

Combination of propofol and tranexamic acid as a protocol of providing optimal surgical condition in comparison with halothane during tympanoplasty

Jalaeian Taghadomi R. MD¹, Majidi M. MD², Peivandi A. MD

¹Assistant professor of Anesthesia, ²Assistant professor of Otolaryngology,

³Assistant of Anesthesia – Medical Science University of Mashhad

Abstract

Introduction: Tympanoplasty is accomplished under general anesthesia. One major drawback of general anesthesia is the increased bleeding encountered, which can interfere with optimal visualization of the microscopic surgical field. We performed a prospective study to compare the effect of combination of propofol and tranexamic acid as a protocol versus halothane on blood loss and the surgeon's subjective assessment of operating conditions during tympanoplasty.

Materials and Methods: 40 patients undergoing tympanoplasty were randomly assigned to receive the mentioned protocol or halothane (n=20). One surgeon, who was blinded to the anesthetic agent, performed all the operations, and assessed surgical condition, using a grading system of score as follow: 1. minimal or no bleeding 2. modest bleeding 3. significant bleeding 4. severe bleeding. Results were compared in the two anesthetic groups using appropriate statistical tests.

Results: There was no difference between the duration of surgery or the intraoperative mean arterial pressure when comparing the two groups. Mean bleeding scores were less over time with above protocol. 80% of the patients had a satisfactory visualization of the surgical field in protocol group, while it was 45% in halothane group.

Conclusions: General anesthesia, based on the combination of propofol and tranexamic acid may have the advantage of decreased bleeding compared with conventional inhalation agents, making tympanoplasty technically easier and safer by improving visualization of surgical field. This anesthetic technique may have other applications in otolaryngology, when bleeding within a confined space frequently can interfere with visibility.

Keywords: Tympanoplasty, General Anesthesia, Propofol, Tranexamic Acid

Introduction

As different components of middle ear are tiny and slender, most of the operations are performed under microscope.

So a small amount of bleeding during the operation leads to disturbed visualization and concentration of the surgeon, and eventually causes a disturbance in performing a successful and effective surgery.

Jalaeian Taghadomi R. MD
Address: Department of Anesthesiology and Resuscitation,
Ghaem Hospital, Mashhad.
Email: r-jalaeian@mums.ac.ir
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A critical factor in the management of general anesthesia is to provide a relatively bloodless field to optimize visibility for the surgeon. This will be of great benefit to the surgeon and the patient (1,2,3).

Techniques commonly used to minimize bleeding include local injection of vasoconstrictors, head elevation and controlled hypotension (4).

In the 1970s, systolic blood pressure as low as 50 mmHg appeared to be well tolerated in healthy patients. In spite of arterial pressure being reduced to very low values in many instances, there was no morbidity or mortality which could be ascribed to the technique.

Since then, various drugs have been used to facilitate the induction of controlled hypotension, for middle ear surgery including vasodilators such as sodium nitroprusside, nicardipine, nitroglycerin, beta-blockers such as propranolol, esmolol, alpha and beta-adrenergic antagonist such as labetalol and high dose of potent inhaled anesthetics, such as halothane.

Some disadvantages have been reported for these techniques including long post-anesthetic recovery for halothane, resistance to vasodilators, tachyphylaxis, and cyanide toxicity for nitroprusside, or possibility of myocardial depression for esmolol (4).

In some studies, combination of different hypnotic anesthetics have been suggested as a method of reducing the amount of bleeding. Propofol has gained a widespread attention. The present study was designed to compare a surgeon's subjective assessment of operating conditions in patients randomly assigned to receive combination of propofol and tranexamic acid or halothane during maintenance of anesthesia.

Materials and Methods

This study was performed between 1383 and 1384 in Ghaem Hospital, Mashhad University of Medical Sciences. Forty normotensive ASA physical status I-II patients undergoing tympanoplasty were studied. They were randomly assigned to receive either the combination of propofol and tranexamic acid or halothane anesthesia. During surgery, the patients were maintained in 10° reverse Trendelenburg position to minimize venous bleeding.

