Comparison study between Sevoflurane/Remifentanil with Isoflurane/Remifentanil to induce hypotension in Rhinoplasty Operations

Rawa Azad Ahmed[1], Dr. Abdulhameed Al-dabbagh[2], Dr. Rekawt Fadhel[3]

[1]MBChB, Kurdistan Higher Council of Medical Specialties Anesthesiology Resident.
[2]MBChB, DA, MSc Phm, Consultant Anesthesiologist, Hawler Medical University, College of Medicine, Erbil, Kurdistan Region, Iraq.
[3]MBChB, FIBMS, Kurdistan Higher Council of Medical Specialties Anesthesiology Board, Coordinator and Consultant Anesthesiologist.

KEYWORDS

Sevoflurane/Remifentanil, Isoflurane/Remifentanil, Rhinoplasty Operations

ABSTRACT

Background: Answering the question of "which modality and combination is having the upper handy?" in bleeding control during rhinoplasty surgery through controlled hypotension achieved by administering anesthesia with two different inhalation agents: sevoflurane or isoflurane, both in combination with remifentanil. Numerous studies and articles are published annually, yet the wider question regarding the efficacy of each formula has remained unaddressed.

Methods: This prospective observational study utilized convenient sampling with a total of 100 patients undergoing rhinoplasty. Participants were divided into two groups: one receiving remifentanil combined with sevoflurane and the other receiving remifentanil combined with isoflurane. Controlled hypotension was achieved and monitored throughout the procedure.

Results: Both anesthesia combinations effectively achieved controlled hypotension and created a dry operative field. Notably, the sevoflurane/remifentanil combination resulted in a faster onset of decreased heart rate and mean arterial blood pressure (MAP) within the first 40 minutes of the procedure compared to the isoflurane/remifentanil combination.

Conclusion: The study demonstrated that both sevoflurane/remifentanil and isoflurane/remifentanil combinations are effective in controlling bleeding during rhinoplasty. Sevoflurane/remifentanil showed a quicker initial effect on cardiovascular parameters, but both protocols successfully met the primary goal of minimizing bleeding and enhancing surgical visibility.

1. Introduction

ne the optimal method for achieving controlled hypotension in the context of rhinoplasty surgery

Introduction

Controlled hypotension means lowering blood pressure for specific purposes in surgery. Advantages of decreasing blood pressure are numerous, like reduced blood loss, enhancing visibility, and shorter operative times. While Safety measures rely on factors such as the procedure and patient's condition.

Optimum techniques are reliable, amenable, have the least adverse effects, and limit duration. Surgical considerations of undesirable consequences, like the risk of rapid hemorrhage should also be considered (4).

Numerous medications, whether on their own or in combination, are utilized to achieve controlled hypotension. The ideal drug for induced hypotension during anesthesia should be easily administered, have a brief duration of action, and produce anticipated outcomes. It should permit punctual control of arterial pressure, have no toxic byproducts, and be excreted independently of liver or kidney function. Minimal interactions with other anesthesia drugs are also desired. However, currently, there is no perfect agent for reducing arterial blood pressure (7,11)

Nowadays, the preferred method is a combination of Agents from different classes may be combined to ameliorate the side effect of individual agents used in larger doses. (7)

New controlled hypotension techniques utilize anesthetic drugs like isoflurane and sevoflurane, which have hypotensive properties. These agents can be used alone or with adjuvant agents to mitigate

tachycardia and rebound hypertension. Isoflurane and sevoflurane are preferred due to their ability to reduce systemic vascular resistance, lower mean arterial pressure, and maintain cardiac output. They have dose-dependent effects on vascular resistance and blood pressure. (9)

2. Methodology

The study protocol was approved by the local ethical committee, and patients 'written informed consent' was obtained. Study design is cross-sectional, observational for the sample size to be conveniently chosen.

One hundred patients were conveniently sampled who were undergoing Rhinoplastic surgery from Jan 2023 to Sept 2023, and who were meticulously complying to American Society of Anesthesiologist (ASA) grade I and II of both genders, aged 18–40 years, in two separate centers both Rizgary teaching hospital and Hawler teaching hospital. They were conveniently distributed to be allocated into two equal groups: group I (n = 50) and group S (n = 50) to receive isoflurane (group I), sevoflurane (group S), for maintenance of hypotension.

Inclusion Criteria: Nasal surgery to the aim of rhinoplasty, patients being between 19 to 40 years old and classified by American Society of Anaesthesiology as ASA I and ASA II.

Exclusion Criteria: Inability to obtain informed consent for Mental capacity, simply candidates' refusing to grant consent. Patients with bleeding disorders, Consumption of anti-coagulants. