Hypotensive Anaesthesia for Endoscopic Sinus Surgery and Septorhinoplasty: A Comparison of Propofol-Alfentanil Infusion and Isoflurane

ENDOSKOPİK SİNÜS CERRAHİSİ VE SEPTORİNOPLASTİDE HİPOTANSİF ANESTEZİ: PROPOFOL-ALFENTANİL İNFÜZYONU İLE İSOFLURANIN KARŞILAŞTIRILMASI

Varol ÇELİKER*, Didem DAL*, T. Metin ÖNERCİ**, M.Kemal ERDEM*

* Dept. of Anaesthesiology and Reanimation, Medical School of Hacettepe University, Ankara
** Dept. of Otorhinolaryngology-Head and Neck Surgery, Medical School of Hacettepe University, Ankara, TURKEY

Summary

Control of bleeding and improved visualization of the operative field is crucial for the successful outcome of the endoscopic sinus surgery (ESS). One of the major disadvantages of general anaesthesia is the increased bleeding encountered which can interfere with optimum visualization of the intranasal anatomy. In this study, we compared two different anaesthetic techniques regarding to their impact on blood loss and duration of surgery.

Twenty-three patients undergoing ESS or septorhinoplasty were allocated randomly into two groups. 10 patients in Group 1 (TIVA-total intravenous anaesthesia) received a continuous intravenous infusion of propofol and alfentanil and 13 patients in Group 2 (isoflurane) anaesthetized with isoflurane inhalation. Controlled hypotension was maintained with nitroglycerin if the surgeon could not work because of bleeding.

There was no difference in the duration of surgery or the mean measured blood loss between the two techniques. The mean measured blood loss for TIVA group was 294.50 ml (median=290, SD=186.11) while the mean measured blood loss for the isoflurane group was 312.31 ml (median=280, SD=210.12). There was a significant difference between the groups in nitroglycerin requirement (%10 in TIVA vs. %77 in isoflurane group) ($p<0.05$).

In this study it is concluded that TIVA is a better choice than isoflurane anaesthesia for ESS and septorhinoplasty, because there is less requirement for an additional agent like nitroglycerin to reduce intraoperative bleeding.

Key Words: Anaesthetics; Propofol, Isoflurane, Anaesthesia; Hypotensive, Surgery; Endoscopic sinus surgery, Septorhinoplasty

T Klin J Med Res 2000, 18:98-104

Received: June 22, 1999

Correspondence: Varol CELIKER
Dept. of Anaesthesiology and Reanimation
Medical School of Hacettepe University
06100, Ankara, TURKEY

Özet

Endoskopik sinüs cerrahisinde (ESS) cerrahinin başarısı için kanama kontrolü ve cerrahi sahadaki görüşün iyileştirilmesi çok önemlidir. Genel anestezinin önemli dezavantajı kanamayı artırıcı etkisine bağlı olarak intranazal anatominin optimum görünüşünü etkilemesidir. Bu çalışmada iki farklı anestezi tekniği, kanama miktarı ve cerrahi süre üzerindeki etkileri yönünden incelenmiştir.

ESS veya septorinoplasti uygulanacak 23 hasta rastgele 2 gruba ayrıldı. Grup l'deki 10 hastaya (TIVA-total intravenöz anestezi) propofol ve alfentanil infüzyonu, Grup 2'deki 13 hastaya isofluran anestezisi uygulandı. Kanamanın cerrahın çalışmasını engellediği durumlarda nitrogliserin ile kontrollü hipotansiyon sağlandı.

İki grubun karşılaştırılmasında cerrahi süre ve ortalama kan kaybı yönünden anlamlı fark saptanmadı. Ortalama kan kaybı TIVA grubunda 291.50 ml (medyan=290, SD:186.11), isofloran grubunda 312.31 ml (medyan=280, SD:210.12) idi. Nitrogliserin ihtiyacı yönünden gruplar arasında istatistiksel olarak anlamlı fark saptandı (TIVA grubunda %10'a karşı isofloran grubunda %77) ($p<0.05$).

ESS ve septorinoplasti ameliyatlarında, TIVA uygulamasının intraoperatif kanamayı azaltmak için nitrogliserin gibi ek yardımcı bir ajana daha az ihtiyaç göstermesi nedeni ile isofluran anestezisine göre daha iyi bir seçenek olduğu kanaatine varıldı.

Anahtar Kelimeler: Anestezikler; Propofol, İsofluran, Anestezi; Hipotansif, Cerrahi; Endoskopik sinüs cerrahisi, septorinoplasti

T Klin Araştırma 2000, 18:98-104

Endoscopic sinus surgery (ESS) is becoming a more common procedure for the treatment of chronic sinusitis (1). Most of the patients prefer to have surgery under general anaesthesia. There is a consensus in the literature that one of the major drawbacks of general anaesthesia for endoscopic sinus surgery and septorhinoplasty is the associated increase in intraoperative bleeding which can interfere with optimal visualization through the endoscope or nasal cavity (2,3).

We studied and compared two different anaesthetic techniques to determine if these techniques have an impact on blood loss and duration of surgery.

Methods

Twenty-three A S A physical status I-II patients scheduled for ESS or septorhinoplasty (SRP) were included in the study. The approval of the ethics committee of the institution and informed consent of all patients were obtained.

A11 of the ESS patients underwent sphenoethmoidectomy. 0°, 30° and 70° sinus endoscopes with attached irrigation sheahts (endoscrub[R]- xomed) were used. Cotton pledgets soaked with the mixture of 2% pantocaine (4 to 5 parts) and 1:1000 epinephrine (1 part) were introduced into the recesses and corners of the inferior and middle meatus 5 minutes before the induction.

The surgeon and the anaesthetist who made blood loss measurements were unaware which anaesthetic technique was being used. The surgeon assessed the operative field for bleeding and graded as " dry, moderate or excessive".

Bleeding classified from 1 to 3 (l=dry, 2=moderate, 3=excessive) by the surgeon.

Preoperative laboratory package included complete blood count with platelets, protrombin time, partial trombin and bleeding times. Patients were excluded if they had a history of bleeding diathesis, using anticoagulant, aspirin or nonsteroid anti-inflammatory agents.

They were premedicated with atropine (O.Olmg kg^{-1}) and pethidine (1mg kg^{-1}) intramuscularly given 30-45 minutes before induction of anaesthesia.

A plastic cannula was inserted in a large vein of the hand or forearm upon arrival in the operating theatre and connected to an infusion of a 5% dextrose solution in water. ECG, peripheric oxygen saturation and blood pressure were monitored continuously and recorded at 10 minutes intervals. $EtCO_2$ values were also monitored J after laringoscopy until extubation.

Patients, were randomly allocated into two groups. In group 1 (TIVA; n=10) anaesthesia was induced with propofol (2mg kg^{-1}) and alfentanyl (lOug kg-") followed by continuous infusion of propofol at a rate of 12 mg kg^{-1} hr^{-1}, reducing to 10, 8 and 6 mg kg"' hr^{-1}, respectively at ten minutes intervals. A11 of the patients were ventilated with air/ O_2 (Fi 50%) mixture after the intubation. Alfentanil was infused at a rate of 1 u.g kg^{-1} mim^{-1} throughout the procedure until 10 minutes before the end of the surgery. Propofol infusion was stopped at the end of the surgery. In group 2 (Isoflurane; n=13) after the induction with propofol, anaesthesia was maintained with isoflurane (1-1.5%) and 70% N_2O in oxygen. A11 patients received vecuronium bromide (0.08 mg kg^{-1}) intravenously after induction of anaesthesia to facilitate endotracheal intubation and supplemental dose of vecuronium (one-third to one-forth of the initial dose) was given when necessary. In both groups the doses of propofol and isoflurane were titrated according to clinical (sweat production, painful reaction to surgical stimuli, etc.) and haemodynamic criteria (incease in baseline blood pressure and heart rate). Besides these criteria when there was a simultaneous elevation encountered in blood pressure or heart rate, propofol concentration was elevated to previous value in group I and isoflurane concentration was elevated from 1% to 1.5% in group II in order to keep blood pressure and heart rate within the baseline limits. Isoflurane and N_2O were discontinued as soon as surgeon had terminated the operation. At the end of the surgery the neuromuscular blockade was reversed with 0.02 mg kg^{-1} atropine and 0.04 mg kg^{-1} prostigmine.

When excessive bleeding prevented the surgery, controlled hypotension was instituted with nitroglycerin at a rate of 1 \xg kg-' mim^{-1} in order to keep local bleeding to a minimum. Controlled hypotension was achieved with maximum decline of 20% of the original blood pressure.

At the end of the surgery, the blood volume which collected during surgery, surgeon's evaluation about surgical field, recovery time (the time from discontinuing anaesthesia to opening the eyes on command), the lenght of surgery, complications (vomiting, awareness, recall of events during surgery) and nitroglycerin requirement were noted. In order to measure the total blood loss in ESS, the amount of fluid used for irrigation during the operation was substracted from the fluid collected in vacuum aspirator system. For measuring the blood loss in SRP operations the amount of blood contained in surgical sponges was also measured by subtracting the weight of equal number of dry sponges from the total weight of sponges used during the operation.

Mann-Whitney U, Chi-square and Fisher's Exact tests were used for statistical analysis. Difference of $p<0.05$ was considered significant.

Results

Demographic data are shown in Table 1. The TIVA and isoflurane groups were of similar gender ratio, weight, ASA grade, operation type. The mean age of the isoflurane group was 11 years older than the TIVA group ($p<0.05$). No statistically significant difference was found between the lenght of surgery or duration of anaesthesia or recovery time when comparing the two groups (Table 1).

There was not a significant difference in blood pressure and heart rate before induction between two groups.

In TIVA group there was a significant reduction in blood pressure and heart rate during intubation ($p<0.05$) (Figure 1,2). Laryngoscopy and intubation caused no increase on blood pressure and heart rate in TIVA group and a minor increase in isoflurane group.

There was a significant difference between groups in using nitroglycerin infusion (1 patient in Group 1 vs. 10 patients in Group 2 ($p=0.00217$) (Table 1). Classification of bleeding by the surgeon was not significantly different and also there was a significant correlation between nitroglycerin infusion and classification of bleeding ($p=0.1797$) (Figure 3). In TIVA group the surgeon classified 8 patients as dry and only one patient as excessive, while in isoflurane group 7 patients as dry, 4 of them as moderate and 2 of them as excessive.

Table 1. Demographic data. Mean ±SD (Range)

	Group 1 (TIVA)	Group 2 (Isoflurane)
n	10	13
Age (year)	22.70±6.86 (15-37)	33.70±10.39* (19-51)
Sex(M/F)	6/4	7/6 J
Weight (kg)	63.10±10.24 (51-76)	65.54±13.63 (45-85)
Duration of anaesthesia (min.)	104.00±34.94 (80-120)	121.92±30.58 (50-150)
Duration of surgery (min.)	91.70±31.23 (45-125)	104.15±30.46 (32-140)
Recovery time (min.)	9.60±1.30	10.33±0.88
Nitroglycerin used	1	10*
ASA physical status		
I	9	8
II	1	5
Type of operation		
Septorhinoplasty	5	5
ESS	5	8

*$p<0.05$

Table 2. Estimated blood loss (ml) for patients receiving propofol or isoflurane. Mean±SD.

Patient no.	Group 1	Group 2
1	160	550
	540	120
3	420	335
4	320	240
	320	500
6	260	160
7	5	720
8	190	500
9	130	70
10	600	150
11	-	400
12	-	280
13	-	35
Mean	294.50	312.31
Median	290	280
Standard Deviation	186.11	21 0.12

$p=0.9758$

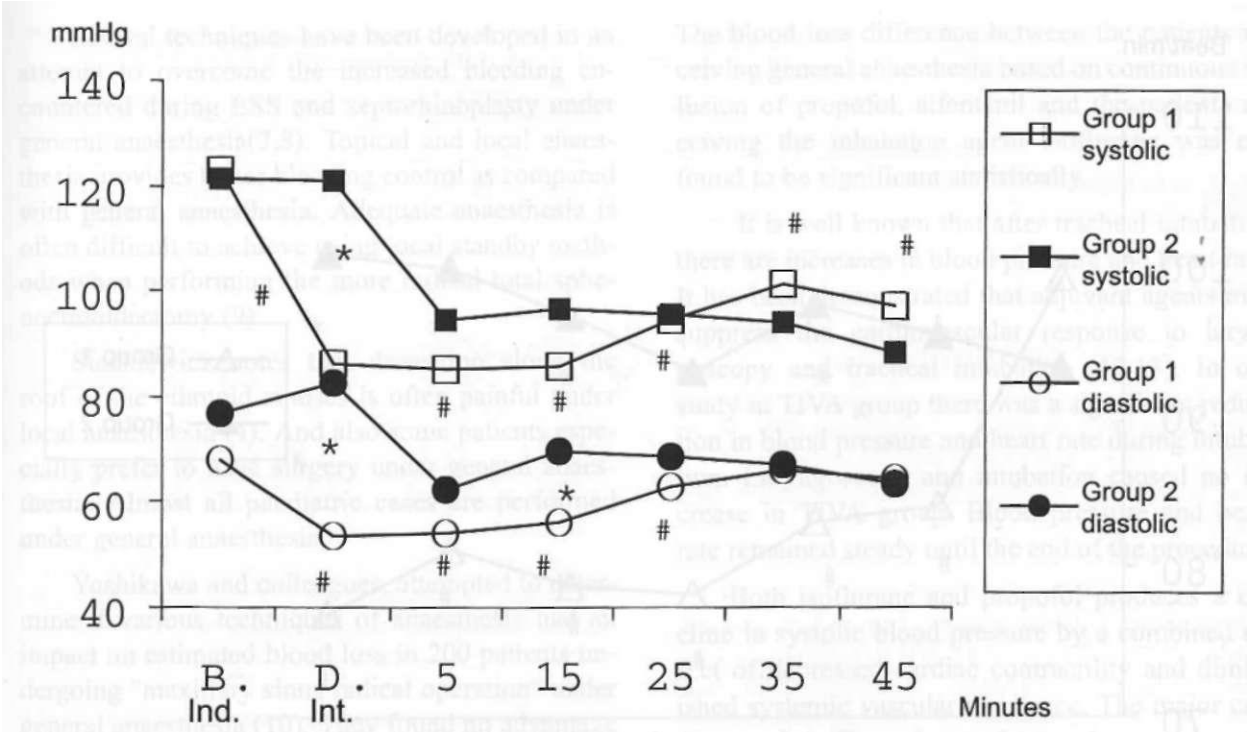

Figure 1. Changes in the individual values of systolic and diastolic blood pressures over the study period.
*p<0.05 between groups.
#p<0.05 compared with base value (B. Ind) in group 1.
t p<0.05 compared with base value (B. Ind) in group 2.
B. ind: Before induction, D. int: During intubation.

The mean blood loss for TIVA group was 294.50 (median=290, SD=186.11) ml while the mean blood loss for the isoflurane group was 312.31 (median=280, SD=210.12) ml (p= 0.9758) (Table 2).There was no significant association between blood loss and weight (r= -0.4091, p= 0.240 in TIVA group; r=-0.0821, p=0.790 in Isoflurane group) and lenght of surgery (r=0.4380, p=0.206 in TIVA group; r= 0.2257, p=0.458 in isoflurane group) and age (r=-0.301, p=0.934 in TIVA group; r= 0.2781, p=0.358 in isoflurane group).

No complications were mentioned by the patients i.e., vomiting, awareness, recall of events during surgery.

Discussion

The most commonly reported complications in ESS are re-bleeding in the postoperative period, periorbital emphysema and unilateral eye echymosis (1,4,5). Endoscopic sinus surgery in patients with extensive pathology should be used with caution, especially if general anaesthesia is selected or if excessive bleeding occurs.

It is widely recognized that one of the major disadvantages of general anaesthesia for ESS or septorhinoplasty is the increased bleeding encountered intraoperatively. Stankiewicz found intraoperative hemorrhage to be the most frequent major complication of ESS in reviewing his experience with 180 patients.

Control of bleeding and improved vizualization of the operative field is therefore crucial for the successful outcome of the surgery. The procedure is performed through a rigid endoscope and any blood or secretions at the top of the scope severely decreases visualization. Sufficient visualization decreases the surgeon's workload and intraoperative anxiety and may also decrease the incidence of operative complications.

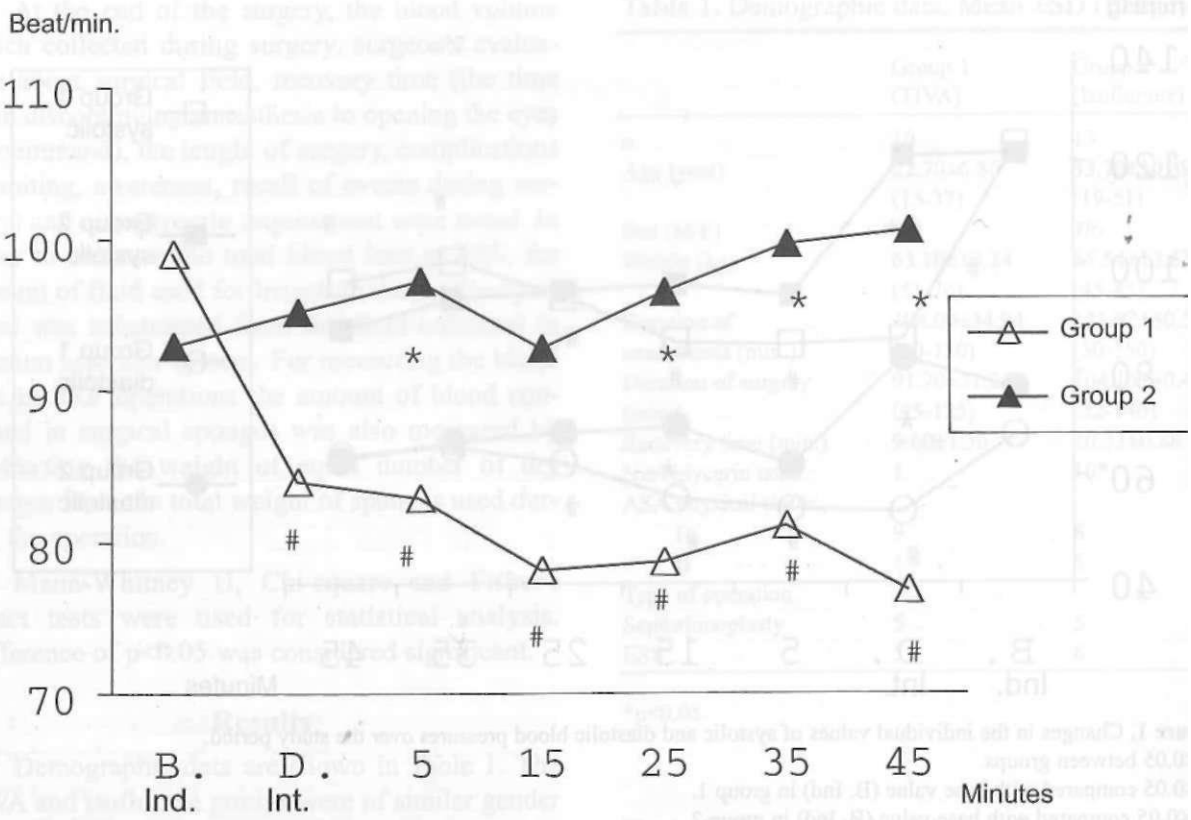

Figure 2. Changes in the individual values of heart rates over the study period.
*p<0.05 between groups.
#p<0.05 compared with base value (B. Ind) in group 1.
B.ind: Before induction, D. int: During intubation.

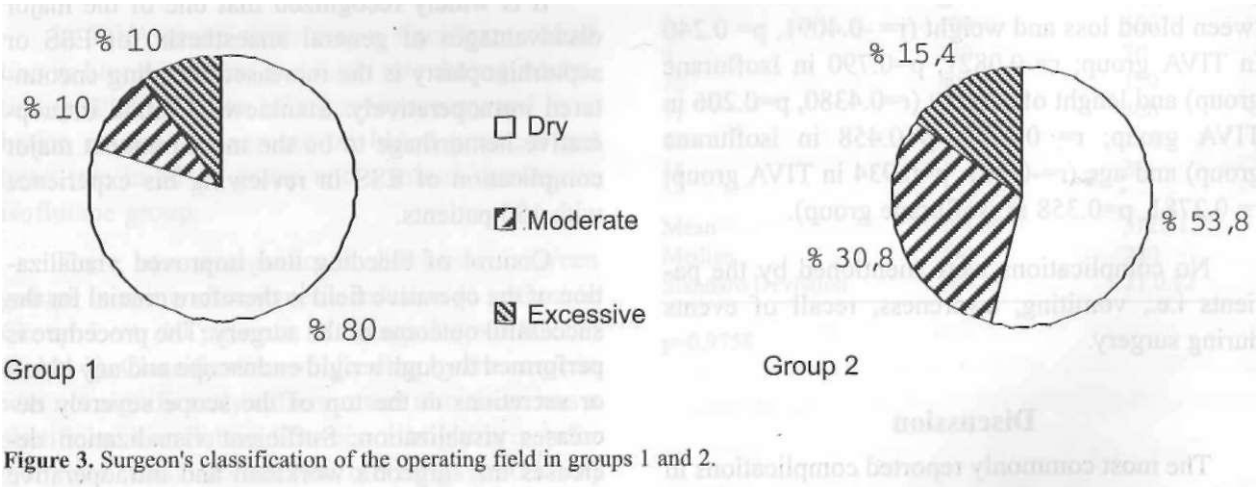

Figure 3. Surgeon's classification of the operating field in groups 1 and 2.

Several techniques have been developed in an attempt to overcome the increased bleeding encountered during ESS and septorhinoplasty under general anaesthesia(7,8). Topical and local anaesthesia provides better bleeding control as compared with general anaesthesia. Adequate anaesthesia is often difficult to achieve using local standby methods when performing the more radical total sphenoetrnoidectomy (9).

Stankiewicz notes that dissection along the roof of the ethmoid sinuses is often painful under local anaesthesia (4). And also some patients especially prefer to have surgery under general anaesthesia. Almost all paediatric cases are performed under general anaesthesia.

Yoshikawa and colleagues, attempted to determine if various techniques of anaesthesia had an impact on estimated blood loss in 200 patients undergoing "maxillary sinus radical operation" under general anaesthesia (10). They found no advantage of techniques using halothane or enflurane or neuroleptic anaesthesia to each other. According to anaesthesia methods, estimated blood loss was correlated to body weight and to operative time in the halothane group, and estimated blood loss was correlated to operative time in the neurolept anaesthesia group. In our study, we could not find such a correlation just like the data of Blackwell et al.

The mean ages were not similar between the groups but we could not find a significant correlation between age and blood loss. Because of this we could say that the difference of age may not play a major role on blood loss.

Yoshikawa et al and also Blackwell and colleagues did not mentioned any kind of hypotensive supplementary medication in their study (11). Blackwell noted that 10 to 13 patients received intravenous midazolam, and 12 of 13 patients received intravenous fentanyl or alfentanil in isoflurane group; and all patients received intravenous fentanyl or alfentanil and 5 of 12 patients also received midazolam in propofol group. In their study mean arterial pressure was 80 mmHg in propofol group and 81 mmHg in isoflurane group.

In our study; when excessive bleeding prevented the surgery and also original blood pressure did not decline more than 10% we used nitroglycerin. The blood loss difference between the patients receiving general anaesthesia based on continuous infusion of propofol, alfentanil and the patients receiving the inhalation agent isoflurane was not found to be significant statistically.

It is well known that after tracheal intubation there are increases in blood pressure and heart rate. It has been demonstrated that adjuvant agents may suppress the cardiovascular response to laryngoscopy and tracheal intubation (12,13). In our study in TIVA group there was a significant reduction in blood pressure and heart rate during intubation. Laryngoscopy and intubation caused no increase in TIVA group. Blood pressure and heart rate remained steady until the end of the procedure.

Both isoflurane and propofol produces a decline in systolic blood pressure by a combined effect of depressed cardiac contractility and diminished systemic vascular resistance. The major cardiovasculer effect of propofol is a decrease in arterial blood pressure owing to a drop in systemic vascular resistance, cardiac contractility, and preload. Factors exacerbating the hypotension include large doses, rapid injection and old age. Patients with impaired ventricular function may experience a significant drop in cardiac output owing to decreases in ventricular filling pressures and contractility. Isoflurane causes minimal depression invivo. Cardiac output is maintained by a rise in heart rate due to partial preservation of carotid baroreflexes. Mild beta-adrenegic stimulation increases skeletal muscle blood flow, decreases systemic vascular resistance and lowers arterial blood pressure. Despite the drop in perfusion pressure, the vasodilation causes tissue perfusion to increase substantially. Blackwell et al. found a statistically significant less blood loss in propofol group and suggested that propofol infusion produces less systemic vasodilation than isoflurane. However, in our study nitroglycerin which relaxes vascular smooth muscle with venous dilatation predominating over arterial dilatation was used in more patients in the isoflurane group than the propofol group (77% vs. 10%).

TIVA is a new technique for maintenance of general anaesthesia that may be associated with decreased bleeding during ESS and septorhinoplasty compared with conventional inhalation agent tech-

niques. Addition of nitroglycerin infusion to the isoflurane inhalation was probably the reason of the observed insignificance in blood loss.

In this study it is concluded that TIVA with propofol is better than isoflurane anaesthesia because of the rare necessity to use an additional agent like nitroglycerin to control intraoperative bleeding.

REFERENCES

1. Levine HL. Functional endoscopic sinus surgery: evaluation and follow up of 250 patients. Laryngoscope 1990; 100:79-84.
2. Teichgraeber IF, Russo RC. Treatment of nasal surgery complications. Ann of Plast Surg 1993; 30:80-8.
3. Maniglia AJ. Fatal and other major complications of endoscopic sinus surgery. Laryngoscope 1991; 101:349-54.
4. Stankiewicz JA. Complications of endoscopic intranasal ethmoidectomy. Laryncoscope 1987; 97:1270-3.
5. Stankiewicz JA. Complications in endoscopic intranasal ethmoidectomy: An update. Laryncoscope 1989; 99: 686-90.
6. Stankiewicz JA. Complications of endoscopic nasal surgery: Occurence and treatment. Am J Rhinol 1987; 1:45-9.
7. Gittelman PD, Jacops JB, Skorina J. Comparison of functional endoscopic sinus surgery under local and general anestesia. Ann Oto Rhin Laryn 1993; 102: 289-93.
8. Boezaart AP. Comparison of sodium nitroprusside-and esmolol-induced controlled hypotension for functional endoscopic sinus surgery. Can J Anaesth 1995; 42: 373-6.
9. Schaefer SD. Endoscopic total sphenoethmoidectomy. Otolaryngol Clin North Am 1989; 22:727-32.
10. Yoshikawa T, Sano K, Kan T. Clinical assessment of anesthesia and estimated blood loss during maxillary sinus surgery. Anest Prog 1989; 36:242-8.
11. Blackwell KE, Ross DA, Kapur P. Propofol for maintenance of general anesthesia: A technique to limit blood loss during endoscopic sinus surgery. Am J Otolaryngol 1993; 4:262-6.
12. Bedford RF, Marshall WK. Cardiovascular responses to endotracheal intubation during four anaesthetic techniques. Acta Anaesthesiol Scand 1984; 28:563-6.
13. Ebert JB, Pearson JD, Gelman S, Harris C, Bradley EL. Circulatory responses to laryncoscopy; the comperative effects of placebo, fentanyl and esmolol. Can J Anaesth 1989; 36:301-30.