative period, the total dose of nalbuphine used in the hypertension group was significantly lower than that in the control group (p <0.001). The VAS score for pain was significantly lower in the hypertension group on arrival to PACU and during the period between 1 and 6 hours postoperatively (Table 2).

### Discussion

This study demonstrates that pharmacologically induced mild acute intraoperative hypertension significantly reduces postoperative nalbuphine consumption and pain scores following laparoscopic ovarian cystectomy. These results confirm the

### Table 2

<table>
<thead>
<tr>
<th></th>
<th>Hypertension Group (n = 45)</th>
<th>Control Group (n = 45)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>On Arrival to PACU</td>
<td>4 (3-5)</td>
<td>5 (3-5)</td>
<td>0.002</td>
</tr>
<tr>
<td>30 min</td>
<td>3 (2-3)</td>
<td>3 (2-3)</td>
<td>0.441</td>
</tr>
<tr>
<td>1 hour</td>
<td>2 (2-3)</td>
<td>3 (2-3)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>2 hours</td>
<td>1 (1-2)</td>
<td>2 (2-3)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>6 hours</td>
<td>0 (0-2)</td>
<td>1 (1-2)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>12 hours</td>
<td>0 (0-1)</td>
<td>0 (0-1)</td>
<td>0.075</td>
</tr>
<tr>
<td>24 hours</td>
<td>0 (0-1)</td>
<td>0 (0-1)</td>
<td>0.042</td>
</tr>
<tr>
<td>Total dose of Nalbuphine (mg)</td>
<td>28.0 (23.0-32.0)</td>
<td>43.0 (35.0-46.0)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>PONV</td>
<td>3 (6.7%)</td>
<td>16 (35.6)</td>
<td>&lt;0.05</td>
</tr>
</tbody>
</table>

Data presented as median (range) or No. (%)  
PONV: postoperative nausea and vomiting
Hypertension-associated hypoalgesia theory previously suggested by Ghione.

These findings support results of a previous study by Delfino et al. in patients undergoing laparoscopic cholecystectomy. The authors reported significant reduction of pain scores and morphine consumption after intraoperative induction of mild hypertension. Similarly, in men recovering from radical prostatectomy, France and Katz have reported that postsurgical pain ratings were inversely related to resting systolic blood pressure obtained from patient records collected at the time of admission to the hospital.

Many investigators have reported lower sensitivity to pain in hypertensive patients. This phenomenon was also observed in normotensive humans under the effect of pharmacologic elevation of blood pressure or acute mechanical aortic occlusion.

Mechanisms underlying hypertension-associated hypoalgesia remain unclear. Some studies in animals and humans suggested a role for endogenous opioids. Other investigators found the same association between blood pressure and pain after pharmacological block of opioid systems. The increased pain threshold and reduced perception of painful stimuli may be mediated by a central activity through the inhibitory descending pathways. Noradrenergic systems might contribute to regulatory interactions between cardiovascular system and pain perception.

The results of the current study and previous studies in normotensive individuals suggest a direct effect of arterial hypertension on pain modulation. High arterial blood pressure has shown to activate high-pressure baroreceptors in the carotid sinus-aortic arch regions. Consequently, pain modulatory neurons become activated and increase the pain threshold from the vasopressinergic effect in the spinal cord.

We can conclude that in cases of day surgery and minimally invasive procedures like laparoscopic ovarian cystectomy, postoperative analgesia can be potentiated through induction of mild acute intraoperative hypertension without increasing opioid consumption. This can enhance more rapid discharge and regaining normal activity in these cases.

Acknowledgement

Non declared.

List of abbreviations

References


ANALGETIC EFFICACY OF FLURBIPROFEN AXETIL IN RIGID CYSTOSCOPY FOR MEN: A PROSPECTIVE STUDY
JINGUO WANG¹, HAICHUN MA², LEI WANG³, HONGLAN ZHOU⁴, YANG GAO⁵ AND NA WANG*²

Objective: To evaluate the analgesic effect of preprocedural flurbiprofen axetil on rigid cystoscopy-associated pain for men.

Methods: Fifty-two men scheduled for cystoscopy were recruited in this study. The effects of oxybuprocaine jelly alone or in combination with preprocedural flurbiprofen axetil, were compared. The pain intensity was assessed using visual analogue scale (VAS) scores during injecting oxybuprocaine jelly into the urethra, during inserting rigid cystoscope into the urethra, during viewing inside the urinary bladder, at the first urination after cystoscopy and at the first urination on the following morning at home.

Results: VAS scores with preprocedural flurbiprofen axetil were significantly lower as compared with the control group at the time periods of inserting rigid cystoscope into the urethra, viewing inside the urinary bladder, the first urination after cystoscopy and at the first urination on the following morning at home. No side effects associated with flurbiprofen axetil were observed.

Conclusion: Preprocedural flurbiprofen axetil can decrease cystoscopy-associated pain.

Keywords: non-steroidal anti-inflammatory drug; pain; preventive analgesia; rigid cystoscopy; flurbiprofen axetil.

Introduction
Cystoscopy is painful examination. Despite the availability of flexible cystoscope in clinical practice, the use of rigid cystoscope is still common because it is less expensive, easier to handle and maintain and has a better visual field. Instillation of analgesic jelly into the urethra several minutes before the procedure has shown little significant effect for reducing pain. Patients complain for not being able to stand the pain even with the assistance of analgesic jelly when undergoing

1 Jinguo Wang, MD, PhD, Department of Urology, the First Hospital of Jilin University. Phone number: +86-13756861656. E-mail address: wangjinguolily@163.com
2 Haichun Ma, MD, PhD, Department of Anaesthesiology, the First Hospital of Jilin University. Phone number: +86-13756661291. E-mail address: mahaichun2003@163.com
3 Lei Wang, MD, Department of Cardiovascular Surgery, the First Hospital of Jilin University. Phone number: +86-18343080797. E-mail address: 387866736@qq.com
4 Honglan Zhou, MD, PhD, Department of Urology, the First Hospital of Jilin University. Phone number: +86-15843073211. E-mail address: walkerzhouhl@163.com
5 Yang Gao, Department of Cardiovascular Surgery, the First Hospital of Jilin University. Phone number: +86-17604302550. E-mail address: 975707998@qq.com
* Na Wang, MD, PhD, Department of Anesthesiology, the First Hospital of Jilin University. No. 71 Xinmin Street, Changchun, Jilin, China. 130021. Phone number: +86-13578899126. E-mail address: lilyly12345@163.com
Correspondence: Na Wang, Department of Anesthesiology, the First Hospital of Jilin University, Phone number: +86-13578899126. E-mail address: lilyly12345@163.com Address: No. 71 Xinmin Street, Changchun City, Jilin Province, China, 130021.
Source of funding: the First Hospital of Jilin University. There are no conflicts of interest to disclose. There is no part of this article presented in conference proceedings, and this work is not supported or funded by any drug company.
rigid cystoscopy. Moreover, patients also complain of great pain during urination after cystoscopy. Thus, more effective methods are necessary to reduce pain associated with rigid cystoscopy.

Preprocedural administration of non-steroidal anti-inflammatory drug (NSAID) such as flurbiprofen by the oral route has been reported to have a positive effect on cystoscopy-related pain. However, to our knowledge no study about the analgesic effect of this injectable NSAID drug on cystoscopy-related pain has been conducted.

The aim of this prospective, double-blinded and randomized study is to evaluate the efficacy of flurbiprofen axetil by the intravenous route on cystoscopy-related pain.

Methods and Materials

This prospective and randomized study was approved by the institutional ethical committee. Male patients who were scheduled to undergo rigid cystoscopy in the outpatient urology clinic of our hospital were asked to participate in this study and 52 male patients were enrolled after written informed consents were obtained. Exclusion criteria were American Society of Anesthesiologists (ASA) physical status more than II, a history of cystoscopy, active urinary tract infection, allergic reaction to the study drugs, peptic ulcer, liver or renal insufficiency and mental disorder. All patients were instructed of the visual analogue scale (VAS: 0- no pain; 1, 2, 3-mild pain; 4, 5, 6-moderate pain; 7, 8, 9-severe pain; 10-worst imaginable pain) for measuring pain intensity before cystoscopy.

Venous access was achieved after the patients were taken to the clinic without premedication. The patients were equally assigned to one of the two treatment groups according to a computer-generated schedule. Group F received 50 mg flurbiprofen axetil (flurbiprofen axetil, Beijing Tide Pharmaceutical CO LTD, Beijing, China) and Group C received 20% fat emulsion injection (medium and long chain fat emulsion injection C8-24Ve, B. Braun Melsungen AG, Suzhou, China) diluted with normal saline to achieve the concentration of 2% as control agent. The study drugs were administered intravenously slowly over 1 minute. Fifteen minutes later, 20 ml 0.3% oxybuprocaine jelly (oxybuprocaine hydrochloride jelly, Shenyang Luzhou Pharmaceutical CO. LTD, Shenyang, China) was injected transurethrally. A penile clamp was placed for 10 minutes. The patient lay supine during the 10-minute interval, and then cystoscopy began. The study drugs were prepared by an independent researcher who was not involved in the procedures, so neither the physician performing cystoscopy nor the patients knew the grouping situation.

Cystoscopy was done by the same urologist using a rigid 22 F cystoscope (27005CA HOPKINS II Telescope 70°, STORZ, Tuttlingen, Deutschland). All patients were observed for 1 hour after cystoscopy before they went home. Patients rated pain perceived based on VAS at various time periods, including T1—during injecting oxybuprocaine jelly into the urethra; T2—during inserting rigid cystoscope into the urethra; T3—during viewing inside the urinary bladder; T4—at the first urination after cystoscopy and T5—at the first urination on the following morning at home. One of the researchers who was not involved in the procedures recorded VAS scores. The overall patient satisfaction was evaluated using a four-point scale (1: poor; 2: moderate; 3: good and 4: excellent). Side effects were evaluated.

Based on previous studies, pain score during inserting cystoscope into urethra is considered the primary outcome. To detect a standard deviation of 30% (estimated from initial pilot observations) in VAS score during inserting rigid cystoscope into the urethra between the two groups with an 80% power and two-sided 5% α a sample size of 20 patients per group was required. We enrolled 22 patients per group for possible dropouts.

SPSS 17.0 (SPSS Inc, IL, US) was used for statistical examination. The normally-distributed data were compared by student’s t-test. Differences in VAS scores were calculated using Mann-Whitney U test. The categorical variables were analyzed with Fisher’s exact test or Chi-square test, as appropriate. The level of statistical significance was set at $P<0.05$.

Results

The pain examination forms were collected from all of the participants. The characteristics of the patients
were comparable between the two groups (Table 1). The VAS scores of the two groups were given in Figure 1. Pain scores in Group F were significantly lower than those in Group C at the time periods of inserting rigid cystoscope into the urethra, viewing inside the urinary bladder, the first urination after cystoscopy and the first urination on the following morning at home. Preoperative flurbiprofen axetil did not result in any significant change in pain during injecting 0.3% oxybuprocaine jelly into the urethra. The patients were more satisfied in Group F than in Group C (Table 2). No adverse events associated to flurbiprofen axetil were observed.

Discussion

In the present study, significant decreases in pain are observed with preprocedural flurbiprofen axetil at various time periods except when injecting 0.3% oxybuprocaine jelly into the urethra as compared with the control group. As similar to the findings by Matsuda et al. and Komiya et al., the pain intensity during inserting the cystoscope into the urethra was largest, followed by the pain at the first urination after cystoscopy, during viewing inside the urinary bladder and at the first urination on the following morning at home. Our findings indicate that preprocedural...
flurbiprofen axetil can reduce pain at these four time periods. Preoperative intravenous administration of flurbiprofen axetil provides preemptive analgesia for transurethral resection of the prostate, tonsillectomy, spinal fusion surgery, hysterectomy and arthroscopic rotator cuff repair surgery. Flurbiprofen axetil is not only a NSAID drug, but also an injectable nonselective cyclooxygenase inhibitor with peripheral analgesic effect which is also called targeted analgesia. The patented technology of flurbiprofen axetil uses emulsified lipid microspheres which have a high affinity for injured tissues to achieve targeted drug therapy. Thus, preoperative flurbiprofen axetil can decrease or even eliminate the peripheral sensitivity resulting from physical stimulation of the urethra by the cystoscope. The results of our study are mostly consistent with Komiya’s findings. In their study, no significant decreases are detected in pain at the first urination on the following morning at home. In our study, the pain decreases in the flurbiprofen axetil group at this time period.

The present study is conducted only in male patients, so further study is necessary to evaluate the effect of flurbiprofen axetil for women who also suffer cystoscopy-associated pain.

**Conclusion**

Preprocedural flurbiprofen axetil can decrease rigid cystoscopy-associated pain and is recommended for use in clinical practice.
FLURBIPROFEN FOR ANALGESIA DURING CYSTOSCOPY

References

NASOTRACHEAL INTUBATION WITH PARKER FLEX-TIP VERSUS PREFORMED NASAL ENDOTRACHEAL TUBES FOR CHILDREN UNDERGOING ADENOTONSILLECTOMY

MOUSTAFA ABDELAZIZ MOUSTAFA¹ AND YASSER MOHAMED OSSMAN²

Abstract: The design of the endotracheal tube might be an important factor in the incidence of injurious complications during nasotracheal intubation.

Aim of the work: Primary aim: to compare the parker flex tip (PFT) and the preformed nasal (PNT) tubes regarding the ease of insertion during nasotracheal intubation in children undergoing adenotonsillectomy. Secondary aim: to verify the incidence of traumatic complications of both types of tubes during nasotracheal intubation in children undergoing adenotonsillectomy.

Patients and methods: 100 patients aged between 4 and 10 years ASA physical status I-II scheduled for adenotonsillectomy were divided into two groups; Group PFT: Patients were nasally intubated using the parker flex-tip endotracheal tube, Group PNT: Patients were nasally intubated using the preformed nasal tube. Ease of insertion of the ETT, degree of trauma and the time of intubation was measured.

Results: ETT was easily inserted without any resistance in 24% of patients of the PFT group versus 12% of patients in the PNT group. ETT could not be passed through the right or left nostrils in 20% of patients of the PNT group relative to only 4% of patients of the PFT group. Incidence of trauma to the nasal mucosa was significantly higher in patients of the PNT group than patients of the PFT group. Duration of intubation was statistically significantly longer among patients of the PNT group than patients of the PFT group.

Conclusions: It seems that the flexible tapered tip of the PFT tube has led to easier insertion through the nasal passages as well as less trauma to the nasal mucosa in children having nasopharyngeal pathology in the form of adenoids. At the same time, the duration of intubation was less in the PFT group relative to the control group in spite of the more familiarity of the investigator with the standard portex tube.

¹ M.D, Alexandria Faculty of Medicine, Anesthesia and Surgical Intensive Care, Alexandria, Egypt. E-mail: m.3abdelaziz@hotmail.com
² M.D, Alexandria Faculty of Medicine Anesthesia and Surgical Intensive Care, Alexandria, Egypt. E-mail: yasserals@hotmail.com

Corresponding Author: Moustafa Abdelaziz Moustafa, M.D, Alexandria University Hospitals, Egypt, Alexandria, smouha, Alnaaq street, Alboroug buildings, Building 5, Phone: +201222373407, Fax: 2035459881. E-mail: m.3abdelaziz@hotmail.com

This report describes human research. IRB contact information: Ethics Committee of the Alexandria Main University Hospitals, 16/6/2011, IRB NO: 00007555-FWA NO:00015712. This study was conducted with written informed consent from the study subjects.
Introduction

Adenotonsillectomy is a very common surgical procedure done all over the world. In spite of the relative easiness of the procedure, it does have its risk and challenges to both the surgeon and the anesthesiologist1. The main anesthetic consideration is to provide a good surgical field in spite of the shared airway by the surgeon and the anesthesiologist2. The oral route is the usual way of placement of the endotracheal tube (ETT). The oral ETT has the advantage of avoiding any trauma to the nasopharyngeal area especially with the enlarged adenoids3. Unfortunately, the oral ETT may hinder the surgical access as well as being liable to misplacement during the surgical maneuver. Hence, the nasal route is advantageous avoiding such complications. However, the adenoids may be an obstacle to the passage of the ETT through the nose and several studies have been conducted for avoiding traumatic injury to the adenoids by the passage of the nasotracheal tube4. The design of the ETT might be an important etiologic factor in such complications. Recently, Parker Medical (Bridgewater, Conn) introduced the Parker Flex-Tip (PFT) tube. It has a unique design with a flexible, curved, centered, tapered distal tip that may help avoid injury to the nasopharyngeal structures during its passage to the vocal cords5.

The primary aim of this study was to compare the Parker Flex-Tip and the preformed nasal (PNT) tubes regarding the ease of insertion during nasotracheal intubation in children undergoing adenotonsillectomy. A secondary aim was to verify the incidence of traumatic complications of both types of tubes during nasotracheal intubation in children undergoing adenotonsillectomy.

Methods

The study protocol was reviewed and approved by the Ethics Committee of the Alexandria Main University Hospitals. A written informed consent was obtained from the parents for participation of their child in the study.

This prospective, randomized, study was carried out at the university hospital day case surgery unit. One hundred patients aged between 4 and 10 years ASA physical status I-II who were scheduled for adenotonsillectomy, were considered for the study. Exclusion criteria included contraindications to nasotracheal intubation such as coagulopathy, known or suspected CSF leak and anticipated difficult intubation in the form of known congenital airway anomalies.

Complete history was obtained from the parents. All patients were subjected to thorough examination and routine laboratory investigations. Patients were randomly assigned for nasal intubation using the Parker Flex-Tip endotracheal tube (Group PFT) or the preformed nasal endotracheal tube (Group PNT) using a computer-generated program.

All patients were premedicated 30 minutes before the procedure by midazolam nasal drops 0.1 mg.kg⁻¹ and xylometazoline nasal drops (one drop each nostril). After admission to the operative theatre, all patients were monitored by continuous electrocardiography, heart rate, pulse oximetry, non-invasive arterial blood pressure, end-tidal capnography and transrectal temperature probe. An intravenous line was inserted after induction with 8% sevoflurane in 100% oxygen for 90 seconds using an appropriate sized facemask via a primed pediatric circle system. Fentanyl 1µg.kg⁻¹ and atracurium were given for facilitation of intubation. The proper sized ETT was chosen for each group and its tip was lubricated by a lubricating gel.

After full muscle relaxation, gentle insertion of the tube was tried in the right nostril first till it entered the oropharynx. By using the suitable Magil forceps and suitable sized laryngoscope, advancement of the ETT was carried out under direct vision until it entered the larynx to its final position. If the tube did not pass in the right nostril, the left one was tried. Anesthesia was maintained till the end of the surgery.

The ease of insertion of the tube through the nose was scored as

A-Ease of insertion of the tube through the nose:

1: no resistance is felt when advancing the tube till it passes to the oropharynx. 2: some resistance is felt when advancing the tube till it passes to the
### Table 1
**Demographic data. Data is presented as mean ± standard deviation or as a number**

<table>
<thead>
<tr>
<th></th>
<th>Group PFT (n = 50)</th>
<th>Group PNT (n = 50)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>5 ± 2.03</td>
<td>4.5 ± 2.4</td>
<td>0.465</td>
</tr>
<tr>
<td>Male/Female</td>
<td>25/25</td>
<td>26/24</td>
<td>0.611</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>19 ± 6.9</td>
<td>18 ± 5.98</td>
<td>0.456</td>
</tr>
<tr>
<td></td>
<td>12-29</td>
<td></td>
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</table>

### Table 2
**Scoring of the ease of insertion of the endotracheal tube through the nose**

<table>
<thead>
<tr>
<th>Grades</th>
<th>Group PFT (n = 50)</th>
<th>Group PNT (n = 50)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number</td>
<td>%</td>
<td>Number</td>
</tr>
<tr>
<td>1:No resistance</td>
<td>12</td>
<td>24</td>
<td>6</td>
</tr>
<tr>
<td>2:Some resistance</td>
<td>21</td>
<td>42</td>
<td>16</td>
</tr>
<tr>
<td>3:didn’t pass through right nostril</td>
<td>15</td>
<td>30</td>
<td>18</td>
</tr>
<tr>
<td>4:didn’t pass through right or left nostril</td>
<td>2</td>
<td>4</td>
<td>10</td>
</tr>
</tbody>
</table>

### Table 3
**Trauma of the endotracheal tube to the nasal mucosa**

<table>
<thead>
<tr>
<th>Grading</th>
<th>Group PFT (n = 50)</th>
<th>Group PNT (n = 50)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number</td>
<td>%</td>
<td>Number</td>
</tr>
<tr>
<td>1-No blood on the tube</td>
<td>15</td>
<td>30</td>
<td>8</td>
</tr>
<tr>
<td>2-Traces of blood on the tube</td>
<td>16</td>
<td>32</td>
<td>14</td>
</tr>
<tr>
<td>3-Some blood in the oropharynx</td>
<td>15</td>
<td>30</td>
<td>22</td>
</tr>
<tr>
<td>4- Some fleshy parts in the tube</td>
<td>4</td>
<td>8</td>
<td>6</td>
</tr>
</tbody>
</table>
oropharynx. 3: tube can’t pass through the right nostril in spite of some force used, and 4: tube can’t pass through the right or the left nostril and the tube will be put orally.

Also the degree of trauma, if any, by the passage of the ETT through the nose was assessed by the presence/amount of blood noticed in the oropharynx by laryngoscopy and was scored as 1: No blood is noted on the tube or oropharynx; 2: Trace of blood is noted on the tube; 3: Some blood is seen trickling in the oropharynx; and 4: Some fleshy parts is seen in the tube.

This was done through inspection of the tip of the ETT and the oropharynx during laryngoscopy after its passage through the nose and nasopharynx.

Time of intubation which was defined as the time interval between passage of the ETT through the right nostril till confirmation of its position by the capnogram, was determined in both groups.

**Sample size calculation:** It was done using Med Calc statistical software. A minimum sample size of 100 patients divided into two equal groups was determined to achieve a 20% difference in the ease of insertion of the endotracheal tube with a standard type I and type II error (α 0.05, β 0.2). The power of the study was 90.0%.

**Data Analysis:** Data were analyzed by using SPSS software (Statistical package for social science for personal computers) using Student t and chi-square tests, data were expressed as mean ± SD, and P ≤0.05 was considered significant.

**Results**

There were no statistically significant differences between the two groups in regards to demographic data (Table 1) No resistance to insertion of the tube was higher in the PFT group as compared to the PNT group (Table 2). Also, the failure to pass the tube through the right or left nostril was higher in the Group PNT as compared to the Group PFT (Table 2). On inspection of the ETT after insertion during laryngoscopy, no blood noticed on the ETT was statistically significantly higher in the PFT group (30%) compared to the PNT group (16%). Also, presence of blood in the oropharynx was significantly higher in the PNT group (44%) compared to the PFT Group (30%) (Table 3). Duration of intubation was significantly longer in patients of the PNT group (42 ± 7.11 sec) versus patients of the PFT group (34 ± 6.01 sec).

**Discussion**

The findings of the current study suggest that the flexible tapered tip of the PFT tube can result in easier insertion through the nasal passages as well as in less trauma to the nasal mucosa in children having nasopharyngeal pathology in the form of adenoids. Also, the duration of intubation can be decreased in the PFT group compared to the PNT group despite of the more familiarity of the investigators with the standard PNT tubes.

Several previous studies have investigated the different factors that may contribute to trauma to the nasal mucosa during tracheal intubation, of which the tracheal tube tip design was a prominent factor. Several authors described in previous studies the design of the PFT tube and how such design could improve the nasal intubating conditions. Yet, most of these studies have been done in patients with healthy nasal passages where patients with nasal pathologies were excluded from such studies. In their study comparing the PFT tube with the standard tube for nasotracheal intubation in oral surgery in adults using the fiberscope, Prior et al demonstrated that the PFT tubes glide over the nasal mucosa and tracheal rings rather than wedges and bruises against the involved mucosa leading to less trauma, less bleeding and less postoperative complications like sore throat. Higueras et al failed to pass a standard ETT over a nasally inserted fiberscope in a case of difficult intubation and replaced it in a second attempt with a PFT tube that passed easily over the fiberscope and suggested that the PFT tube may be helpful in awake fiberoptic nasotracheal intubation. Sanuki et al hypothesized in their manikin study of airway scope assisted nasotracheal intubation that the PFT tube may be superior over the standard ETT as its tip is less liable to impinge around the vocal cords during passage over the airway scope. Sugiyama et al examined the effect of bevel orientation and bending of the tube tip
by a stylet on the easiness of nasal tube passage and the incidence of epistaxis. They demonstrated that the styleted tip with the bevel facing posteriorly of the PFT tube improved the circumstances of intubation together with decreasing the degree of epistaxis relative to the standard portex ETT. On the other hand, Turkstra et al\(^9\) found that there was no difference between the standard Mallinckrodt endotracheal tube and the PFT tube regarding postoperative sore throat after nasal intubation. However, the sizes of the endotracheal tubes used ranged from 7 to 8.5 which are considered large relative to the nasal passages in addition to the use of a stylet in a higher percentage in the PFT group. In addition to the nasal route, Radesic et al\(^10\) compared the PFT tube with the standard ETT during oral intubation in adults using the glidescope. They reported that the posteriorly facing bevel together with the flexible tip of the PFT allowed better visualization during video laryngoscopy, reduced the time needed for endotracheal intubation and decreased the number of redirections needed before insertion of the ETT. Similar results were also obtained by Kristensen et al\(^11\) and So et al\(^12\) during orotracheal intubation using the fiberoptic and conventional laryngoscopy respectively. They also attributed these results to the gentle sliding movement of the PFT tube over the anatomical structures of the airway.

Preference of the nasal route of intubation in cases of adenotonsillectomy in our institution has led to more efforts and studies to improve the outcome in such cases regarding trauma to the upper airway, and to our knowledge, the present study may be the first to examine the PFT tube in children with unhealthy nasopharyngeal anatomy. However, the present study has certain limitations. Blindness could not be achieved since the type of the tube could not be hidden from the investigator. Also, some of the postoperative complications expected from the procedure of intubation such as sore throat or change in the tone of voice could not be assessed since adenotonsillectomy surgery itself may lead to the same postoperative complications.

Conflicts of interest: None declared by the authors
References


EFFECTS OF CIRCUIT LEAK DEVELOPMENT OVER TIME AND RESPONSE DURING LOW-FLOW VOLUME AND PRESSURE-CONTROLLED VENTILATION

ROLAND KADDOU1, CHADI I YAACOUB2, GEORGE M MCKELVEY3 AND HONG WANG4

Study Objective: To study the effects of circuit leak development over time and response during volume and pressure controlled ventilation using low flow in human patient simulator and to examine the minimum fresh gas flow needed to compensate for such a leak.

Design/Setting: Prospective study using a patient Simulation Lab at Wayne State University.

Measurements: A human patient simulator was endotracheally intubated. The endotracheal tube (ETT) was connected to the Datex-Ohmeda AS/3 Anesthesia machine. The tidal volume was set to 500ml in the volume controlled trial and the pressure to 6cm H2O in the pressure controlled trial. A hole was created in each experiment placed 10 cm after the inspiratory valve. Leaks were simulated from holes using 4 different needle diameters: 25, 21, 18 and 16G. A series of data were collected using fresh gas flow at 4 different flow rates (0.5, 1, 1.5 and 2 liters.min⁻¹). Data was measured at different time points (baseline, 1, 3 and 5 minutes) in the series of simulated leaking breathing circuits.

Results: Leak alarms were only detected with 16G hole at 5 minutes in the volume control mode versus leaks at 3 minutes with 16G hole and at 5 minutes with 18G hole in the pressure control mode.

Conclusion: When a very low flow of 0.5 L/min is used, volume control is safer than pressure control mode since leak alarms only occurred with 16G hole. However when a flow of 1L/min was used, there was no difference in leak compensation between volume and pressure control modes.

1 MD, Department of Anesthesiology, American University of Beirut Medical Center, P O Box 11-0236, Riad El Solh, 1107-2020, Beirut, Lebanon.
2 MD, Illinois Pain Institute, Elgin, IL 60010.
3 PhD, Department of Anesthesia, Detroit Medical Center, Detroit, MI, USA.
4 MD, PhD, Department of Anesthesiology, West Virginia University, 1 Medical Center Dr, Morgantown, WV 26506, USA. Superscripts denoting the academic degrees.

Correspondence Author: Hong Wang, Department of Anesthesiology, West Virginia University, 1 Medical Center Dr, Morgantown, WV 26506, USA. Phone: 304-598-4122. E-mail: howang@med.wayne.edu

Sources of financial support: Department of Anesthesiology Detroit Medical Center, Wayne State University, 3990 John R., Detroit, MI 48201, USA.

Institutional Review Board review of this study was not required as all data obtained from a human patient simulator connected to a Datex-Ohmeda AS/3 Anesthesia Delivery Unit.

Conflicts of interest: None of the study authors had any financial relationships or commercial interests with a vested interest in the outcome of this study.
Introduction

Low flow anesthesia was used with cyclopropane to limit the leak of this explosive gas\textsuperscript{1-3}; it became popular after the development of circle systems\textsuperscript{4,5}. The concomitant use of low flow and closed circuit in anesthesia might reduce the cost\textsuperscript{6,7} and the atmospheric and personnel pollution by inhalational agents\textsuperscript{8}, improve inhalational gas humidity and temperature when compared to the use of a high flow anesthesia. However the main factor limiting its use is the possibility of hypoxic anesthetic gas delivery like rebreathing of exhaled CO\textsubscript{2}\textsuperscript{9,10}, rebreathing of carbon monoxide\textsuperscript{11} and accumulation of nitrogen within the breathing circuit\textsuperscript{12}. Another possible limiting factor could be the inability to compensate for a circuit leak, resulting in hypoventilation of the anesthetized patient.

Leak within the anesthesia circuit might lead to inadequate ventilation and hypoxemia\textsuperscript{9} over time and their severe consequences if it went unnoticed. In this study we studied the minimum fresh gas flow that is required to compensate for such a leak.

Methods

Institutional Review Board review for this study was not required as all data obtained from a human patient simulator connected to a Datex-Ohmeda AS/3 Anesthesia Delivery Unit.

A) Selection and description of participants:

We designed this prospective simulator trial to study the effects of circuit leak development over time and response during volume and pressure controlled ventilation using low flow in human patient simulator.

B) Technical information:

A human patient simulator was endotracheally intubated with an 8.5mm internal diameter endotracheal tube (ETT), the cuff was inflated with 15cc or air to create a good seal for air leak. The ETT was connected to the Datex-Ohmeda AS/3 Anesthesia Delivery Unit machine breathing, the tidal volume was set to 500ml in the volume controlled trial and the pressure to 6cm H\textsubscript{2}O in the pressure controlled trial. The respiratory rate is set to 10/min, PEEP to 0cm H\textsubscript{2}O. A hole was created in each experiment 10cm after the inspiratory valve. Leaks were simulated from holes made in the circuit using 4 different needle diameters (consecutively used 25, 21, 18 and 16 gauge needles). A series of data measurements were collected using fresh gas flow at 4 different flow rates (0.5, 1, 1.5 and 2 liters.min\textsuperscript{-1}).

Data from the anesthesia machine was measured from the ventilator monitor at different time points (baseline then 1, 3 and 5 minutes) in the series of simulated leaking breathing circuits. The two primary variable parameters were the diameter of a hole created in the breathing circuit and the fresh gas flow. Two different scenarios were simulated to measure the primary variables; 1. Volume controlled scenarios (breathing circuit was set at tidal volume of 500ml) and 2. Pressure controlled scenarios (breathing circuit was set at a pressure rate of 6cm H\textsubscript{2}O).

C) Statistics:

The tidal volume, minute volume, peak airway pressure, plateau pressure, positive end expiratory pressure data were collected in 10 separate experiments. Each data point on these simulated cases was an averaged value derived from 5 individual runs on the simulated anesthesia machine. In addition to continuous volume and pressure measurements, categorical data was collected with machine bellows status that was designated as either bellows full or bellows leaking and machine alarm status designated as either alarm present (alarming) or alarm absent (not alarming). Data was collated and analyzed using Microsoft Excel 2010.

PEEP: positive end expiratory pressure
Bellow F: bellow full
Bellow L: bellow leaking
Alarm A: absent (not alarming)
Alarm P: present (alarming)
Results

The standard deviation range for all Pressure controlled data stayed below 1% of mean values for all data.

The standard deviation range for all Volume controlled scenario data was below 10% of mean values data obtained from 25, 21 and 18 gauge produced system leaks. The SD of mean data rose to 25% for 16 gauge system leaks at low flow rates (0.5 l/min and 1.0 l/min) by the 3 and 5 minutes periods.

Volume controlled data

When the simulated breathing circuit was set at a tidal volume of 500ml the circuit leak alarm was only detected in the circuit at a gas flow rate of 0.5 l/min at the 5 minute duration when a 16-gauge hole was present. (Panel A, Figure 1). No leak holes regardless of gauge diameter could activate the circuit leak alarm at any time point during gas flow rates of 1, 1.5 or 2 l/min (Panels B, C and D, Figure 1).

Pressure controlled data

When the simulated breathing circuit was set at a pressure rate of 6cm H2O the circuit leak alarm was detected in the circuit at a gas flow rate of 0.5 l/min at 3 minutes duration when a 16-gauge hole was present and also at 5 minutes duration for both 16 and 18 gauge holes. (Panel A, Figure 2). No leak holes regardless of gauge diameter could activate the circuit leak alarm at any time point during gas flow rates of 1, 1.5 or 2 l/min (Panels B, C and D, Figure 2).

Discussion

For both pressure control and volume control simulations only the large gauge holes in the breathing circuit occurring during the lowest flow rate (0.5 L/min) will result in a machine alarm. The volume control mode seems safer than the pressure control mode since leaks were only present with a 16G hole at 5 minutes in the volume control mode versus leaks at 3 minutes with a 16G hole and at 5 minutes with an 18G hole in the pressure control mode. The anesthesia machines and inhalational anesthetics currently available allow a safe use of low-flow techniques. Low-flow anesthesia techniques using a fresh gas flow rate of 1 l/min can be performed with almost every anesthesia machine. The major benefit of rebreathing techniques can be reached only if the fresh-gas flow is reduced to 1 l.min-1 or less. Our results showed that a fresh gas flow of 1.l.min-1 is safe while it is not with lower fresh gas flow of 0.5 l.min-1 in the presence of leaks in the circuit.

Leaks in anesthesia machines can increase the risk of hypoxia, hypoventilation, and can also lead to inadequate delivery of anesthetic gases with possibility of awareness. Small leaks in the low-pressure system (LPS) of the anesthesia gas machine can cause hypoxia or patient awareness. Small circuit leaks can occur anywhere in the anesthesia machine. It can occur due to APL valve malfunction. It can occur in unusual places like a circuit leak from capnograph sampling line, a loose lock nut holding the exhalation port to the body of the CO2 absorber manifold creating a leak, a crack in a fresh gas circuit valve, mis-installation of a different but very similar canister, or a leak within the anesthesia circuit due to a tear near the insertion site of ETT cuff inflation line, a leakage from the junction of two vaporizers, soda lime granule trapped in the flap valve of the water trap, rendering that valve incompetent or even a fault with the electronically controlled Man-Auto valve causing it to stick in the bypass direction, thereby diverting inspiratory gas flow directly to the scavenging system.

Administering anesthesia without the use of nitrous oxide facilitates the use of low flow anesthesia since washing out nitrogen is no longer required. Desflurane and sevoflurane can be used with low flow anesthesia. Another advantage of keeping the fresh gas flow at 1 l.min-1 is that when the flow is reduced to 1 l/min, the inspired desflurane concentration achieved in the initial high-flow phase can be maintained without changing the vaporizer setting. However if the flow is reduced down to to 0.5 l/min, the fresh gas concentration has to be increased to a value 1%-2% higher than the inspired nominal value. Because of its low solubility and high maximum concentration delivered by the vaporizer, sevoflurane is suitable.
Fig. 1
Minute volume over time with a set volume of 500ml during gas flow rates (L/min) of A) 0.5, B) 1.0, C) 1.5 and D) 2.0.
**Fig. 2**

Minute volume over time at a pressure of 6cm H2O pressure during gas flow rates (L/min) of A) 0.5, B) 1.0, C) 1.5 and D) 2.0.
for low flow anesthesia. With careful attention to managing fresh gas flow, anesthetic drugs can be used more efficiently by reducing the waste while achieving the same effect on the patient.

The sensitivity and specificity of the positive pressure tests were 92% and 100% respectively and the possibility of gas leakage around the oxygen flush device is not generally recognized. Therefore a fresh gas flow of 1 l.min⁻¹ will still be safer than lower fresh gas flows in the presence of negative leak test on the checking of the anesthesia machine. The primary cause of the leak is thought to be related to the canister. It is important to inspect the canister if the low flow leak test does not meet the standard.

Low fresh gas flows can be used with laryngeal mask airways. The reduction in the fresh gas flow to 0.5 L.min⁻¹ was possible in 96.7% of the patients managed with a laryngeal mask. The laryngeal mask airway provides a tight gas seal comparable to that of a tracheal tube in this context and would be beneficial in reducing anesthetic gas pollution.

Mucociliary clearance and respiratory function are better preserved in a low-flow anesthesia technique than in high-flow anesthesia. Low fresh gas flow technique using sevoflurane is cost saving compared to intravenous anesthesia in laparoscopic cholecystectomy. Cost-effectiveness has become a major focus in healthcare nowadays. The effect of a new policy on the use of low fresh gas flow during maintenance of general anesthesia effectively reduces the amount of sevoflurane consumed for the same duration of anesthesia. Sevoflurane stability was studied during low flow anesthesia, this showed that there was no connection with nephropathy or liver toxicity and that renal and hepatic effect of moderate duration low-flow sevoflurane and total intravenous anesthesia is similar.

**Conclusion**

The mechanical effects and consequences, such as volume and pressure changes, that resulted from the interaction of the presence of a leak and low flow in the breathing circuit were studied. Volume control mode seems to be safer than pressure control mode when low fresh gas flows were used. We did not study the possibility or the amount of rebreathed CO₂ nor the presence of carbon monoxide or the concentration of inhalational anesthetics or compound A or other degradation products due to the fact that we used a human patient simulator where no gas is consumed.
EFFECTS OF CIRCUIT LEAK DURING VENTILATION

References

CLINICAL EXPOSURE AND ORGANIZATION
OF THE CRITICAL CARE ROTATION DURING
THE HAJJ PERIODS IN 1434-1435; PERSPECTIVES
OF ARABIAN SAUDI ANESTHESIOLOGY
PROGRAM RESIDENTS

ABDULAZIZ M BOKER

Abstract

Background: The nature of massive mass gathering during Hajj was expected to provide a
challenging and stimulating working experience for anesthesiology training program residents. An
new rotation arrangement was reached between the Ministry of Health and the Saudi Commission
of Health Specialties to recruit anesthesia resident to provide critical care services during the Hajj
seasons in 1434 and 1435.

Objectives: This study aimed to explore the perspectives of anesthesia residents on their
experience working among critical care teams during Hajj seasons in 1434H and 1435H at various
locations of Makkah city and Al-Mashaer.

Subjects and methods: This cross-sectional study was conducted using a self-administered
questionnaire distributed to all residents (n = 35) enrolled in anesthesia residency training program
of the SCFHS and participated in critical care areas as locum during the Hajj seasons of 1434H and
1435H. Data was analyzed by using the statistical package of social science.

Results: The mean score of residents agreement on being treated with respect from both
nurses and administration was the highest among the surveyed item (6.13 and 6.22 respectively). It
was observed that, satisfaction of the residents with the direct observations and feedback provided
to them (p = 0.01), the adequacy of the services components (p = 0.01) being treated with respect
by the senior doctors and nurses (p = 0.03, p = 0.002) was significantly increased in the year 1435
compared to that of the year 1434. The satisfaction was generally higher in Makkah hospitals when
compared to that of Al-Mashaer (Arafat and Menna) hospitals although this difference was of no
statistical significance.

Conclusion: Hajj critical care rotations in 1434 and 1435 were well perceived by anesthesia
residents. They found them useful as they give them the chance to gain self-confidence and
experience the provision of healthcare services for mass gathering sessions.

Keywords: anesthesiology, mass gathering, critical care, rotations, residency training, hajj
perspectives on Hajj rotations.

1 Consultant & Associate Professor, Department of Anesthesia & Critical Care, Director, Clinical Skill Center, Faculty of
Medicine, King Abdulaziz University, Jeddah, Saudi Arabia.

Correspondence author: Dr. Abdulaziz MA. Boker, MBBS, Med, FRCPC, Consultant & Associate Professor, Dep. of
Anesthesia & Critical Care, Director, Clinical Skill Center, Faculty of Medicine, King Abdulaziz University, Jeddah, Saudi
Arabia, P.B. Box: 80215, Jeddah 21589. E-mail: boker@hotmail.com. aboker@kau.edu.sa, Tel: 966-2-640-1000 (ext:
1-10199/10209), Fax: 009662640-8335.
Introduction

The healthcare profession needs adequate medical residency training programs to increase its members’ professional qualifications and to maintain patient safety\(^1\). Over the last few years, postgraduate medical training programs have to increase training capacity to meet the increasing number of medical school graduation rates and meet national health care shortages. Therefore, the postgraduate training programs in general and the anesthesia training programs in specific are aiming to prepare competent graduates with independent specialist practice\(^2\). The Saudi Commission for health Specialties (SCFHS) has an active five-year residency program to train residents to obtain certification in anesthesiology. The residency training program is divided into three junior years followed by two senior final years. The program is further subdivided into clinical rotations covering general anesthesia, critical care and subspecialties of anesthesia like cardiac anesthesia, neuroanesthesia, obstetric anesthesia and many more subspecialties and elective rotations.

Hajj (Pilgrimage) is a special season where more than two million Muslims from more than 150 countries gather every year at the holy shrine (Al-Mashaer) to perform this important ritual of Islam. Hajj is performed in Makkah and Al-Mashaer (includes Mina, Mozdalifah and Arafat) in the Kingdom of Saudi Arabia (KSA). The ritual starts on the 8\(^{th}\) and ends on the 13\(^{th}\) day of Dhul Hijjah, the 12\(^{th}\) month of the lunar Islamic calendar year. Approximately 2 to 3 million pilgrims perform Hajj every year. Hajj is considered a major public health challenge that required an undivided attention from a number of governmental and non-governmental sectors in Saudi Arabia. Chief among the government sectors is the Ministry of Health (MOH) which provide free medical care to pilgrims\(^3\)\(^-\)\(^5\). In this decade a remarkable advancement has been made in the development of health services during Hajj seasons. The Saudi government allocated a lot of resources including health facilities, qualified personnel, materials and logistics to serve the pilgrims\(^1\).

For decades, anesthesiologists have contributed to the provision of healthcare during Hajj seasons for years through provision of anesthetic services at operating rooms as well as support team working at the critical care units and emergency rooms. During the Hajj seasons intense health coverage of 1434H and 1435H, corresponded to October 6 to 20 2013, and September 25 to October 9, 2014 respectively, an agreement was reached with the main healthcare service provider, MOH, to recruit residents enrolled in anesthesia residency training program to cover locum duties in critical care areas. This was a great chance to increase the critical care training of the anesthesia residents and increase their self-confidence, it was considered a step to prepare residents for independent practice. This study aimed to explore the perspectives of anesthesiology training program residents on their experience working among critical care teams during Hajj seasons in 1434H and 1435H at various locations of Makkah city and field hospitals at Mena and Arafat locations.

Subjects and Methods

The study was approved by the biomedical research ethics committee at the FOM, KAU. This cross-sectional study was conducted using a self-administered, anonymous questionnaire. It included some questions about demographic data of the residents, in addition to some questions about the general and specific training information of the Hajj rotation. Residents’ response was classified according to seven Likert scale and was rated from strongly disagree (1) to strongly agree (7). The reliability of the questionnaire was calculated by Cronbach’s alpha and it was 0.79.

The questionnaire was distributed to all residents (n = 36) enrolled in anesthesia residency training program and participated in critical care areas as locum during the Hajj seasons of 1434H and 1435H, corresponded to October 13 to 18, 2013, and September 3 to 8, 2014 respectively. The response rate was 97.2% and 75.3% of the respondents were males (26 out of 35).

After data collection, it was analyzed using the statistical package of social science (SPSS) program version 16 Inc. The data were examined for normality in distribution using the Kolmogrov-Smirnov test. The quantitative data was expressed as mean and standard
deviation (SD). The Student t-test was used to test significance for quantitative data of two groups and the F-test was used to test significance for quantitative data of three groups. Person correlation coefficient test was used to study the correlation between the two quantitative parameters. p<0.05 is considered significant. The qualitative data were expressed as number and percentage. The x²-test was used to test significance for qualitative data. The x²-test with linear trend was used for ordinal data. Significance was considered at p value less than 0.05.

Results

It was noticed that about 75% of the anesthesia residents participated in the Hajj rotation during the two seasons were male and about half of them were in the 3rd level of the anesthesia residency. The number of the residents in the rotation was doubled in the year 1435. They were coming from the three geographical regions of the kingdom namely, the eastern, western and middle regions with more or less equal distribution (Table 1).

Table 1
Demographic data of the anesthesia resident trainees participated in the Hajj rotation

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>9</td>
<td>25.7</td>
</tr>
<tr>
<td>Male</td>
<td>26</td>
<td>75.3</td>
</tr>
<tr>
<td>Level</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3rd</td>
<td>5</td>
<td>14.3</td>
</tr>
<tr>
<td>4th</td>
<td>17</td>
<td>48.6</td>
</tr>
<tr>
<td>5th</td>
<td>13</td>
<td>37.1</td>
</tr>
<tr>
<td>Region</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Central</td>
<td>11</td>
<td>31.4</td>
</tr>
<tr>
<td>Eastern</td>
<td>13</td>
<td>37.1</td>
</tr>
<tr>
<td>Western</td>
<td>11</td>
<td>31.4</td>
</tr>
<tr>
<td>Number of rotation/Year</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1434</td>
<td>22</td>
<td>36.1</td>
</tr>
<tr>
<td>1435</td>
<td>39</td>
<td>63.9</td>
</tr>
</tbody>
</table>

Table 2
Resident trainees-reported experience with training during the Hajj rotation according to gender and resident trainees level

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Gender</th>
<th>Resident trainees level</th>
<th>Total Mean ± SD</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Male</td>
<td>Female</td>
<td>3rd level</td>
</tr>
<tr>
<td>My education needs and goals were met</td>
<td>4.72 ± 1.2</td>
<td>5.44 ± 0.9</td>
<td>4.5 ± 0.7</td>
</tr>
<tr>
<td>There was enough direct observation and feedbacks</td>
<td>4.88 ± 1.3</td>
<td>5.33 ± 1.1</td>
<td>5.6 ± 1.1</td>
</tr>
<tr>
<td>The services components were excessive</td>
<td>5.27 ± 1.6</td>
<td>5.22 ± 1.9</td>
<td>5.8 ± 0.8</td>
</tr>
<tr>
<td>I was treated with respect by senior doctors</td>
<td>5.15 ± 1.5</td>
<td>5.33 ± 1.1</td>
<td>4.8 ± 1.3</td>
</tr>
<tr>
<td>I was treated with respect by the nurse</td>
<td>6.58 ± 1.0</td>
<td>5.78 ± 1.7</td>
<td>6.6 ± 0.5</td>
</tr>
<tr>
<td>I was treated with respect by the administration</td>
<td>6.38 ± 1.3</td>
<td>6.11 ± 1.1</td>
<td>6.2 ± 1.3</td>
</tr>
<tr>
<td>I was evaluated in fair manner</td>
<td>5.58 ± 1.7</td>
<td>6.11 ± 1.2</td>
<td>5.2 ± 1.5</td>
</tr>
<tr>
<td>I will recommend this site to future training</td>
<td>6.31 ± 1.0</td>
<td>5.78 ± 1.1</td>
<td>6.4 ± 0.5</td>
</tr>
</tbody>
</table>

Data is presented in the form of mean ± standard deviation (SD). The Student t-test (when comparing two groups) or F-test (when comparing three groups) was used to compare the quantitative data between the two groups. p<0.05 is considered significant.
### Table 3
Resident trainees-reported experience with training during the Hajj rotation in 1434H and 1435H

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Hajj season</th>
<th>Region of the resident trainees</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1434H</td>
<td>1435H</td>
<td>P value</td>
<td>Central</td>
<td>Eastern</td>
<td>Western</td>
</tr>
<tr>
<td>My education needs and goals were met</td>
<td>4.67 ±1.2</td>
<td>5.29 ±1.1</td>
<td>0.15</td>
<td>4.90 ±1.3</td>
<td>4.88 ±0.8</td>
<td>5.11 ±1.4</td>
</tr>
<tr>
<td>There was enough direct observation and feedbacks</td>
<td>4.26 ± 1.7</td>
<td>5.27 ± 1.2</td>
<td>0.01*</td>
<td>4.64 ± 1.2</td>
<td>5.31 ± 1.1</td>
<td>5.00 ± 1.4</td>
</tr>
<tr>
<td>The services components were excessive</td>
<td>4.28 ± 1.8</td>
<td>5.64 ± 1.6</td>
<td>0.01*</td>
<td>4.27 ± 2.0</td>
<td>6.08 ± 0.9</td>
<td>5.27 ± 1.7</td>
</tr>
<tr>
<td>I was treated with respect by senior doctors</td>
<td>4.38 ± 1.8</td>
<td>5.36 ± 1.3</td>
<td>0.03*</td>
<td>4.73 ± 1.7</td>
<td>5.85 ± 0.9</td>
<td>4.91 ± 1.4</td>
</tr>
<tr>
<td>I was treated with respect by the nurse</td>
<td>5.59 ± 1.7</td>
<td>6.77 ± 0.5</td>
<td>0.002*</td>
<td>6.09 ± 1.8</td>
<td>6.54 ± 0.7</td>
<td>6.45 ± 1.2</td>
</tr>
<tr>
<td>I was treated with respect by the administration</td>
<td>6.0 ± 1.4</td>
<td>6.5 ± 0.8</td>
<td>0.33</td>
<td>6.09 ± 1.8</td>
<td>6.31 ± 0.9</td>
<td>6.55 ± 1.0</td>
</tr>
<tr>
<td>I was evaluated in fair manner</td>
<td>5.38 ± 1.9</td>
<td>6.27 ± 1.1</td>
<td>0.05</td>
<td>5.36 ± 2.1</td>
<td>6.46 ± 0.7</td>
<td>5.82 ± 1.6</td>
</tr>
<tr>
<td>I will recommend this site to future training</td>
<td>5.28 ± 1.4</td>
<td>6.55 ± 0.6</td>
<td>&lt;0.001*</td>
<td>5.82 ± 1.3</td>
<td>6.46 ± 0.9</td>
<td>5.68 ± 0.9</td>
</tr>
</tbody>
</table>

Data is presented in the form of mean ± standard deviation (SD). The F-test was used to compare the quantitative data between the two groups. p <0.05 is considered significant.

### Table 4
Resident trainees-reported experience with training during the Hajj rotation according to training locations

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Mean ± SD</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Makkah</td>
<td>Arafat</td>
<td>Menna</td>
</tr>
<tr>
<td>My education needs and goals were met</td>
<td>4.96 ± 1.16</td>
<td>4.8 ± 1.4</td>
<td>5.25 ± 1.2</td>
</tr>
<tr>
<td>There was enough direct observation and feedbacks</td>
<td>5.1 ± 1.23</td>
<td>4.25 ± 1.3</td>
<td>4.96 ± 1.8</td>
</tr>
<tr>
<td>The services components were excessive</td>
<td>5.26 ± 1.68</td>
<td>4.19 ± 2.1</td>
<td>5.04 ± 1.84</td>
</tr>
<tr>
<td>I was treated with respect by senior doctors</td>
<td>5.2 ± 1.43</td>
<td>4.06 ± 1.8</td>
<td>5.26 ± 1.60</td>
</tr>
<tr>
<td>I was treated with respect by the nurse</td>
<td>6.37 ± 1.6</td>
<td>5.8 ± 1.68</td>
<td>6 ± 1.24</td>
</tr>
<tr>
<td>I was treated with respect by the administration</td>
<td>6.31 ± 1.3</td>
<td>6.19 ± 0.8</td>
<td>6.11 ± 1.6</td>
</tr>
<tr>
<td>I was evaluated in fair manner</td>
<td>5.91 ± 1.56</td>
<td>5.69 ± 1.74</td>
<td>5.76 ± 1.63</td>
</tr>
<tr>
<td>I will recommend this site to future training</td>
<td>6.17 ± 1.04</td>
<td>5.62 ± 1.58</td>
<td>5.44 ± 1.3</td>
</tr>
</tbody>
</table>

Data is presented in the form of mean ± standard deviation (SD). F-test was used to compare the quantitative data between the two groups. p <0.05 is considered significant.

### Table 5
Correlation between resident trainees-reported experience with training during the Hajj rotation and the duration of training

<table>
<thead>
<tr>
<th>Duration of training</th>
<th>r</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>There was enough direct observation and feedbacks</td>
<td>0.37</td>
<td>0.001*</td>
</tr>
<tr>
<td>The services components were excessive</td>
<td>0.29</td>
<td>0.009*</td>
</tr>
<tr>
<td>I was treated with respect by senior doctors</td>
<td>0.33</td>
<td>0.002*</td>
</tr>
</tbody>
</table>

Person correlation coefficient was used to study the correlation between the two parameters. p <0.05 is considered significant.
The mean score of residents agreement on being treated with respect from both nurses and administration was the highest among the surveyed item (6.13 and 6.22 respectively). They agreed that they were fairly evaluated while somewhat agreed that their educational needs and goals were met. Although there was no significant difference in residents perception of the surveyed items between male and female, male residents strongly agreed more than the female residents that they were being treated with respect from both nurses and administration and they would recommend Hajj rotation for future training while the females perceived their evaluation as fair more than males (Table 2). Regarding the level of resident residents, there was no significant difference in perception of the surveyed items among the resident from different levels. Overall the perception of the 4th level residents was higher than those at the 3rd and 5th level (Table 2).

It was observed that, satisfaction of the residents with the direct observations and feedback provided to them was significantly increased \((p = 0.01)\) in the year 1435 compared to that of the year 1434. Not only that, their perception regarding the adequacy of the services components was also significantly increased \((p = 0.01)\) in the year 1435. Their agreement on being treated with respect by the senior doctors and nurses were increase significantly increased \((p = 0.03, p = 0.002)\) in the year 1435 respectively. Overall, they significantly recommended the Hajj rotation for future training higher than those of the year 1434H (Table 3). Interestingly, the residents from the eastern region of the kingdom rated the services components provided as excessive significantly more than \((p = 0.03)\) those from other regions (Table 3).

Regarding the training site, the satisfaction of the resident was generally higher in Makkah hospitals when compared to that of Al-Mashaer (Arafat and Menna) hospitals although this difference was of no statistical significance. Residents trained at Makkah hospitals reported that they would recommend this site for future training significantly higher \((p = 0.04)\) than those who trained at Arafat and Menna. On the other hand, residents trained at Arafat reported that they were treated with respect by senior doctors significantly lower \((p = 0.03)\) than the other two sites (Table 4).

There are significant positive correlation between the duration of training of the residents and they satisfaction with the amount of the direct observations and feedback provided to them \((p = 0.001)\), being treated with respect by the senior doctors \((p = 0.002)\) and agreement on the adequacy of the service components provided during the season \((p = 0.001)\) (Table 5).

Discussion

Gathering of a large number of pilgrims during Hajj, the largest religious festivals worldwide, could compromise the health system of the host country but Saudi Arabia has extensive experience of providing health care at mass gatherings acquired through decades of managing millions of pilgrims at the Hajj. It was reported that more than 25% of patients attended to the Haram medical center facilities in the year 1434 was referred to the Ajyad, Makkah and the King Abdulaziz Hospitals and others which indicated the need for more staff, patients’ beds, and medicines at these locations. It seemed that this problem was spotted, although not documented in published works, from the previous Hajj season in 1433H. In response to that an agreement was reached between the MOH and the SCFHS to recruit anesthesia residents to cover locum duties in critical care areas during the Hajj seasons in 1434 and 1435.

In this study, the perspectives of anesthesia residents on their training and working the Hajj seasons in 1434H and 1435H at various locations of Makkah city and Al-Mashaer were explored. Generally the experience of anesthesia training during Hajj rotation was well perceived by residents. The nature of massive mass gathering during Hajj might provide a challenging and stimulating working experience for anesthesia residents during this rotation. Hajj critical care rotation provided anesthesia residents ample opportunity to practice at the frontline.

The Hajj rotations provided resident with chances to work at various locations included established critical care units at formal hospitals in Makkah City as well as the critical care units at temporary and seasonal field hospitals. In this study it was observed that the residents were more satisfied, but of no statistical...
significance, with the training at Makkah hospitals when compared to those of Al-Mashaer and this was reflected on their reporting that they will recommend Makah for future training significantly higher than other hospitals in Al-Mashaer. The perception could be explained when understanding the difference between Makkah and Al-Mashaer hospitals. Makkah hospitals are well-equipped permanent ones, provided with infrastructure and stable, expert health providers teams who are provided with suitable comfortable accommodations and transport facilities. On the other hand, health workers at the seasonal hospital at Al-Mashaer were recruited from different areas and weren’t acclimatized with each other and might following different health care systems. They were suffer from crowded accommodations, extra-workload and difficulty in transportation.

It was observed that the residents were not highly satisfied with the amount of the direct observation and feedbacks as well as the way they were treated with the senior doctors. This might be attributed to the stressful conditions under which the whole health team providers were working doing the Hajj seasons. During the hajj the working shift was lasting for 12 hours per day for consecutive 15 days with no break. In one of the recent studies conducted on Saudi residents in different specialties it was reported that stress was associated with higher workload (dealing with more patients and working more weekends), sleep deprivation (sleeping few hours and feeling un-refreshed after sleep) and dissatisfaction with colleagues. This was consistent with other previous studies that identified the parameters associated with higher stress in residents, such as prolonged working hours, high patient load, critical patients assigned, night duty, poor sleep duration, and quality, poor work environment, and process failure. Abdulghani et al., found significantly high levels of stress among the residents of SCFHS training programs namely, Internal Medicine, Emergency Medicine and Family Medicine and they reported that high levels of stress may have an effect on their working efficiency and general physical health.

The satisfaction with training among the 5th level of residents was lower than those in the 3rd and 4th level, although it was of no statistically significance. Generally the fierce competition lying ahead on the senior residents in the form of postgraduate examination, responsibility, high expectations, and suitable jobs making them less satisfied and at risk to stress as was reported by Abdulghani et al.

One of the fundamental observations in this study that the residents experience with training in Hajj rotations of 1435 was almost all better than that of 1434H and they significantly recommended the Hajj rotation for future training higher than those of the year 1434. It is notably that anesthesia Hajj rotation was implemented for the first time in1434 and neither the trainers nor the supervisors were sufficiently informed about the arrangements of accommodations, transportations and distribution of work hours. In 1435, the supervisors and trainers gained experience in managing all these tissues and tried to avoid much of the reported problems in the previous year. The perception of the residents regarding the adequacy of the services components was significantly increased in the year 1435 compare to that of 1434. It is worth mention that in the Hajj season of 1434, the MOH equipped 23 hospitals to serve the pilgrims of which 8 hospitals were seasonal. A total of 4,326 hospital beds as well as 110 emergency beds were available. The MOH, as well, provided 154 health centers for the pilgrims of which 112 were seasonal. In the Hajj season of 1435, the MOH added 2 permanent hospitals at Makah and the total number of the emergency beds reached 458 and the number of the seasonal health centers reached 114 in this reason.

Publications in mass gatherings medicine, in general, and in Hajj-related health issues, in specific, were limited in number. In order to overcome this the Saudi MOH established the Global Center for Mass Gathering Medicine in 2012 in Riyadh. This center established an overarching board chaired by the Saudi MOH with membership of experts from the University College London, Public Health England, WHO, SCFHS, and the Saudi national research funding agency King Abdulaziz City for Science and Technology. This Center aims to drive the best health promotion, prevention guidelines and practice, and health education for attendees at the Hajj and other mass gatherings through provision of a scientific evidence base.
In this study some limitations were existed; first, being cross-sectional one excluded the identification of any causal association adding to that the possibility of reporting bias from self-reported data and second, was the small sample size. Further studies on future performance of residents after their Hajj rotations is currently planned.

In conclusion, Hajj critical care rotations in 1434 and 1435 were well perceived by anesthesia residents. They found them useful as it was a great chance to increase their critical care training, their self-confidence. It was considered a step to prepare residents for independent practice. The Hajj is considered a great chance for residents training not only in anesthesia, but although in other all health specially.

Acknowledgment:

This was work was supported by the members of the Anesthesiology Training Program Central Training Committee at the SCFHS (Dr. Adel Kamal, Dr. Nizar Alzughibi, Dr. Ali Almomen, Dr. Tariq Jillani). Also, the chairman of Ministry of Health Hajj locum workforce committee, Dr. Ali Alghamdi, has been very keen and instrumental for the success of this project.

Conflict of interest

The author reports no conflict of interest.
References

smj.2015.8.1212.
smj.2015.5.10814.
ULTRASOUND GUIDED IN-PLANE PENILE NERVE BLOCK FOR CIRCUMCISION: A NEW, MODIFIED TECHNIQUE SUGGESTS LOWER ANESTHETIC VOLUME AND NARCOTIC USE

M-Irfan Suleman¹, Anita N. Akbar Ali, Valbona Kanarek², Ming Li and Ashay Patel²*

Abstract

Context: Circumcision is one of the most common surgical procedures in pediatric males. Anesthesia is often the classic dorsal penile nerve block (DPNB), which is based on landmark identification and tactile feel of tissue resistance during needle advancement. However, this technique is associated with technical failures and vascular complications.

Objective: We used an ultrasound-guided in-plane technique to avoid injury of penile vascular and neural tissues during DPNB. The aims of this retrospective study were to compare the success rate and efficacy of these two penile block techniques.

Methods: Male pediatric patients undergoing circumcision received general anesthesia before the penis and surrounding area were prepared with 0.5% chlorhexidine in 70% alcohol. Sixteen patients underwent classic DPNB, and 16 underwent the modified ultrasound-guided in-plane technique. The ultrasound machine was adjusted to the musculoskeletal setting, and a linear ultrasound probe with a frequency range of 5 to 10 MHz was placed transversely along the base of the penis, which received gentle traction.

Results: Though not statistically significant, patients who underwent the classic DPNB were approximately 1.8 times more likely to require rescue analgesia and approximately 2 times more likely to have a complication than those in the ultrasound-guided group. Results also showed lower volume requirements for local anesthetic and intraoperative narcotics, longer time until rescue analgesic, and lower incidence of vomiting in the ultrasound-guided group than in the landmark-guided group.

Conclusions: The ultrasound-guided DPNB technique appears to offer advantages over classic DPNB and warrants a prospective controlled trial to confirm these findings.

Keywords: circumcision, pediatric, anesthesia, nerve block, pain, ultrasound, in-plane.

¹ Johns Hopkins University School of Medicine, 1800 Orleans Street/Suite 6349C, Baltimore, MD, 21287.
² Arkansas Children’s Hospital, University of Arkansas for Medical Sciences, Division of Pediatric Anesthesia and Pain Medicine, Little Rock, AK, USA.

Correspondence Author: M-Irfan Suleman, MD, Director Pediatric Regional Anesthesia, Director Pediatric Interventional Pain Management, The Charlotte R. Bloomberg Children’s Center, Johns Hopkins University School of Medicine, 1800 Orleans Street/Suite 6349C, Baltimore, MD 21287. E-mail: suleman@jhmi.edu
Introduction

Circumcision is one of the most frequent surgical procedures undergone by pediatric males. In an effort to relieve postoperative pain and improve safety, physicians use several anesthetic approaches with various efficacies, including topical analgesics such as lidocaine-prilocaine and lidocaine, ring block, and caudal block. A study by Weksler et al revealed that children treated with caudal block experienced higher rates of tachycardia, motor block, and vomiting than those treated with penile block, although pain severity did not differ between the groups. The ring block procedure includes an 8% failure rate and edema, but complications have not been reported as a result of this technique.

Dorsal penile nerve block (DPNB), a procedure first described in the mid-1970s, requires a local anesthetic injection close to the dorsal nerve of the penis. Needle advancement is based on landmark identification and tactile feel of tissue resistance. Although the American Academy of Pediatrics approves the use of DPNB, minor complications include swelling, hematoma or edema, and bruising at the injection site. Other safe approaches for using DPNB in infants and children have been described.

More recently, Sandeman and Dilley described the ultrasound-guided out-of-plane technique, which allows identification of both the subpubic space and the penile structure and direct bilateral injections into the subpubic space, but some researchers are still unconvinced of its benefits. DPNB needle placement described by Maxwell et al has been a standard method to block the dorsal penile nerve.

In this retrospective study, we describe a modified DPNB ultrasound-guided in-plane penile block technique and compare the efficacy and safety to that of the classic, landmark-guided DPNB approach.

This ultrasound-guided in-plane penile nerve block technique was first described and presented at the Society of Pediatric Anesthesia on March 8, 2014 and published in Anesthesiology NEWS, May 2015. Vol. 41:5.

Methods

Patients

This study was carried out at Arkansas Children’s Hospital/University of Arkansas for Medical Sciences. The institutional review board approved this study, and we received signed parental consent for the procedure and publication of results.

After administering general anesthesia to the patients, we prepared the penis and surrounding area, including the scrotum, with 0.5% chlorhexidine in 70% alcohol. Universal sterile technique was used to perform the DPNB. Sixteen patients underwent classic DPNB and 16 underwent the modified ultrasound-guided in-plane technique.
Modified Ultrasound-guided In-plane DPNB

We used a linear ultrasound probe with a frequency range of 5 to 10 MHz and adjusted the Sonosite M-Turbo® (Bothell, WA) ultrasound machine to the musculoskeletal setting. We placed the probe transversely along the base of penis and applied gentle traction to the penis (Figs. 1 and 2). The corpora cavernosa, dorsal arteries, dorsal veins, and superficial and deep penile Buck’s fascia were identified. A 25-gauge, 1.5-inch hypodermic needle was advanced by the in-plane technique until loss of resistance was felt when the needle passed through the hyperechoic superficial lining of Buck’s fascia. Immediately after it passed through this superficial layer, the needle tip was positioned lateral to the dorsal artery into the substance of Buck’s fascia. After confirming negative aspiration, we injected 1 ml of bupivacaine 0.25% while monitoring the spread (Fig. 3)21. The same procedure was performed on the other side. We also injected 0.5-1 mL of the same solution at the penoscrotal junction to block the scrotal branches of the pudendal nerve as recommended by Sandeman and Dilley².

We used a total of 2-3 ml of plain 0.25% bupivacaine for the complete block in the ultrasound guided DPNB group. The landmark-guided technique was performed as described by Maxwell et al²⁰.

Statistical Methods

All analyses were carried out with R version 3.0.2 (Vienna, Austria: R Development Core Team). The two patients groups were compared for potential confounding factors, including age, weight, and pain on arrival. Because of the small sample size and the non-normality of data, we applied a Wilcoxon rank sum test to examine whether the distribution of each variable differed between the two groups. Among the outcomes of interests, four were of continuous variables (i.e., volume of bupivacaine, total intraoperative opioids, postoperative opioid use, and time to first dose of rescue pain medication), and two were binary variables (i.e., rescue medication requirements and complications). For each continuous outcome, a Wilcoxon rank sum test was applied to compare the difference between the two groups. For each binary outcome, a Fisher’s exact test was applied.
Fig. 4
Box-whisker plot of bupivacaine volume usage by treatment. Bupivacaine volume was generally less in the ultrasound-guided DPNB group than in the landmark-guided DPNB group (DPNB; i.e., quartiles are lower for ultrasound-guided group).

Fig. 5
Box-whisker plot comparing intraoperative narcotic use in the landmark-guided and ultrasound-guided DPNB groups.

Fig. 6
Box-whisker plot comparing postoperative opioid use in the landmark-guided and ultrasound-guided DPNB groups.
Ethics

Our institutional review board approved the study described here, and we received signed parental consent for the procedure and publication of results.

Results

The two groups of patients showed no significant differences in baseline variables of age, weight, and pain level on arrival (all \( p \) values >0.05; Table 1). The median volume of bupivacaine used was larger in the landmark-guided DPNB group (6 ml) than in the ultrasound-guided DPNB group (2 ml, \( p<0.001 \); Fig. 4). The total intraoperative opioid use also was greater in the landmark-guided group than in the ultrasound-guided group (median 0.14 mg/kg vs. 0.0 mg/kg, respectively, \( p=0.001 \); Fig. 5). Postoperative opioid use did not differ significantly between the two groups (\( p = 0.324 \); Fig. 6).

Patients in the landmark-guided DPNB group were approximately 1.8 times more likely to require rescue medication and approximately 2 times more likely to have a complication than patients in the ultrasound-guided group (Fig. 7). However, neither comparison was statistically significant, most likely because of the small sample size. Among patients who required rescue medication, the median time to rescue medication was 34 minutes in the landmark-guided DPNB group (n=6) and 55.5 minutes in the ultrasound-guided DPNB group (n=4). This decrease of 21.5 minutes was statistically significant (\( p = 0.014 \); Table 1).

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>DPNB Ultrasound (N=16)</th>
<th>DPNB Landmark (N=16)</th>
<th>Wilcoxon p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (yrs)</td>
<td>Median (Q1, Q3)</td>
<td>Median (Q1, Q3)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>6.0 (5.0, 9.0)</td>
<td>6.5 (5.0, 10.0)</td>
<td>0.985</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>21.5 (19.1, 33.7)</td>
<td>23.0 (19.1, 32.0)</td>
<td>0.806</td>
</tr>
<tr>
<td>Pain on arrival</td>
<td>0 (0, 0)</td>
<td>0 (0, 0)</td>
<td>0.999</td>
</tr>
<tr>
<td>Bupivacaine (ml)</td>
<td>2.0 (1.0, 3.0)</td>
<td>6.0 (4.0, 8.0)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Total intraoperative opioid (mg/kg)</td>
<td>0.00 (0.00, 0.04)</td>
<td>0.14 (0.09, 0.19)</td>
<td>0.001</td>
</tr>
<tr>
<td>Postoperative opioid requirements (mg/kg)</td>
<td>0.00 (0.00, 0.01)</td>
<td>0.00 (0.00, 0.00)</td>
<td>0.324</td>
</tr>
<tr>
<td>Time to first rescue medication (min)</td>
<td>55.5 (54.0, 56.5)</td>
<td>34.0 (16.8, 35.0)</td>
<td>0.014</td>
</tr>
</tbody>
</table>

\( ^{a} \)Q1: lower quartile; Q3: upper quartile.

\( ^{b} \)Time to first rescue medication (min) for patients who required rescue medication (n=4 for ultrasounds, n=6 for landmark controls).
Discussion

Interest in the use of ultrasound imaging techniques for pediatric regional anesthesia is growing because the technology allows the practitioner to visualize the target nerve directly, maneuver the needle under real-time observation, precisely navigate from complex or sensitive anatomy, and accurately administer local anesthetics. Our data suggested that patients in the ultrasound-guided DPNB group required less local anesthetic volume, required intraoperative narcotics less frequently, had a longer duration before rescue pain medication, and experienced less vomiting than patients who underwent the classic, landmark-guided DPNB technique.

The ultrasound-guided method appeared to be safe, as patients were less likely to experience complications than those in the landmark-guided group. At least one study has suggested that ultrasound use offers little benefit to the DPNB technique. However, in our study, ultrasound enabled us to clearly recognize two-dimensional anatomy of the subpubic space and penile structures and thereby place the needle directly into the substance of Buck’s fascia. Thus, we were able to avoid damage to the surrounding structures and resultant problems that could occur. Several studies have concluded that when needles are placed correctly close to the nerves, the frequency of adverse events declines.

The primary limitation of this pilot study was the small number of study subjects. Although patients in the ultrasound-guided group were less likely to require rescue medication for pain relief and experienced fewer complications, the differences between groups were not statistically significant. We expect that the statistical power will increase when follow-up studies are carried out with a larger sample size.

Placing needles close to the nerves with ultrasound guidance appears to be a reliable technique that minimizes adverse events, thus supporting the existing studies. We think that the ultrasound-guided DPNB technique will improve clinical care for patients undergoing circumcision and is a promising approach to improve efficacy and safety of penile nerve block in children, particularly in newborns and infants. A prospective control trial in a large study population is warranted to confirm the findings of this small pilot study.

Acknowledgments

The authors wish to acknowledge Jeff Gossett, MS; Christine Greco, MD; Navil Sethna, MD, FAAP; and Charles Berde, MD, PhD, for assistance with data interpretation, manuscript editing, and technical review.
References


DOSE-DEPENDENT ANTI-INFLAMMATORY EFFECT OF KETAMINE IN LIVER ISCHEMIA-REPERFUSION INJURY

Zafer Gundogdu¹, Ismail Demirel², Mustafa Kemal Bayar³, Zeynep Ozkan⁴, Serpil Bayindir¹, Fatma Kocyigit¹, Onur Hanbeyoglu¹ and Mustafa Kahraman¹

Abstract

Introduction: Hepatic ischemia-reperfusion (I/R) injury is commonly observed in severe sepsis, hemorrhagic shock, liver transplantation, hepatic resection, and major trauma. Ketamine suppresses the production of cytokines, such as IL-6 and TNF-α, via NF-κB inhibition. We investigated the anti-inflammatory effects of ketamine in liver I/R injury.

Materials and Methods: Female Wistar-Albino rats (n = 18), weighing 150-200g, were divided into three groups (n = 6 each). Group I underwent reperfusion for 4h following 30 min of ischemia. Group II received 2.5 mg/kg ketamine IM following 30 min of ischemia and 4h of reperfusion and Group III received 10 mg/kg ketamine IM following 30 min of ischemia and 4h of reperfusion. Blood samples were obtained before and after ischemia and reperfusion. MDA, AST, ALT, TNF-α, IL-1β, IL-6, and NO levels were determined. Liver tissue samples were evaluated histologically.

Results: Increased TNF-α, IL-1β, and IL-6 levels were observed in all groups post-ischemia versus pre-ischemia (p <0.05). The TNF-α, IL-1β, and IL-6 levels in Group III increased less than they did in Groups I and II (p <0.05). Higher MDA, NO, AST, and ALT levels were found during the ischemia and reperfusion periods compared with during the pre-ischemia period in all groups (p <0.05). The MDA, NO, AST, and ALT levels of rats that received ketamine increased less than did those of Group I (p <0.05). Significantly less injury was observed in the histopathological analysis of livers of rats administered ketamine (p <0.05).

Conclusions: Ketamine showed a dose-dependent anti-inflammatory effect in I/R injury in the liver when administered after ischemia.

Key words: ketamine, liver, ischemia-reperfusion injury, TNF-α, IL-1β, IL-6

1. MD, Elazığ Training and Research Hospital, Department of Anesthesiology and Reanimation
2. MD, Assoc Prof, Firat University Medical Faculty, Department of Anesthesiology and Reanimation.
3. Prof, Ankara University Medical Faculty, Department of Anesthesiology and Reanimation.
4. MD, Elazığ Training and Research Hospital, Department General Surgery.

Corresponding Author: Zeynep Ozkan, MD, Elazığ Training and Research Hospital, General Surgery Department Elazığ-Turkey, Phone: +904242341450, GSM: +905053727178, Fax: 04242121461.
Introduction

Ischemia-reperfusion (I/R) injury in patients who receive treatment in intensive care units and/or undergo surgical interventions is a crucial problem involving oxygen, free radicals, and cytokines. I/R injury in the liver is observed in clinical situations such as surgical interventions for hemorrhagic shock, the late period of sepsis, liver transplantation, significant trauma, and hepatic resection. In liver I/R injury, reactive oxygen metabolites secreted from Kupffer cells activate neutrophils by inducing a series of complex inflammatory processes.

Activated neutrophils cause the secretion of numerous enzymes, such as myeloperoxidase, elastase, and collagenase, and free radicals by adhering to endothelial cells, leading to a vicious cycle of increasing injury. As a result of I/R injury in the liver, aspartate aminotransferase (AST) and alanine aminotransferase (ALT) levels increase.

Tumor necrosis factor-alpha (TNF-α), interleukin 1 beta (IL-1β), and interleukin 6 (IL-6) have adhesion receptor-increasing effects on leukocyte activation, endothelial cells, and leukocytes. They coordinate the immune response by inducing the secretion of TNF-α and cytokines that play a key role in the inflammatory response. Increased TNF-α and IL-6 further increase the injury by causing the secretion of adhesion molecules and an influx of leukocytes in the perfused tissue.

Cytokines that appear after I/R (interferon-gamma IFN-γ, TNF-α, IL-1β) induce the inducible nitric oxide synthetase (iNOS) enzyme, expression of which occurs within a few hours. It then remains active for 4-24h and causes nitric oxide (NO) secretion independently of calcium/calmodulin. Through the mediation of iNOS, NO is liberated while L-arginine is transformed into L-citrulline. The cytotoxic effects of NO are non-specific, and its overproduction may be detrimental to the host.

Nuclear factor kappa B (NF-κB) is a transcription factor and is responsible for the expression of many genes in the inflammatory response. NF-κB is found in the cytoplasm, bound to its inhibitor (inhibitor kappa B, iκB). This becomes free NF-κB by separation from the inhibitor as a result of stimulation, such as by IL-1β, TNF-α, and lipopolysaccharide (LPS). Numerous binding sites exist for NF-κB in the upper region of the human iNOS gene promoter.

Ketamine prevents liver injury due to LPS by increasing heme oxygenase-1 (HO-1) and decreasing iNOS levels. It has been demonstrated that ketamine has protective effects in liver injury caused by LPS; thus, ketamine may be an appropriate intravenous agent in patients with sepsis who require anesthesia. It has been shown that ketamine suppressed TNF-α levels due to endotoxins and reduced mortality in rats in endotoxemic shock. Through NF-κB inhibition, ketamine suppresses the production of such pro-inflammatory cytokines as IL-6 and TNF-α. Ketamine shows anti-inflammatory effects by inhibiting the reactivity of leukocytes.

The aim of this study was to investigate the effects of low and high doses of ketamine in rats who had experienced liver injury as a result of an experimental I/R injury.

Materials and Methods

After local ethics committee approval was obtained, 18 Wistar-Albino female rats weighing 150-200g were used. The study was conducted in accordance with the ethical provisions of the European Convention for the Protection of Vertebrate Animals Used for Experimental and Other Scientific Purposes, and care was taken to use the minimum number of rats. The rats were kept in a room that received sunlight for 12h and has an air conditioning system (22-24°C, 70-75% humidity) and were fed with standard laboratory food and water. Feeding was stopped 12h before the experiment, and the rats were allowed access to only water.

Rats were randomized into three groups (n = 6 each) using the sealed envelope method. Intraperitoneal xylazine (Rompun, Bayer-Istanbul, 5-10 mg/kg) and ether inhalation were used to anesthetize the rats. After draping and sterilization procedures, layers of the abdomen of the rats were opened, and the liver and arteria hepatica propria were reached. Rats in Group I (n = 6) underwent 30 min of ischemia by clamping the arteria hepatica propria, followed by reperfusion for 4 hours. Rats in Group II (n = 6) were administered...
intramuscular (IM) 2.5 mg/kg ketamine (Ketalar, 50 mg/mL Eczacibasi-Istanbul) following 30 min of ischemia and then underwent 4 hours of reperfusion. Rats in Group III (n = 6) were given 10 mg/kg ketamine IM following 30 min of ischemia and then underwent 4 hours of reperfusion. The isolated hepatic artery was clamped to cause ischemia. The portal vein was not clamped. No heparin was administered during the procedure.

Blood samples, obtained by vein puncture from the tail, avoiding hemolysis, were placed in plain tubes before and after ischemia and after 4 hours of reperfusion. Malondialdehyde (MDA), AST, ALT, TNF-α, IL-1β, IL-6, and NO levels were determined. Following centrifugation of blood samples (800g, 10 min), serum was separated and kept at -20°C until the biochemical analyses. At the end of the reperfusion period, hypovolemic shock was induced by incising the aorta abdominales of the rats, and they were sacrificed.

**Biochemical Analyses**

Plasma MDA levels of each animal were measured by high-performance liquid chromatography (HPLC; 515 nm excitation, 533 nm emission, C-18 column (125 nm × 4 mm) and flow rate 1 mL/min). TNF-α, IL-1β, and IL-6 levels were determined by ELISA (Invitrogen).

To assess nitric oxide levels, specimens were first deproteinized to prevent non-specific reactions, and the nitrite and nitrate concentrations were determined by the Griess reaction. Total nitrite (nitrite + nitrate) concentration was determined by a modified cadmium reduction method. Nitrate reduction was obtained by keeping copper-coated cadmium granules in pH 9.7 glycine buffer for a 90-min incubation with deproteinized sample supernatant. The rate of produced nitrite was assessed with spectrophotometer at 545 nm. Serum AST and ALT levels were measured with an autoanalyzer (results in U/L).

**Histology**

Liver tissue samples taken after reperfusion were fixed in 10% formaldehyde, and sections of 5 μm were obtained from paraffin wax-embedded samples and assessed under a light microscope (Olympus BX51, Japan) following staining with hematoxylin and eosin. Changes in cell histology were evaluated for congestion, necrosis, cytoplasmic vacuolization, eosinophilia, nuclear pyknosis, and inflammatory cell density by a pathologist who was blind to the details of the experiment. The histological scoring for liver injury (HSLD) was used for evaluation (HSLD 0: no injury or minimal injury, 1: mild injury, 2: moderate injury, 3: severe injury).

**Statistical Analysis**

The SPSS software (ver. 15.0) was used. Data are shown as means ± SD. Variance comparison analyses between the groups were conducted with a post hoc Tukey HSD test. The Wilcoxon test was used to assess in-group repeated measurements. P-values <0.05 were considered to indicate statistical significance.

**Results**

The MDA levels in all groups were higher in the post-ischemia and reperfusion periods than in the pre-ischemia period (p < 0.05). The MDA levels of the groups given ketamine increased more than did those of the Group I during the same periods of time (Table 1).

The group that received low-dose ketamine showed a significantly smaller increase in ALT levels in the post-reperfusion period (p < 0.005). However, the ALT levels in the group that was given high-dose ketamine increased more than did those in the other groups. The total nitrite levels increased in all groups during the ischemia and reperfusion periods compared with during the pre-ischemia period (p < 0.005). The post-reperfusion total nitrite levels in Groups II and III increased less than did those in Group I; however, the difference was not statistically significant.

AST and ALT levels were higher in all groups during the ischemia and reperfusion periods than during the pre-ischemia period (p < 0.05). The group that received low-dose ketamine showed a significantly smaller increase in ALT levels in the post-reperfusion period (p < 0.005). However, the ALT levels in the group that was given high-dose ketamine increased more than did those in the other groups (Table 1).
Table 1
Serum MDA, AST, ALT, TNF-α, IL-6, IL-1β and NO levels pre-ischemia, post-ischemia and reperfusion injury in groups

<table>
<thead>
<tr>
<th></th>
<th>Pre-ischemia</th>
<th>post-ischemia</th>
<th>post-reperfusion</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MDA (mmol/l)</strong>*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Group I</td>
<td>12 ± 0.78</td>
<td>22.83 ± 1.07*</td>
<td>27.47 ± 2.07*</td>
</tr>
<tr>
<td>Group II</td>
<td>17.00 ± 2.31</td>
<td>28.94 ± 5.20*</td>
<td>36.25 ± 4.43*</td>
</tr>
<tr>
<td>Group III</td>
<td>18.18 ± 0.98</td>
<td>28.12 ± 0.98*</td>
<td>38.75 ± 1.74*</td>
</tr>
<tr>
<td><strong>AST (U/L)</strong>*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Group I</td>
<td>135 ± 28.31</td>
<td>338.16 ± 71.99*</td>
<td>466.17 ± 138.92*</td>
</tr>
<tr>
<td>Group II</td>
<td>119.66 ± 48.88</td>
<td>233.66 ± 22.30*</td>
<td>274.17 ± 45.97*</td>
</tr>
<tr>
<td>Group III</td>
<td>114 ± 38.87</td>
<td>266.66 ± 28.40*</td>
<td>262.67 ± 121.06*</td>
</tr>
<tr>
<td><strong>ALT (U/L)</strong>*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Group I</td>
<td>47 ± 9.09</td>
<td>105.83 ± 42.62*</td>
<td>246.33 ± 86.37*</td>
</tr>
<tr>
<td>Group II</td>
<td>56 ± 10.56</td>
<td>90.16 ± 9.04*</td>
<td>145 ± 31.57**</td>
</tr>
<tr>
<td>Group III</td>
<td>52.66 ± 21.01</td>
<td>143.33 ± 29.82*</td>
<td>262 ± 57.11*</td>
</tr>
<tr>
<td><strong>TNF-α (pg/ml)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Group I</td>
<td>12.57 ± 1.83</td>
<td>2665.52 ± 38.76*</td>
<td>1300.04±57.87*</td>
</tr>
<tr>
<td>Group II</td>
<td>12.79 ± 2.66</td>
<td>1922.37 ± 64.76*</td>
<td>1156.96 ± 42.89*</td>
</tr>
<tr>
<td>Group III</td>
<td>13.27 ± 2.95</td>
<td>1435.36 ± 50.86*</td>
<td>689.83 ± 66.84*</td>
</tr>
<tr>
<td><strong>IL-6 (pg/ml)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Group I</td>
<td>107.61 ± 7.58</td>
<td>3374.51 ± 68.78*</td>
<td>3738.02 ± 48.29*</td>
</tr>
<tr>
<td>Group II</td>
<td>107.48 ± 0.79</td>
<td>2679.24 ± 203.69*</td>
<td>3085.96 ± 246.00*</td>
</tr>
<tr>
<td>Group III</td>
<td>111.42 ± 5.97</td>
<td>2180.70 ± 48.96*</td>
<td>2500.14 ± 57.60*</td>
</tr>
<tr>
<td><strong>IL-1β (pg/ml)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Group I</td>
<td>19.39 ± 3.33</td>
<td>3120.98 ± 80.64*</td>
<td>3815.03 ± 60.18*</td>
</tr>
<tr>
<td>Group II</td>
<td>23.02 ± 2.74</td>
<td>2715.19 ± 175.10*</td>
<td>3121.33 ± 64.54*</td>
</tr>
<tr>
<td>Group III</td>
<td>19.29 ± 3.198</td>
<td>2279.80 ± 89.69*</td>
<td>2755.16 ± 86.22*</td>
</tr>
<tr>
<td><strong>NO (U/L)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Group I</td>
<td>0.2 ± 0.31</td>
<td>0.09 ± 0.09**</td>
<td>0.32 ± 0.30**</td>
</tr>
<tr>
<td>Group II</td>
<td>0.18 ± 0.19</td>
<td>0.05 ± 0.07**</td>
<td>0.09 ± 0.12**</td>
</tr>
<tr>
<td>Group III</td>
<td>0.02 ± 0.01</td>
<td>0.07 ± 0.07**</td>
<td>0.10 ± 0.14**</td>
</tr>
</tbody>
</table>

*p <0.05 pre-ischemia period vs other periods in all groups
** p <0.005
The TNF-α, IL-6, and IL-1β levels increased significantly in the post-ischemia period in all groups compared with their pre-ischemia values (p <0.05). During the reperfusion period, the TNF-α, IL-6, and IL-1β levels in Group III increased significantly less than they did in Groups I and II (p <0.05; Table 1).

The total nitrite levels increased in all groups during the ischemia and reperfusion periods compared with during the pre-ischemia period (p <0.005). The post-reperfusion total nitrite levels in Groups II and III increased less than did those in Group I; however, the difference was not statistically significant (Table 1).

According to the histopathological analysis, necrosis, inflammation, and congestion in the liver were significantly less common in Groups II and III than in Group I (p <0.05; Table 2) (Figs. 1, 2, 3).

<table>
<thead>
<tr>
<th>Histologic changes staging of liver in groups</th>
<th>Group I</th>
<th>Group II</th>
<th>Group III</th>
</tr>
</thead>
<tbody>
<tr>
<td>Congestion</td>
<td>1.83</td>
<td>1.17</td>
<td>1.17</td>
</tr>
<tr>
<td>Necrosis</td>
<td>1.83</td>
<td>1.83</td>
<td>1.67</td>
</tr>
<tr>
<td>Stoplasm vacuolisation</td>
<td>2.00</td>
<td>1.25</td>
<td>1.67</td>
</tr>
<tr>
<td>Eosinophilia</td>
<td>1.83</td>
<td>1.08</td>
<td>1.00</td>
</tr>
<tr>
<td>Nuclear picnosis</td>
<td>1.00</td>
<td>0.83</td>
<td>0.83</td>
</tr>
<tr>
<td>Inflammatory cell accumulation</td>
<td>2.00</td>
<td>1.67</td>
<td>1.00</td>
</tr>
</tbody>
</table>
Fig. 1
Liver histology in group I; Congestion, inflammation and necrosis is significant.
(Heamatoxilen eosin x200)

Fig. 2
Liver histology in group II; Necrosis, inflammation and congestion is fewer than group I
(Heamatoxilen eosin x200)

Fig. 3
Liver histology in group III Necrosis, inflammation and congestion is significantly decreased groups;
(Heamatoxilen eosin x200)
Discussion

In current study reveals that ischemia and reperfusion injury can cause increased tissue inflammation in liver and high levels inflammatory cytokines in plasma. Ketamine can ameliorate this inflammatory process as dose dependent.

Although various techniques can be used in order to evaluate liver functions after I/R injury, the most widely accepted and frequently used currently is to evaluate the level of AST and ALT. The activity of those enzymes are known to increase in liver damage. Ischemia-reperfusion has been suggested to increase ALT and AST levels and this was attributed to the damage of the tissues that was developed by free radicals that are produced following ischemia-reperfusion.

In this present study, plasma AST and ALT levels were found to be increased after I/R injury. Increase in AST levels following reperfusion in the groups that were administered ketamine was found to be lesser compared to the control group, though statistically not significant. ALT levels following reperfusion in the groups that were administered ketamine was found to be lesser compared to the group I.

On the other hand the MDA, NO, AST, and ALT levels of rats that received ketamine increased less than did those of Group I (p <0.05) and significantly less injury was observed in the histopathological analysis of livers of rats administered ketamine (p <0.05).

During the reperfusion period, the TNF-α, IL-6, and IL-1β levels in high dose ketamine (group III) increased significantly less than they did in Groups I and II (p <0.05).

IL-1β and TNF-α stimulate a group of changes in the endothelium. These changes are increased expression of adhesion molecules, secretion of some cytokines and growth factors, synthesis of eicosanoids and nitric oxide (NO) and increased endothelial thrombogenicity. Leukocytes secrete toxic oxygen products and proteolytic enzymes and may produce endothelial damage.

Antiinflammatory effect of ketamine investigated some researcher, Suliburk et al. reported in a study where rats were given saline (no anesthesia), underwent isoflurane inhalation, and received intraperitoneal ketamine (70 mg/kg); 1h later, saline or LPS (20 mg/kg) was given for 5h intraperitoneally. They analyzed liver inducible nitric oxide synthase (iNOS) protein and heme oxygenase-1 (HO-1) by Western blotting, and NF-κB (LPS) significantly elevated AST levels, hepatic iNOS, and heme oxygenase-1 (HO-1) immunoreactivity. They reported that ketamine had protective effects on the liver in LPS-induced hepatic injury via regulation of oxidative stress proteins, such as iNOS and HO-1. The use of ketamine as anesthesia has been suggested for septic patients.

Two different doses of ketamine were used in this study to investigate its role in preventing liver I/R injury. No significant difference was found in the NO levels of rats administered low and high doses of ketamine following I/R; however, the NO levels of these rats increased more than the levels of the controls that were not administered ketamine.

Lipids are an important target structure damaged by free radicals as a result of I/R. Indeed, lipid peroxidation is key in I/R injury. Free radicals induce lipid peroxidation by abstracting a hydrogen atom from polyunsaturated fatty acids, creating hydroperoxides. As a result of these reactions, cell membranes lose viscosity, and membrane integrity is damaged. This leads to the release of cell fractions into the environment and cell death. These released subcellular components trigger inflammatory events and further exacerbate the injury. Various methods have been used to produce indicators of lipid peroxidation in tissues. Among the most frequently used is the assessment of MDA. Studies conducted with an experimental I/R model demonstrated that gadolinium chloride (GdCl3) suppressed AST and ALT release and decreased mitochondrial MDA formation. Li et al. reported that inhibition of liver Kupffer cells by GdCl3 can protect against hepatic reperfusion injury. They randomly divided Wistar rats into two groups, a GdCl3 group and a control group, and collected blood samples from each group at 0.5, 1, 6, 12, and 24h following reperfusion. They analyzed ALT, AST, TNF-α, and MDA levels in hepatic mitochondria. They showed that GdCl3 depressed ALT, AST, and TNF-α levels and reduced the accumulation of mitochondrial MDA.
In our study, we showed that ketamine suppressed AST release dose-dependently; however, that it did not prevent the MDA increase in reperfusion injury and did not suppress ALT levels in the group given high-dose ketamine after reperfusion. We also investigated in our study the hepatoprotective effect of ketamine which demonstrated this effect by suppressing the release of proinflammatory cytokines such as TNF-α. Inflammatory cytokines, namely, TNF-α, IL-1β, and IL-6 levels were observed in all groups post-ischemia versus pre-ischemia (p <0.05). Administration of ketamine in subanesthetic doses inhibited the release of TNF-α and other pro-inflammatory cytokines. TNF-α has an important role in inflammatory reaction and regulation of inflammation in addition to its cytotoxic effect13.

Hepatic NF-κB activation and plasma TNF-α and IL-6 concentrations increased in rats subjected to experimentally induced inflammation. Ketamine has been demonstrated to reduce hepatic NF-κB activation in many studies17,18,19,20. It is believed that TNF-α plays a key role in the pathogenesis of inflammatory events. In our study, we analyzed IL-6 and IL-1β levels in addition to TNF-α levels. In vivo experimental studies have found that ketamine suppressed TNF-α and IL-6 formation in shock induced with an endotoxin and reported that it had dose-dependent anti-inflammatory effects18,21,22. Additionally, many in vitro studies have reported that ketamine suppressed the production of pro-inflammatory cytokines and the expression of TNF-α23. In our study, TNF-α, IL-1β, and IL-6 levels were decreased in the groups that were administered ketamine.

Sun et al. reported that ketamine reduced the activity of TNF-α and IL-6 in the intestine and that this effect may have been achieved through the inhibition of NF-κB. Their experimental study included six groups of rats: saline controls, rats challenged with an endotoxin (5 mg/kg) and administered saline, rats challenged with an endotoxin (5 mg/kg) and treated with three different doses of ketamine (0.5, 5, and 50 mg/kg), and rats injected with saline and treated with ketamine (50 mg/kg). They measured TNF-α, IL-6, and NF-κB levels in jejunal tissue after 1, 4, and 6h. Ketamine 0.5 mg/kg depressed endotoxin-induced TNF-α elevation and inhibited NF-κB activity. IL-6 can be inhibited by a 5-mg/kg ketamine dose4. Ketamine also suppressed serum levels of endotoxin-induced TNF-α and reduced mortality in mice in endotoxin shock. Ketamine inhibits neutrophil activation and neutrophil-endothelial association. TNF-α causes release of adhesion molecules in endothelial cells (ELAM-1 ve ICAM-1) and IL-6 and IL-8. Ketamine inhibits adhesion of leukocytes to the endothelium. It is debatable that ketamine suppresses the phagocytic function of neutrophils11.

Peralta et al. reported that preventing high-level TNF-α release from Kupfer cells in the liver via NO by preconditioning decreased both liver and lung injury related to hepatic I/R. Preconditioning has preventative effects through reducing liver TNF-α levels after I/R24.

NF-κB is an inducible nuclear transcription factor that plays a role in the expression of pro-inflammatory cytokines. Many researchers have reported that the major source of pro-inflammatory cytokines in the acute phase of inflammatory events was hepatic Kupfer cells25. Few studies have examined the effects of ketamine on NF-κB. In vivo and in vitro experiments have shown that ketamine inhibits NF-κB in brain cells26. It was also demonstrated that ketamine depressed TNF-α and NF-κB activation in the liver, lungs, and intestines27. Additionally, high-dose ketamine (50 mg/kg) induced LPS injury and inhibited acute lung injury in rats28. In this study, ketamine was used at two doses, 2.5 and 10 mg/kg, and was found to suppress TNF-α, IL-6, and IL-1β levels compared with the control group.

Cytokines play important roles in endotoxin-induced shock, and some studies have claimed that ketamine reduces the production of some cytokines under endotoxemic conditions8,29. Tanuguchi et al. studied 40 rats in four groups: a group given Escherichia coli endotoxin (15 mg/kg, administered intravenously), a saline control group, a group administered ketamine (10 mg/kg per h) before the endotoxin challenge, and another group administered ketamine 2h after the endotoxin challenge. After a 5-h period of endotoxin exposure, the hemodynamic parameters and acid-base status and plasma TNF-α and IL-6 levels were measured in each group. They demonstrated that ketamine administration inhibited hypotension, metabolic acidosis, and cytokine responses in rats...
injected with an endotoxin. The results suggested that judicious use of ketamine as an anesthetic agent may offer advantages in endotoxemia.

Tanuguchi et al. reported that ketamine administration depressed hypotension, metabolic acidosis, and cytokine responses in endotoxemia. In their study, 65 rats were divided into five equal groups: after exposure to an endotoxin, Group C was given saline alone, Group E was given an endotoxin alone (E. coli endotoxin, 10 mg/kg, IV), Group L received low-dose ketamine (5 mg/kg/h, IV), Group M received a medium dose of ketamine (10 mg/kg/h, IV), and Group H received a high dose of ketamine (20 mg/kg/h, IV). After endotoxin injection, hemodynamics, acid-base status, mortality, and plasma concentrations of TNF-α and IL-6 were assessed. Hypotension, metabolic acidosis, and increased plasma cytokine concentrations were observed. They found that ketamine administration dose-independently inhibited hypotension, metabolic acidosis, and cytokine responses in rats injected with an endotoxin. On the contrary to that study, this present study suggests that the anti-inflammatory effect of ketamine might be dose dependent. In our study, IL-6 levels in subjects that were applied high dose ketamine during reperfusion period were found to increase lesser compared to the Groups 1 and 2.

The limitation of current study is that there might be an additional study group in which the dose of ketamine would be 5 mg/kg. However, since a significant difference in the applied doses suggests a different effect, we kept the dose range high. We did not administer the dose of 20 mg/kg either since this dose may be toxic for the rats and might have put the study in a challenge.

In conclusion, ketamine administration might be effected anti-inflammatory process in experimental liver I/R injury in to rats as dose-dependent but this topic may confirm more studies.
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ANESTHETIC MANAGEMENT OF ADVANCED STAGE LUDWIG’S ANGINA: A CASE REPORT AND REVIEW WITH EMPHASIS ON COMPROMISED AIRWAY MANAGEMENT

MOHAMMED AL HARBI*, JUBIL THOMAS**, NANCY KHALIL HASSAN**, NERMEEH SAID HASSANIN***, SALAH WANNOUS****, CHADI ABOURAS**, AHMED AL HARTHI***** AND VASSILIOS DIMITRIOU******

Abstract

Ludwig’s angina, although uncommon, remains a potentially life-threatening condition because of the risk of impending airway obstruction. Effective treatment is based on early recognition of the clinical process, with the appropriate use of parenteral antibiotics, securing the airway, and formal surgical drainage of the infection.Awake fiberoptic intubation under topical anesthesia may be the preferred method to secure the airway. Flexible nasotracheal intubation requires skill and experience. When fiberoptic bronchoscopy is not feasible, not available, or has failed, an elective awake cricothyrotomy and tracheostomy are the options. Furthermore, the introduction of newer advanced airway techniques, such as video-assisted laryngoscopy, may allow the clinician additional flexibility in nonsurgical airway management. We present a recent case of a patient with Ludwig’s angina, successfully managed at our hospital, with a brief review of airway management options.

Keywords: Ludwig’s angina, complications, airway management.
Introduction

LA is a known, yet an uncommon surgical emergency that is potentially life threatening unless early recognized and aggressively treated, requiring immediate interventions. Potentially life-threatening complications have been reported to occur at a rate of 10-20%, even in recent literature on LA cases. Despite a reduction in mortality rates that exceeded 50% prior to the development of antibiotics, LA remains a potentially lethal entity primarily because of rapidly progressive airway obstruction. As a result of antibiotic therapy, along with improved imaging modalities and surgical techniques, mortality currently averages approximately 8-10%.

Airway management in patients with Ludwig’s angina is of the utmost importance and remains challenging. The choice of the safest technique is not yet determined and should be based on clinical signs and stage of LA, technical conditions available and mainly on clinical experience. We present a recent case of a patient with advanced stage Ludwig’s angina, successfully managed at our hospital, with a brief review with emphasis on airway management options.

Case Report

A 35 years old male (73 Kg, 179 cm, BMI 23 kg/m²), presented to the emergency department of our tertiary university hospital complaining of inability to open the mouth, mouth pain, neck pain and inability to swallow.

From history he reported that he was symptomatic for three days prior to admission with progressive swelling in the neck, mouth pain especially with tongue movement and reduced mouth opening. He was on treatment with oral antibiotics (amoxicillin 500 mg orally 3 times a day) taken the first two days. He was able to swallow only small quantity of water but no solid food for the last two days due to progressive increased difficulty and eventually inability in swallowing. For this reason on the third day no antibiotic was received.

On physical examination, the patient was anxious and uncomfortable because he could not tolerate at all the supine position. He had hoarse voice with moderate degree of stridor and respiratory distress. His body temperature was 38.9°C with a pulse rate of 120 beats per minute, blood pressure of 135/85 mmHg, oxyhemoglobin saturation 94% on room air and respiratory rate of 26 breaths per minute. There was a diffuse, indurated, nonfluctuant, large neck swelling with bilateral involvement of the submental and particularly the submandibular area, elevating his tongue upwards and backwards. On airway examination, there was trismus and severely restricted mouth-opening, with an interincisor gap of 1 cm. Neck extension was painful and limited. Both the nares were patent and the trachea was palpable in the lower part of the neck. A blood sample was sent for culture and neck CT scan was ordered. However, preoperative CT scan was not possible since the patient could not remain in the supine position. From the laboratory findings white blood count was 26,800/mm³. Except for being smoker, otherwise the patient was not known to have any medical illness and was classified as ASA physical status IIIIE. A clinical diagnosis of Ludwig’s angina was made and he was scheduled for emergency surgical decompression.

A nasotracheal awake fiberoptic intubation (AFOI) was planned, with tracheostomy as a backup. This procedure was explained to the patient and written informed consent was obtained for AFOI and possible tracheostomy. Both nasal passages were inspected and clinically examined by asking the patient to expire through each nostril separated and the best was selected for intubation.

In the operating theater, the patient could not tolerate at all the supine position because it precipitated to complete airway obstruction. For this reason he was put in semisitting (Fowler’s) position at 60° and the anesthetist with the fiberscope (FB) standing on the right side of the patient. Patient was advised to be cooperative as possible. Electrocardiography, noninvasive blood pressure, and pulse oximetry were monitored. Intravenous (IV) access was obtained and an infusion of Ringer’s Lactate started. An antisialagogue (glycopyrrolate 200mcq) and dexamethasone 16mg were administered IV, to reduce upper airway edema and improve the view. Antibiotic treatment started and included IV penicillin and clindamycin. No sedative or opioid agent was administered. The surgical team was
in the operating room ready and gowned for emergency cricothyrotomy in case of acute airway loss.

For the nasotracheal intubation, the selected nostril was prepared with 0.1% xylometazoline drops for nasal decongestion prior to topical anesthesia of the airway. Additionally, using a thin forceps a small wet gauze soaked with phenylephrine solution 0.5% was pushed into the selected nostril as far as possible and remained for almost 4-5min. Then the gauze was removed and the nostril was anesthetized with puffs of 10% lidocaine spray. Patient was asked to take slow regular deep breaths through nose to facilitate distribution of local anesthetic spray. The posterior pharynx airway was topically treated with 4% lignocaine gargle and 10% lignocaine spray puffs applied to the base of the tongue and the oropharyngeal mucosa. A transtracheal cricothyroid puncture performed with 2 ml 2% lignocaine, to anesthetize the infraglottic structures. Thorough suctioning of the posterior pharynx was performed before starting the AFOI.

For nasal intubation, the tube-first technique was used. A straight reinforced tracheal tube 6.5mmID, was placed in a warm fluid (normal saline 0.9%) to make it more pliable. Then it was lubricated and was gently passed through the prepared nostril into the pharynx. The FB was passed through the endotracheal tube to the posterior pharynx. Thick copious and purulent secretions were suctioned. The trachea was identified on the second attempt, with the vocal cords surrounded by soft tissue edema and the FB was further advanced until carina was visualized. The endotracheal tube was then advanced into the trachea. After confirmation of tracheal intubation by fiberoptic viewing of tube tip inside the trachea and end-tidal carbon dioxide in capnography, anesthesia was induced with fentanyl 100 mcg, propofol 120 mg and cisatracurium 12 mg. Anesthesia was maintained with nitrous oxide in oxygen and sevoflurane and was subsequently uneventful. The patient was dehydrated and received 2 lt of crystalloids.

After the surgery and due to the periglottic edema, the patient remained intubated and transferred mechanically ventilated to the intensive care unit. The next morning the patient was comfortable, with a pulse rate of 74 beats per minute, blood pressure of 120/70 mmHg and oxyhemoglobin saturation of 98%. The neck swelling had subsided. A thorough oral examination was performed with the fibrescope. There was no periglottic edema and the trachea was extubated. Post-extubation recovery was uneventful.
The same day it was possible to get a CT scan from the neck (fig. 1, 2). The patient was discharged 4 days later.

**Discussion**

Ludwig’s angina (LA) is a rapidly progressive bilateral infection of the floor of the mouth which starts in either the submaxillary or the sublingual spaces and then involves the loose connective tissue filling the areas between the three layers of deep cervical fascia and disseminates to entire submandibular space. It begins as a cellulitis, then turns into fasciitis, and finally becomes a true abscess. The infection can also spread contiguously to involve the pharyngomaxillary and retropharyngeal spaces, thereby encircling the airway.

The symptoms of Ludwig’s angina vary depending on the patient and the degree of infection.

Most common symptoms on admission are, neck pain followed by neck swelling, throat pain, fever, dysphagia and respiratory distress. Since this entity is uncommon, unnecessary delay in diagnosis and management may occur and may result in serious complications. If left untreated and depending on the virulence of the causative pathogen as with any bacterial infection, sepsis may occur. Without immediate treatment, the submandibular infection may also rapidly spread to the mediastinal or pharyngomaxillary spaces. An unsuspecting physician may underestimate an initially localized infection, which could rapidly present as airway collapse or descending mediastinitis.

The most life-threatening complication of LA is the complete airway obstruction and asphyxia, caused by expanding edema of soft tissues of the neck along with the enlargement, elevation and posterior displacement of the tongue. Cases of hypoxic cardiac arrest have been reported as a result of acute airway compromise, hypoxic obtundation, with resultant...
inability to secure an airway. Another common cause of death is the acute loss of airway during airway management interventions. In a recent study the rate of death related to acute airway compromise or infection-related consequences was 11.8%. Diagnostic sensitivity of clinical examination alone is 55%. In less urgent cases, contrast CT may increase this to 95%. A contrast computed tomography scan is the most appropriate imaging tool, not only for the diagnosis of deep neck space infections, but also to show the extent of disease. However, this was not possible in our case due to inability of the patient to lie supine. In cases of significant airway compromise where an immediate decision regarding the need of a definitive airway is required, clinical experience and judgment are superior to imaging.

In the early stages the disease begins as a mild infection and in selected patients, a trial of intravenous targeted or broad-spectrum empiric antibiotic therapy, associated with an intensive contrast computed tomography scan-based wait-and-watch policy, may avoid an unnecessary surgical procedure. However, widespread diffusion of empirical broad-spectrum oral antibiotic and anti-inflammatory treatments may cause masked presentations of deep neck infections without swelling, fever, or leukocytosis. It is important to remember, that when dealing with LA antibiotic coverage alone will rarely manage the infection, and the prognosis only improves with combined surgical and pharmacological management. Surgical intervention is required in the majority of LA cases (80-100%).

Moreover, about 25% of patients present significant comorbidities, which may negatively affect the course of the infection. In these cases and in patients in advance stage with large or multiple spaces infections, a more aggressive surgical strategy is mandatory. The aggressive surgical intervention, the antibiotic introduction along with improved imaging modalities and the improvement of dental care, have determined a significant reduction of the mortality rate from 50% to currently averages approximately 8%. However, in a recent study deaths related to acute airway compromise or infection-related consequences were at a rate of 11.8%.

Airway compromise due to LA usually originates from parapharyngeal or retropharyngeal edema giving rise to supraglottic obstruction. In advanced stage, like in our case, the patient can’t tolerate the supine position because it precipitates complete airway obstruction. The patient presented with severe dysphagia, trismus, hoarse voice, stridor and sitting posture, which are late signs of impending airway obstruction and indicate the need for an immediate airway management.

Therefore, airway management is crucial and the primary therapeutic concern. The maintenance of a secure airway is a challenging task both for the anesthesiologist and surgeon. Various techniques are available to secure the airway. However, crucial factors in the decision making for specific airway management techniques are the stage of the infection, degree of distorted anatomy, and the experience of the practitioner. The success and safety of these techniques in patients with LA have not yet been established. Sound clinical judgment is critical for timing and for selecting the appropriate method for airway intervention.

Classically, elective awake tracheostomy has been suggested as the standard of care for establishment of a definitive airway for all patients with LA, in order to avoid the dangers of emergency tracheostomy in a severely compromised airway. In the recent literature elective awake tracheostomy was performed in more than 50% of LA cases, while the range varies between 5-65.6%, depending on the stage of the disease. However, others have advocated that tracheostomy should be avoided where possible, due to a connection between the fascial spaces which may lead to the pretracheal space being involved, with possible spread of infection further inferiorly into the chest. Additionally, others have challenged the value of surgical airway. Moreover, tracheostomy may be technically difficult or impossible in advanced cases of infection, because of the position needed for tracheostomy or because of anatomical distortion of the anterior neck or patient’s inability to lie supine, like in our case. In several studies, there has been a trend toward decreased need for immediate airway control by endotracheal intubation or tracheostomy. However, large retrospective series have underlined the catastrophic outcome of the progressive nature...
of the LA that may lead to sudden oropharyngeal obstruction.

Awake fiberoptic intubation (AFOI) using topical anesthesia has now been recommended as the first choice for airway control in adult patients with deep neck infections including Ludwig’s angina. Orotracheal AFOI, has been reported successfully in patients with LA. The nasal AFOI seems to be more suitable in those patients with trismus and restricted mouth opening or those with inability to lie supine. The flexibility and versatility of fiberoptic endoscopy allows dynamic assessment of the airway anatomy in the supraglottic and subglottic region in an atraumatic fashion. Adequate preparation and application of local anesthesia enables the patient to tolerate the procedure with greater comfort. Tissue edema and immobility, the distorted airway, copious and purulent secretions, common in patients with LA, may contribute to the difficulty of fiberoptic intubation. Although AFOI is associated with low success rate, more often the failure to intubate is caused by inadequate preparation of the patient, use of a poor-quality fiberscope, and inadequate experience with the procedure. The necessary equipment may not be fully understood, or it may not be available when needed. National incident reporting systems show that unavailability of equipment and user error, were common reasons for reporting critical equipment-related incidents. However, in skilled and experienced hands, awake nasal fiberoptic intubation is the preferred method of airway management in patients with LA, associated with high success rate.

In one LA case, a supraglottic airway device was used as a guide for AFOI. However, the use of supraglottic airway devices is not indicated in patients with upper airway obstruction. Alternatively, fiberoptic intubation following general anesthesia induction and muscle paralysis is not recommended in patients with LA, since it can cause the collapse of the airway and inability to mask ventilate due to anatomical distortion.

In our case, no sedative or opioid was given during the awake nasal fiberoptic intubation. It is our strong belief, based on adequate evidence along with experience, that even minimal doses of sedatives or opioids, may contribute in losing the fragile balance in the critical muscle tone in upper airway and may precipitate complete airway closure and make mask ventilation and intubation impossible. Securing the airway in the fully awake state is therefore the safest option.

Conventional orotracheal intubation under general anesthesia in patients with LA is challenging. The distorted airway anatomy, tissue immobility, and limited access to the mouth make orotracheal intubation with conventional laryngoscopy difficult or impossible. The edema of the tongue and mouth and trismus are the most common obstacles for an oral intubation. In the early stages of the disease, general anesthesia and muscle relaxants may overcome trismus and allow the mouth to be opened for successful conventional laryngoscopy. However, in advanced cases, the induction of general anesthesia is very dangerous, because it may precipitate to complete airway closure and make face mask ventilation and tracheal intubation impossible (“Can’t intubate, can’t ventilate” situation), thus necessitating emergency tracheostomy. The reported failure rate in a large retrospective review was disappointingly high (55%). Rupture of an abscess and aspiration of pus have been reported during an attempted orotracheal intubation under general anesthesia.

Inhalational induction in patients with LA has been reported. However, this technique is not recommended since it may result in complete airway obstruction, as a result of relaxation and collapse of pharyngeal muscles or coughing in the light stages of anesthesia.

Moreover, blind nasal intubation has been reported in patients with LA. However, this technique is to be avoided as, besides having a high failure rate, it could cause catastrophic bleeding, laryngospasm, airway edema, rupture of pus into the oral cavity, and aspiration. Complete airway obstruction could be precipitated, potentially necessitating an emergency cricothyrotomy.

Depending on the life-saving time required and the emergency situation, transtracheal access and subsequent jet ventilation are among the last options in a ‘cannot intubate-cannot ventilate’ scenario.

All studies, regardless of the approach to airway management recommended, reinforce the importance of careful airway management through
good clinical judgment and adequate experience. The introduction of newer advanced airway techniques, such as video-assisted laryngoscopy, may allow the clinician additional flexibility in nonsurgical airway management. Video-assisted laryngoscopy has an upgraded role during the recent airway management guidelines45,46 and has used successfully in patients with anticipated and unanticipated difficult airway47-53. Additionally, it has been used successfully in one patient with LA16. When compared with the AFOI, it has been reported that the videolaryngoscopy technique is an acceptable alternative and has a comparable success rate54-56. Furthermore, video-assisted laryngoscopy is becoming widely used and thus is gaining the advantage of familiarity and experience, where the stress of using unfamiliar equipment is more keenly felt. Videolaryngoscopes are also easier available especially in an emergency situation, cheaper and more versatile, allowing use in a greater number and wider variety of patients57.

In conclusion, Ludwig’s angina, although uncommon, remains a potentially life-threatening condition because of the risk of impending airway obstruction. Effective treatment is based on early recognition of the clinical process, with the appropriate use of parenteral antibiotics, airway management, and formal surgical drainage of the infection. In advanced cases, securing the airway is of the utmost importance and remains challenging. Awake fiberoptic nasotracheal intubation under topical anesthesia may be the preferred method to secure the airway. However, it requires skill and experience. When fiberoptic bronchoscopy is not feasible, not available, or has failed, an elective awake cricothyrotomy and tracheostomy are the options. Furthermore, the introduction of newer advanced airway techniques, such as video-assisted laryngoscopy, may allow the clinician additional flexibility in nonsurgical airway management.
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POST-PARTUM MALIGNANT HYPERTENSION IN A PATIENT WITH PREECLAMPSIA AND ABRUPTIO PLACENTA

ANTHONY K WOODALL1, AMIR O EL HASSAN2 AND ALAN D KAYE3

Introduction

There are many physiologic changes and potential risks of pregnancy. Though there are numerous proposed mechanisms related to the etiology of preeclampsia, it is well known that this condition can potentially result in morbidity and mortality to both the mother and child. Preeclampsia is a condition commonly encountered by obstetric anesthesiologists and uncommonly complicated by placental abruption.

As a review, preeclampsia is characterized by new onset hypertension occurring beyond 20 weeks gestation and can predispose organ failure, seizure, and stroke to the mother. Diagnosis is made with two different blood pressure measurements of greater than 140/90 and a 24-hour urine sample with 300 mg of protein or more1,2. Severe preeclampsia is seen with blood pressures greater than 160/110, proteinuria worsens to 5g in 24 hours, and other associated symptoms and signs. HELLP syndrome is a variant of severe preeclampsia, with the acronym HELLP referencing the clinical triad of hemolysis, elevated liver enzymes, and low platelets3. Typical treatment regimens for elevated blood pressure at present include magnesium, and the antihypertensive medications labetalol, nifedipine, and hydralazine. Ultimate treatment for preeclampsia is delivery of the fetus.

Keywords: Malignant hypertension, abruptio placenta, anesthesia, nitroglycerin, preeclampsia, vaginal bleeding.

The following case describes a unique situation where a normotensive parturient presented with placental abruption and subsequently developed hypotensive shock, requiring vasopressor support. Soon after delivery, the patient became profoundly hypertensive. Further investigation revealed a history of severe preeclampsia with a prior pregnancy. Both cases tragically resulted in fetal demise.

1 MD, Critical Care Fellow, University of Florida, Gainesville, Florida, awoo11@lsuhsc.edu
2 MD, Assistant Professor, Department of Anesthesiology, LSU School of Medicine, New Orleans, LA, aelhas@lsuhsc.edu
3 MD, PhD, Tenured Professor, Program Director, and Chairman, Department of Anesthesiology, LSU School of Medicine, New Orleans, LA, akaye@lsuhsc.edu
Case Presentation

A 24 year old G4P2 at 24 weeks gestation presented to the Emergency Department (ED) with cramping, abdominal pain and mild “spotty” vaginal bleeding. Her medical history was significant for a previous cesarean section 3 years earlier. Review of systems was positive for abdominal pain, pelvic pain, and vaginal bleeding. Physical exam was significant, abdominal distention consistent with a gravid uterus without tenderness. Laboratory values were within normal limits other than 2+ red blood cells and 1+ leukocytes on urinalysis. A renal ultrasound was conducted in the ED and the summary was, “normal anatomy” and “bilateral perinephric fluid” by the reviewing radiologist. Her kidneys were somewhat echogenic, and acute renal failure/acute tubular necrosis could not be excluded. The patient was discharged from the Emergency Department with a diagnosis of abdominal pain in pregnancy and pyuria. The patient was prescribed a regimen of oral antibiotics.

Four hours later the patient represented to the ED via ambulance with diffuse vaginal hemorrhage and altered mental status. A STAT Cesarean section was called while the patient was in route to the hospital. The anesthesia team first encountered the now somnolent patient in the OR. Immediately upon arrival, preoxygenation of the patient with 100% O2 began, two large bore intravenous lines was obtained, standard ASA monitoring were placed, and an arterial line was inserted in her right radial artery within five minutes of presentation. A rapid sequence induction consisting of etomidate, in a dose of 12 mg iv, fentanyl, in a dose of 100 ug iv, lidocaine, in a dose of 50 mg iv, and succinylcholine, in a dose of 120 mg iv, which was administered to facilitate intubation. The initial blood pressure was 102/54 mmHg. The time to incision was 8 minutes after arrival, and the baby was delivered 3 minutes after incision. The diagnosis of abruptio placenta was made intraoperatively. The newborn child required intubation, and was transferred to the NICU. The patient had an estimated 3L of intraoperative blood loss and received 4 units of PRBCs intraoperatively. Her vital signs remained relatively stable throughout the case, requiring multiple doses of vasopressors and eventually a phenylephrine infusion to maintain mean arterial pressure of 60-80 mmHg intraoperatively. She was successfully extubated at the end of the case after meeting standard criteria. Upon arrival at the ICU, the patient had a blood pressure of 146/65 mmHg and a pulse of 100 beats per minute. The vasopressor infusion was stopped and the blood pressure measurement repeated, with a subsequent BP reading noted to be 311/109 mmHg. This value was confirmed with a manual reading from the opposite arm, and radial artery measurement. The patient remained asymptomatic and intravenous nitroglycerin was administered with stabilization of her blood pressure over 10 minutes. After 3 hours and 20 minutes of intravenous nitroglycerin delivery postoperatively in the ICU, which included titration to a mean arterial pressure of 100 mgHg, the patient stabilized with cessation of antihypertensive medication. Unfortunately, the neonate died several hours later in the NICU from complications of pulmonary hemorrhage. The patient later reported she vaguely recalled high blood pressure with a previous pregnancy which also resulted in fetal demise.

Discussion

Hypertensive disorders of pregnancy are a leading cause of peripartum morbidity and mortality, and complicate 8-12% of pregnancies\(^4,5\). Placental abruption is a major complication of hypertensive disorders of pregnancy leading to adverse outcomes. Placental abruption is the premature detachment of the placenta from the uterus, either partially or fully. The mechanism of this complication is not completely understood, but it is an obstetric emergency with high rates of maternal and fetal morbidity and mortality\(^6\). A study by Nankali et. al., demonstrated a 7.7% risk of placental abruption in severe preeclampsia, while others have reported an incidence as high as 15%\(^7\). Risk factors for placental abruption include maternal hypertensive disorders, smoking, addictive behaviors, maternal age greater than 35, multiparity, multiple gestations, and premature rupture of membranes. Of note, previous placental abruption may increase the risk of placental abruption 10-30 fold\(^6\). This may be
attributed to an individual parturient’s predisposition for abnormal uterine vascularization during trophoblast migration after implantation of the embryo. It is widely accepted that this abnormal angiogenesis is closely associated with hypertensive disorders of pregnancy. Many studies have demonstrated plasma angiogenic factor abnormalities in patients with preeclampsia. It is presumed that these factor abnormalities are originating from the placenta itself, and are associated with improper vascularization of the placenta. Patients with preeclampsia have significantly more placental vascular lesions including placental abruption.

The diagnosis of placental abruption is typically first made on a clinical presentation of abdominal pain and vaginal bleeding associated with abnormal fetal heart tones. Management is guided by fetal condition and maternal well-being. If the fetus is viable, emergent cesarean section should be performed unless vaginal delivery is eminent. With a bradycardic fetus, delivery within 20 minutes significantly reduces neonatal mortality and the incidence of cerebral palsy. Maternal mortality with placental abruption has been greatly reduced in the last 100 years from 8% to 1%. However, maternal complication of severe hemorrhage and resulting DIC are still common. Neonatal mortality associated with placental abruption is typically related to prematurity. However, after 32 weeks gestation, placental abruption is an independent risk factor for neonatal mortality. Placental abruption is also a major independent risk factor for intratuterine fetal demise.

Though preeclampsia may often be considered a disorder associated with primigravida, it also is common with subsequent gestations. The risk of preeclampsia in a subsequent pregnancy after having preeclampsia in a previous pregnancy has been demonstrated to be 40% in multiple studies. A study by Melamed et al., regarding risk factors for adverse outcomes in pregnancy demonstrated that preeclampsia with a previous pregnancy is an independent risk factor for preeclampsia and placental abruption in subsequent pregnancies. Furthermore, they concluded that women who had been preeclamptic with the complication of placental abruption in a previous pregnancy were at the highest risk for an adverse outcome in a subsequent pregnancy. Similarly, placental abruption in a previous pregnancy was the strongest predictor of preeclampsia in a subsequent pregnancy of all the risk factors they examined.

Knowing the increased risk of morbidity and mortality associated with a previous pregnancy complicated by preeclampsia or placental abruption should alert the clinician that an increased level of vigilance may be warranted in these parturients. Maintaining a high index of suspicion in emergent cesarean sections to preeclampsia, despite a hypotensive presentation, could prevent hypertensive urgency/emergency once intravascular volume had been repleted. In this patient’s case, that was not achieved until ICU transfer, at which the presentation of preeclampsia became clearer, with a consistent medical history. In addition administration of IM corticosteroids at her initial presentation may have helped promote lung maturity in the fetus, possibly increasing the likelihood of survival.
References

THE USE OF FLEXIBLE FIBEROPTIC CYSTOSCOPE FOR DIFFICULT ENDOTRACHEAL INTUBATION IN TMJ ANKYLOSIS PATIENTS: A CASE SERIES
TAISEER HUSSAIN AL-KHATEEB¹
AND DAHER K RABAD²

Abstract

Background: Fiberoptic bronchoscopes might be vital for the safe performance of difficult endotracheal intubations. However, many hospitals in low or middle-income countries are unable to afford the equipment. We describe the use of a flexible fiberoptic cystoscope, as an alternative to a bronchoscope, for difficult nasoendotracheal intubation in patients with temporomandibular joint ankylosis.

Methods: Eight Jordanian patients (five females and three males) with severe restriction of mouth opening, due to ankylosis of the temporomandibular joint, underwent awake nasoendotracheal intubation using a flexible fiberoptic cystoscope under local anesthesia.

Results: The procedure was successful and well tolerated in all eight patients.

Conclusion: A flexible cystoscope can be a successful alternative to a flexible bronchoscope, for difficult nasoendotracheal intubation in hospitals at rural areas in low-or middle-income countries with limited financial resources.

Keywords: TMJ ankylosis, fiberoptic, cystoscope, intubation

Introduction

Congenital and acquired diseases or conditions may alter the airway anatomy to such extent that attaining and maintaining a patent airway during anesthesia may be difficult or impossible. One example of acquired conditions is temporomandibular joint (TMJ) disorders, notably bony ankylosis. During endotracheal intubation, the anesthesiologist typically attempts both rotational and translational movements of the TMJ to allow for the maximum opening of the patient’s mouth. This maneuver aids in successful direct visualization of the epiglottis and vocal cords, and consequently allows for the atraumatic passage of an endotracheal tube.

An updated report by the American Society of Anesthesiologists (ASA) Task Force on Management of the Difficult Airway specifically confirms that an airway physical examination, for acquired or congenital disease states, should be conducted before the initiation of anesthetic care

¹ BDS, MScD, FDSRCS, FFDRCs, Professor, Consultant in Oral and Maxillofacial Surgery, Jordan University of Science and Technology and King Abdullah University Hospital, Irbid 22110, P.O. Box: 3030, Jordan, Tel: +962795672779. E-mail: taiseerhhk@yahoo.com
² VRACH, JBOARD, Associate Professor, Consultant in Anaesthesiology, Jordan University of Science and Technology and King Abdulla University Hospital, Irbid 22110, P.O BOX: 3030, Jordan, Tel: +962772075375. E-mail: daherrabadi@yahoo.com

Corresponding Author: Prof Taiseer Hussain Al-Khateeb, Professor, Consultant in Oral and Maxillofacial Surgery, Jordan University of Science and Technology and King Abdulla University, Irbid 22110, P.O. Box: 3030, Jordan, Tel: +962795672779. E-mail: taiseerhhk@yahoo.com
and airway management in all patients. Fiberoptic-guided intubation was one of the main strategies for intubation of the difficult airway. However, there are hospitals in low and middle-income countries who do not have enough resources to acquire the equipment. In fact, purchasing these costly instruments would consume a significant part of their yearly budget. The Hashemite Kingdom of Jordan was classified by the World Bank as a country of “middle income”. Due to slow domestic growth, high energy and food subsidies and, lately, the Syrian refugee crisis, Jordan usually runs annual budget deficits. In Jordan, health care system services remain highly concentrated in the capital Amman with little and limited governmental health spending directed towards rural areas.

This article describes the use of a flexible fiberoptic cystoscope as a tool to nasoendotracheal intubation in eight patients with severe restriction of mouth opening due to ankylosis of the TMJ.

Methods

Between 2002 and 2015, eight patients (five females and three males) with severe restriction of mouth opening resulting from ankylosis of TMJs presented to King Abdullah University Hospital, Irbid, Jordan (Table 1). The age of patients ranged from eight to 40. All patients were classified an ASA physical status. During the preoperative anesthetic assessment, these patients were considered unsuitable for intubation after induction of general anesthesia due to uncertainty about the ability to ventilate or intubate after induction of general anesthesia. In the operating room, fiberoptic-guided awake intubation, under local anesthesia of the airway was planned. Due to financial restrictions, a flexible bronchoscope was not available, therefore, a flexible cystoscope was used instead.

Table 1

<table>
<thead>
<tr>
<th>patients</th>
<th>Age (yrs)</th>
<th>Gender</th>
<th>Mouth opening</th>
<th>Diagnosis</th>
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<tr>
<td>1</td>
<td>8</td>
<td>F</td>
<td>8mm</td>
<td>Left TMJ bony ankylosis</td>
</tr>
<tr>
<td>2</td>
<td>12</td>
<td>F</td>
<td>10mm</td>
<td>Left TMJ bony ankylosis</td>
</tr>
<tr>
<td>3</td>
<td>23</td>
<td>F</td>
<td>7mm</td>
<td>Left TMJ bony ankylosis-recurrent</td>
</tr>
<tr>
<td>4</td>
<td>33</td>
<td>F</td>
<td>6mm</td>
<td>Bilateral TMJ bony ankylosis</td>
</tr>
<tr>
<td>5</td>
<td>40</td>
<td>M</td>
<td>10mm</td>
<td>Bilateral fibrous ankylosis of TMJ</td>
</tr>
<tr>
<td>6</td>
<td>35</td>
<td>M</td>
<td>4mm</td>
<td>Bilateral Post-radiation fibrosis</td>
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<td>M</td>
<td>10mm</td>
<td>Bilateral TMJ bony ankylosis</td>
</tr>
<tr>
<td>8</td>
<td>34</td>
<td>F</td>
<td>13mm</td>
<td>Bilateral TMJ bony ankylosis-recurrent</td>
</tr>
</tbody>
</table>

Technique

The flexible cystoscope (Wolf Cystoscope Model # 7305-006, USA) was checked for size match relative to the lumen of the endotracheal tube. The insertion cord of the cystoscope was lubricated to move freely within the lumen of the endotracheal tube. After establishing a reliable intravenous access and standard monitoring placement, lidocaine 4% was used for topical anesthesia and vasoconstriction of nasal mucosa to prevent bleeding. Sprays (4-5 puffs) of 4% lidocaine were delivered onto the tongue base and the adjoining lateral pharyngeal walls. Topical anesthesia of the trachea, larynx and hypopharynx was obtained by passing a 25-gauge needle through the cricothyroid membrane. After aspiration of air to confirm settlement within the tracheal lumen, 3 mL of 4% lidocaine was injected.

Following routine pre-induction administration of oxygen, the endotracheal tube, lubricated with lidocaine gel, was inserted gently through the prepared nostril into the oropharynx. To prevent the tube from entering...
the hypopharynx and being directed away from the midline, thus interfering with laryngeal exposure, the tube was not advanced too far distally. The secretions were suctioned through the endotracheal tube, and the cystoscope was inserted through its lumen into the oropharynx. Once the epiglottis and vocal cords were seen, the endotracheal tube was advanced into the larynx and the cystoscope was withdrawn. Successful intubation was noted when the patient was unable to phonate, humidification within the endotracheal tube was noted with ventilation, and carbon dioxide was noted on the capnograph. IV induction of general anesthesia was then commenced.

Ethics approval

A written informed consent was obtained from each patient prior to the use of the flexible fiberoptic cystoscope. Due to the retrospective nature of the study and the fact that no experiments were done, no ethical approval was necessary. No parts of any patient is shown.

Results

The procedure was successful in all eight cases, and all patients tolerated the procedure well. No complications were encountered.

Discussion

Most of the techniques and devices routinely used in clinical practice (awake intubation, blind oral or nasal intubation, fiberoptic intubation, intubating stylet or tube-changer, supraglottic airway or, most recently, light wand videolaryngoscope) maintain airway patency by way of manipulation of the structures of the upper airway. Failure to securing and sustaining a patent airway certainly results in hypoxic brain injury or death. Despite the fact that during the last three decades, mortality figures associated with anesthesia dropped to 0.04-7 per 10, 000 patients administered anesthetics, a qualitative analysis of mortality associated with anesthesia found that 10% of the anesthesia-related deaths were associated with inadequate respiratory management.

A famous cause of difficult airway is a restricted mouth opening. If the mouth opens less than 25 mm, it is unlikely that any part of the larynx will be visualized by direct laryngoscopy. Restricted mouth opening results from a number of disorders that affect the TMJ and its adjacent structures. It can be classified according to the location of the problem (intra or extra articular), type of tissue involved (osseous, fibrous) and the extension of the fusion (complete or incomplete). TMJ ankylosis precludes or excessively restrains the range of mandibular motion. When it occurs before facial growth is completed, it produces micrognathia, especially if the disease is bilateral. Deviation of the mandible to the affected side occurs when it is unilateral. The difficult intubation in TMJ ankylosis classically results from severe restriction of mouth opening that is often associated with mandibular underdevelopment with an abnormal laryngeal position.

For intubation of patients with a difficult airway (e.g. restricted mouth opening), the updated practice guidelines of the ASA recommends the following algorithm:

1. Assess the likelihood and clinical impact of basic management problems, including difficulty with: patient cooperation, mask ventilation, supraglottic airway placement, laryngoscopy, intubation, or surgical airway access.

2. Actively pursue opportunities to deliver supplemental oxygen throughout the process of difficult airway management.

3. Consider the relative merits and feasibility of basic management choices including:
   - Awake intubation vs. intubation after induction of general anesthesia
   - Non-invasive technique vs. invasive techniques for the initial approach to intubation
   - Video-assisted laryngoscopy as an initial approach to intubation
   - Preservation vs. ablation of spontaneous ventilation

4. Develop primary and alternative strategies.

There are no absolute contraindications for awake intubation other than a true allergy to local anesthetics. Relative contraindications include patient refusal and
the uncooperative patient. A flexible scope facilitates awake tracheal intubation because, under good topical anesthesia, the procedure is painless and well tolerated by patients. Spontaneous ventilation keeps the airway open, and deep breathing can assist the endoscopist in locating the glottis when airway anatomy is distorted. We used the method of awake intubation under topical anesthesia because we feel that it is safer to intubate a conscious patient breathing spontaneously when the airway is compromised or tracheal intubation cannot be guaranteed. This is particularly true in our situation of limited equipment and work force imposed by the poor financial resources.

In our cases, as the patient’s maximal mouth opening ranged from 4-13 mm. We chose transnasal fiberoptic intubation under local anesthesia, with the patient breathing spontaneously. In addition to minimizing the patient’s discomfort and aiding tolerability of the procedure, local anesthesia also helped to avoid the possibility of laryngospasm.

Modern fiberoptic technology has improved the visualization of hidden or obscure structures and enabled health professionals to perform non-invasive and less traumatic laparoscopic, endoscopic, and arthroscopic procedures. However, the cost of the equipment is frequently unaffordable to many hospitals in the developing world. We have found that the use of fiberoptic cystoscopes can be helpful in managing difficult airways when a bronchoscope is unavailable. The use of a cystoscope for endoscopy of the airway has previously been published in two case reports. However, we are the first to report its use in a case series. The main drawback of its use is that, unlike a bronchoscope, the flexible cystoscope provides a relatively small field of vision and rough images.

In conclusion, although the bronchoscope is better suited for the airway endoscopy, we have found that the use of a flexible fiberoptic cystoscope can be helpful in managing difficult airways when a bronchoscope is not available in hospitals in low or middle-income countries with limited financial resources.
References


LETTER TO THE EDITOR

POSTOPERATIVE PAIN MANAGEMENT PRACTICE 
AT TEACHING HOSPITALS IN JORDAN

ABOUD AL JABARI1, ISLAM MASSAD2, KHALED AL ZABEN3 
AND IBRAHIM HABEBEH4

Health care providers are participants of pain managements. Efforts to identify barriers to effective pain management and attempts to modify those barriers are essentials1,2,3. We usually do patient pain management survey, but in this survey we did the opposite, to set down the basis and grounds of pain management guidelines for our patients.

The aim of our survey was to assess the status of acute postoperative pain management in Jordan, to evaluate the current postoperative pain management practices, identify areas requiring improvement in pain management, to help caregivers optimize pain management with uphold high care standards and identify deficits. 84% were responders to our five questions questionnaire of pain management in Jordan including: governmental, military services, university and private sector teaching hospitals.

The results of 5 survey questions were as follow:

The first question: which of the following employees is responsible to prescribe the postoperative pain management drugs at your institute?

We found that 45.5% Jordanian Anesthetists were responsible for prescription then Surgeons 40.9% and both 13.6%.

The second question: for which of the following employees dose your institute provide regular on site postoperative pain management training?

Anesthetists 54.4% were providers then surgeons 9.1%, both 22.7% and others such as ward nurses, recovery room nurses were 13.6%.

The third question: Are your patients informed preoperatively about postoperative pain management in your institute?

Yes systematically in 32%, Yes if specific /difficult cases 40.9%. Yes on patient demand 13.6%, and No 13.6%.

The fourth question: Are there specific written postoperative pain management protocols in place for treating postoperative pain in ward?

Yes for all patients 22.7%, Yes for following cases (Patient controlled analgesia, Regional or Central block) 40.9%, and NO 27.3%.

1 Regional and Cardiothoracic Anesthesia and Intensive care doctor, University of Jordan, Faculty of medicine, department of anesthesia and intensive care, J_aboud@hotmail.com, +962795143563.
2 Dean Faculty of medicine. University of Jordan.
3 Pediatric anesthesia consultant. University of Jordan.
4 Anesthesia and intensive care senior resident. University of Jordan.

Conflict of interest: none.
Funding: none.
The fifth question: If specific protocols exist for treating postoperative pain in ward, are they applied in daily practice?

Always 22.7%, Often 18.2%, Rarely 45.5%, and Never 13.6%.

This survey has increased our awareness of postoperative pain management and experience for improving the existing practice, also the intense need for written protocols and structured programs. There is still room for improvement with minimum acceptable requirements and much work and continuing vigilance will be required to make transition.

We conclude that despite the growing trend in pain management, our patients are still suffering from postoperative pain in Jordan. No two health care institutions are exactly alike, but rather differ in personnel resources, available equipments and medications, and patient population.

Therefore it is neither possible nor advisable to attempt to create a universal detailed treatment protocol; instead, each institution must develop its own treatment plans to best serve the patient population under its care.

References

SPQ (SELF PROMOTER QUESTIONNAIRE) OR SPEC (SELF PROMOTION EVALUATOR COLLECTOR)

Deepak Gupta¹ and Sarwan Kumar²

ABSTRACT

Healing hospitals have evolved into business companies (institutions). Therefore, the need arises to evaluate the care rendered not only for the sake of adequacy of healing among patients but also for the sake of self-promotions to ensure returning customers. This letter brings forth our post-hoc objective method that can be an answer and/or replacement to pre-hoc subjective scoring of services by Net Promoter Score® or The National Health Service Friends and Family Test. Both the abovementioned scores work on the flawed avenue based on the satisfaction perceived immediate post-care/service by consumers (employees or patients). The reason for this flaw is that these scores do NOT look into whether the scored satisfactions and consequent presumptions actually shape into direct reality for the evaluated institutions. Herein our SPQ: Self Promoter Questionnaire or SPEC: Self Promotion Evaluator Collector comes in handy. This yet to be validated objective assessment of institutions definitely looks encouraging.

Letter To Editor

Healing hospitals have evolved into business companies (institutions). Therefore, the need arises to evaluate the care rendered not only for the sake of adequacy of healing among patients but also for the sake of self-promotions to ensure returning customers. This letter does NOT raise the issues in regards to the inadequacy of subjective scoring by Net Promoter Score®¹² or The National Health Service (NHS) Friends and Family Test³⁶. However, this letter brings forth our post-hoc objective method that can be an answer and/or replacement to pre-hoc subjective scoring of services provided by institutions such as hospitals.

Although Net Promoter Score®¹² can be used to extract level of satisfaction scores among the catered patients (customers), it is often used by hospitals (institutions) to define how likely their employees will refer their families/friends/colleagues to their institutions for the services provided by them. Each respondent scores on the scale of 0-10 based on the level of likelihood that the respondent will refer family/friend/colleague to the institution. Analogously, NHS of England³⁶ asks its patients to rate the patient care services rendered to them on the scale of how “extremely likely” to how “extremely unlikely” they will recommend those services to friends and family.

¹ MD, Clinical Assistant Professor, Anesthesiology, Wayne State University, Detroit, Michigan, United States.
² MD, Assistant Professor, Internal Medicine, Wayne State University, Detroit, Michigan, United States.

Corresponding Author: Dr. Deepak Gupta, Clinical Assistant Professor, Anesthesiology, Wayne State University/Detroit Medical Center, Box No: 162, 3990 John R, Detroit, MI 48201, United States, Ph: 1-313 745-7233, Fax: 1-313-993-3889. E-mail: dgupta@med.wayne.edu
Now both these scores work on the flawed avenue that based on the satisfaction perceived immediate post-care/service by consumers (employees or patients), the institutions can presumptively and safely advertise the satisfaction-score based data to attract common people unrelated to the consumers who were served and asked to score in the first place. The reason for this flaw is that these scores do NOT look into whether the scored satisfactions and consequent presumptions actually shape into direct reality for the evaluated institutions. Herein our post-hoc objective method comes in handy. This yet to be validated objective assessment of institutions definitely looks encouraging on paper because the ideology and bottom-line is raw to the core.

In what we christened as SPQ: Self Promoter Questionnaire or SPEC: Self Promotion Evaluator Collector (Table 1), there will be a disclaimer at the beginning of questioning to ensure that the respondent customers give NEITHER false-positive answers to receive presumed better customer service NOR false-negative answers to maintain the privacy of institutions’ workers. Anyhow, the privacy of workers will be protected as only departments (and not the workers) will be named in the questionnaires. The answers to the questioning will be directly logged into the computerized database at the time of registration of each new clientele transaction as identified by new transaction/billing/registration identification/file number (ID) so as to easily identify to whom (personnel) and for what (service) was who (patient/customer) referred. Although, the current format is not exploring the details about the non-workers or old customers as well as the various modes of advertisement that all prompted respondent customers to seek services at the self-evaluating institutions, these institutions can always expand the questions or the questionnaire to ensure more comprehensive self-evaluations depending on the logistics and sustainability of expanded internal quality and assurance questioning.

Although overtly realistic, our objective scoring is not void of covert presumptions at each level (a) that employees returning to their place of employment for services are NOT returning for internal (monetary or non-monetary) discounts, (b) that kin of employees have NOT been stopped (and hence been passively referred as default) by the employees who have allowed them to come to their place of employment for services, (c) that old customers and non-workers are referring for the services out of purity of their hearts secondary to goodwill generated by their past experiences, (d) that advertisements have put forth the

Table 1

<table>
<thead>
<tr>
<th>SPQ: Self Promoter Questionnaire or SPEC: Self Promotion Evaluator Collector</th>
</tr>
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<tbody>
<tr>
<td><strong>DISCLAIMER:</strong> The questions in the following segment will NOT in any way effect the services that will be provided to you as a client/customer of our institution. The answers to these questions will ONLY serve purposes of internal quality and assurance indices for our institution.</td>
</tr>
<tr>
<td>(a) Do you work at our institution? If so, which department:.............../Unknown</td>
</tr>
<tr>
<td>YOU MAY (not MUST) STOP HERE if Your Response is “yes”</td>
</tr>
<tr>
<td>(b) If not so, have you been referred for our services by one of our workers? If so, which department does our worker work in:</td>
</tr>
<tr>
<td>................................../Unknown</td>
</tr>
<tr>
<td>YOU MAY (not MUST) STOP HERE if Your Response is “yes”</td>
</tr>
<tr>
<td>(c) If not so, have you been referred for our services by someone who has never worked for us but may have been one of our old customers?</td>
</tr>
<tr>
<td>YOU MAY (not MUST) STOP HERE if Your Response is “yes”</td>
</tr>
<tr>
<td>(d) If not so, have you walked in for our services because of our advertisements?</td>
</tr>
<tr>
<td>YOU MAY (not MUST) STOP HERE if Your Response is “yes”</td>
</tr>
<tr>
<td>(e) If not so, have you reached out for our services on your own volition?</td>
</tr>
<tr>
<td>END OF QUESTIONNAIRE</td>
</tr>
</tbody>
</table>
totality of service provisions as honestly as possible in the plate for community of potential consumers to freely choose, and (e) that personal volition to choose the services at particular institution has NOT been out of lack of possible and amenable alternative.

Confidentiality and NOT Anonymity in the Mandatory database feeds must be ensured so that though responses need to be recognized as uniquely attached to each transaction ID, the consumers should NOT feel insecure in regards to immediate and personal repercussions (positive or negative) secondary to their responses. The responses can then be blindly analyzed by institutional statisticians for calculating the milieu of clientele at each site rendering the service (in case of hospital systems, these sites can include but are not limited to emergency rooms, perioperative services, medical admissions, laboratory services and radiology services). The percentage of positive responses to each individual question of five-set-questionnaire among all clients in a representative month or the whole year (24 × 7 × 365 format) can then be compared among the same service-lines at different institutions (business companies and healing hospitals) or among the different service-sites within the same institution. The respondents to questions can be caregivers or guardians in the cases of clients who are legally incapable to understand and/or voice the variable scenarios that made them to pursue the services rendered at the self-evaluating institutions in the first place. As the questioning primarily starts with assessment of employees as potential customers, the institutions smaller than say, 100 employees, may NOT be able to utilize this objective method for evaluation of their services logistically.

In summary, even though we do NOT have any numbers yet that can be accrued as enough self promotions or enough satisfied customers or enough media coverage or enough exclusivity in the community, our suggested objective method looks promising theology that can stand tall in the validation processes.
References


Sir,

Cervical radiculopathy (CR) is a relatively common disorder manifested with neck pain, radicular arm pain, at times associated with neurological signs (paraesthesia, reduced muscle strength, reduced/absent reflexes). Commonly, it results from nerve root dysfunction, secondary to mechanical compression; although cytokines released from damaged intervertebral disks are also responsible. A diagnosis is established from a thorough history, physical examination corroborated by the findings from magnetic resonance imaging (MRI). CR is typically self-limiting with up to 90% of patients achieve symptomatic improvement with conservative management (immobilization, anti-inflammatory medications, physical therapy, cervical traction, and epidural steroid injections\(^1\)). Cervical epidural steroid injections (CESI) is an effective non-surgical treatment option to manage severe radicular pain\(^2\). However evidence supporting the effectiveness of CESI is relatively weak because of a lack of prospective randomized studies\(^3\). We performed this prospective study to evaluate the effectiveness of CESI in patients with CR secondary to a single level herniated intervertebral disc.

Following approval from the Institutional Review Board, and obtaining informed consent from the individual patients, thirty one adult patients (18 male, 13 female) aged between 35-67 years presented with CR and MRI showing a single level herniated intervertebral disc underwent CESI in this prospective study. The anatomical level of prolapsed disc was: C3-C4 in 3, C4-C5 in 8, C5-C6 in 9 and C6-C7 in 11 patients. The duration of symptoms were between 6-72 weeks (mean 30.4 weeks). Patients with significant functional deficits, severe systemic disease, and those with coagulopathy were excluded. All patients received a single dose of CESI using blind midline inter-laminar technique at the same level of the affected intervertebral disc. A mixture of methylprednisolone acetate (80 mg) and preservative free bupivacaine (2.5 mg) diluted to total volume of 4 ml by addition of 0.9% saline was administered in all patients. The outcome variables were the extent of pain relief immediately following the procedure and thereafter at 1, 3 and 6 months using visual analogue scale (VAS) and numeric rating scale (NRS). CESI was repeated if at any point during the follow up period VAS was greater than 5, and referred for surgery if VAS >7, had

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**Corresponding Author:** Nilay Chatterjee, Senior Specialist in Anesthesia, ICU and Pain Management, Directorate of Anesthesia and ICU, Khoula Hospital, Muscat, Sultanate Oman. E-mail: nilay.chatt@gmail.com

**Conflict of Interest:** Authors declare that there is no conflict of interests. **Disclosures of Funding:** Authors declare that NO funding/grant/sponsorship of any kind has been received for the conduct of this study.

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1 MD, Specialist in Anesthesia, ICU and Pain Management, Directorate of Anesthesia and ICU, Khoula Hospital, Muscat, Sultanate Oman. E-mail: drsamareshdas@gmail.com

2 FFARCS, Diplomate of American Board of Anesthesiology, Senior Consultant and Superintendent of Anesthesia, ICU and Pain Management, Khoula Hospital, Muscat, Sultanate Oman. E-mail: suri7@hotmail.com

3 MD, FACHARzt, Senior Specialist in ICU, Directorate of Anesthesia and ICU, Khoula Hospital, Muscat, Sultanate Oman. E-mail: adilalkharusi@yahoo.com

4 MD (Anesthesia), DM (Neuroanesthesia), Senior Specialist in Anesthesia, ICU and Pain Management, Directorate of Anesthesia and ICU, Khoula Hospital, Muscat, Sultanate Oman. E-mail: nilay.chatt@gmail.com
motor deficits or patient opted for surgery. Mean VAS was 8.7 pre CESI, 0.8 immediately following CESI, and thereafter 1.8, 3.9 and 3.8 at 1, 3 and 6 months respectively. As per NRS all patients had complete pain relief following CESI (mean 94%), and thereafter 78%, 60% and 58% at 1, 3 and 6 months respectively. No complication was noted in any patient, except local pain at injection site. Five patients needed repeat CESI and 3 out of them needed surgery.

The findings of this study indicate that CESI is an effective and safe treatment option to consider in selected patients with CR secondary to disc herniation to reduce the pain and could avoid surgical intervention. We recommend that the procedure should only be performed by experienced anesthesiologists. Although safe in experienced hands, rare catastrophic complications like spinal cord trauma and spinal cord hematoma have been reported following CESI; however fortunately seldom encountered following interventional procedures in the cervical spine.4

References

ERRATUM

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Emphasize the new and important findings of the study and the conclusions that may be drawn.

Do not repeat in details data or other information given in the Introduction or the Results sections. For experimental studies, it is useful to begin the discussion by summarizing briefly the main findings, then explore possible mechanisms or explanations for these findings, compare and contrast the results with other relevant studies. State the limitations of the study, and explore the implications of the findings for future research and for clinical practice. Link the conclusions with the goals of the study, but avoid unjustified statements and conclusions not adequately supported by the data.

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They should be brief. Individuals named must be given the opportunity to read the paper and approve their inclusion in the acknowledgments.

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Example: (1) from a journal (2) from a book.


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