Routine monitors included oscillometric blood pressure, electrocardiography and pulse oximetry. Patients were pretreated with 0.05 mg/kg of intravenous midazolam.

Anesthesia was induced by alfentanil 20 µg/kg, propofol 2.5 mg/kg and atracurium, 0.5 mg/kg, in both group. In twenty patients, undergoing protocol of propofol and tranexamic acid, 15mg/kg of tranexamic acid was injected intravenously before the induction of anesthesia and the maintenance dose was 1 mg/kg/min during the operation.

In this group, anesthesia was maintained by infusion of propofol 4-6 mg/kg and alfentanil 10 µg/kg/h. In another twenty patients, anesthesia was maintained with 0.6-0.7% halothane and alfentanil 10 µg/kg. One surgeon, who was blinded to the anesthetic agent, performed all the operation. At 15 minutes intervals, the surgeon provided numeric assessment of the operative conditions, primarily in relation to the amount of bleeding and its effect on visibility (5). The scoring system used is shown in table 1.

Table 1: Grading System of Assessing Operative Condition.

Score	Definition
1	Minimal /no bleeding, excellent satisfaction
2	Modest bleeding and impairment of operating condition, good satisfaction
3	Significant bleeding and impairment of operating condition, bad satisfaction
4	Severe bleeding, operating condition intolerable, very bad satisfaction

Alfentail was stopped 15 minutes and propofol or halothane was stopped 5 minutes before the end of surgery.

All the patients' data were recorded in a specific questionnaires. Then the results were compared in the two groups using chi-squared test, unpaired t-test, Mann-Whitney U test, and a permutation test. A P value of ≤ 0.05 was considered significant.

Results

The demographic characteristics of the patients studied are listed in Table 2. There were no significant differences between two groups with respect to age, weight, height, distribution by sex or duration of surgery.

Table 2: Demographic Characteristics of the Study population

Variables	Protocol (n=20)	Halothane (n=20)
Age	30 \pm 11	32 \pm 12
Weight (kg)	80 \pm 16	77 \pm 16
Height (cm)	175 \pm 10	173 \pm 10
Women	45%	55%
Surgical duration (min)	95 \pm 20	90 \pm 24
Preinduction MAP(mmHg)	98 \pm 11	99 \pm 15
Intra operative MAP(mmHg)	74 \pm 6	70 \pm 4

Average intraoperative mean arterial pressure (MAP) was 4 mmHg lower ($P < 0.085$) in the protocol group, which was not considered significant.

There were significant differences between two groups with regard to bleeding assessment score by the surgeon and his satisfaction. The incidence of the patients with mean score of 2 or less in protocol group was 80% and the rest of them had a mean score of more than 2. While in halothane group, the incidence of mean score of 2 or less was 45%. The results of the scoring of the surgical field condition are depicted in (Table 3).

Table 3: Bleeding assessment score of the two groups

Approximate mean score	Protocol (no)	Halothane (no)
1	7	4
2	9	5
3	4	10
4	0	1

Recovery characteristics of the two groups had significant differences (Table 4). Time to extubation, eye opening and discharge from recovery was less in protocol versus halothane group. Frequency of nausea and vomiting was less in protocol group.

Table 4: Comparison of Recovery Characteristics

	Protocol	Halothane	P
Time to extubation (min)	7 \pm 4	20 \pm 11	0.02
Time to eye opening (min)	8 \pm 4	26 \pm 14	0.015
Time to ambulation (min)	150 \pm 55	207 \pm 72	0.021
Frequency of nausea (%)	30	46	0.3
Frequency of vomiting (%)	15	25	0.6

Discussion

The concept that anesthesia may contribute to blood loss during surgery is not new. In the past, Stankiewicz (6) reported that estimated blood loss was less in patients having local anesthesia as opposed to general anesthesia for endoscopic sinus surgery. Comparing general anesthesia techniques, Yoshikawa et al (7) reported no difference in blood loss during radical maxillary sinus operations, when comparing patients anesthetized by halothane, enflurane or neuroleptanesthesia.

All the studies that investigated the effect of propofol on surgical field condition in endoscopic sinus surgery (1,2,3,5) showed slight improvement in the surgical field visualization and surgeon satisfaction.

In this study, the beneficial effect of the combination of propofol and tranexamic acid in comparison with the conventional inhalation halothane anesthesia was shown in tympanoplasty. The addition of tranexamic acid to propofol provided better surgical visualization. Use of tranexamic acid prevents fibrinolysis and leads to decreased bleeding. With patients in reverse Trendelenburg position, the rate of venous bleeding should be related to central venous pressure and the height of the bleeding site relative to the position and pressure of the right atrium (5).

Conceivably, propofol may preferentially minimize bleeding that is arteriolar in nature and therefore relatively rapid and difficult to control (8), whereas there may be no significant advantage with regard to venous bleeding. Combination of these factors probably causes decreased surgical field bleeding and improved visualization under the microscope and eventually better results of the operation. On the other hand other beneficial effects of this technique is rapid recovery and decreased frequency of nausea and vomiting, which is more favorable for the patients (9,10).

So, using this technique of anesthesia is recommended in patients undergoing tympanoplasty. To use its useful effects in other operations, more studies are suggested.

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خلاصه

مقایسه پروتوکل ترکیب پروپوفول و ترانکسامیک اسید با هالوتان در ایجاد شرایط مطلوب

حین اعمال جراحی تمپانوپلاستی

دکتر رضا جلائیان تقدیمی، دکتر محمدرضا مجیدی، دکتر آرش بیوندی

مقدمه: تمپانوپلاستی تحت بیهوشی عمومی انجام می شود. یکی از مسائل اساسی بیهوشی عمومی، خونریزی حین عمل می باشد که با وضوح دید جراح تداخل می نماید. در این مطالعه آینده نگر اثرات دو روش بیهوشی به صورت ترکیب پروپوفول به همراه ترانکسامیک اسید در مقابل روش مرسوم استفاده از هالوتان بر روی میزان خونریزی و ارزیابی جراح از شرایط فیلد عمل جراحی تمپانوپلاستی مقایسه شده است.

روش کار: چهل بیمار که قرار بود تحت عمل جراحی تمپانوپلاستی قرار گیرند به صورت تصادفی به دو گروه مساوی تقسیم شدند. در یک گروه استفاده از پروپوفول به همراه ترانکسامیک اسید به صورت یک پروتوکل و در گروه دیگر استفاده از هالوتان صورت پذیرفت. تمام اعمال جراحی توسط یک جراح که از نوع بیهوشی اطلاعی نداشت، صورت پذیرفت. برای ارزیابی وضعیت فیلد عمل از یک سیستم امتیاز بندی استفاده گردید به این صورت که امتیاز ۱- فاقد خونریزی، امتیاز ۲- خونریزی متوسط، امتیاز ۳- خونریزی نسبتاً زیاد، امتیاز ۴- خونریزی خیلی زیاد. نتایج ارزیابی جراح از وضعیت فیلد عمل در دو گروه توسط تستهای آماری مناسب مقایسه گردیدند.

نتایج: هیچ اختلاف قابل توجهی بین دو گروه از نظر طول مدت عمل جراحی یا متوسط فشار شریانی وجود نداشت. متوسط امتیاز خونریزی در گروه پروتوکل کمتر بود. ۸۰٪ بیماران در گروه پروتوکل وضعیت فیلد جراحی خوبی داشتند. در حالی که این میزان در گروه هالوتان ۴۵٪ بود.

نتیجه گیری: بیهوشی عمومی بر استفاده از ترکیب پروپوفول و ترانکسامیک اسید در مقایسه با هالوتان دارای مزیت خونریزی کمتر است و با افزایش دید جراحی موجب می شود عمل تمپانوپلاستی راحت تر صورت پذیرد. این تکنیک بیهوشی ممکن است در سایر اعمال جراحی گوش و گلو و بینی که خونریزی در یک فضای محدود موجب اختلال دید می شود نیز کاربرد داشته باشد.

واژه های کلیدی: تمپانوپلاستی، بیهوشی عمومی، پروپوفول، ترانکسامیک اسید.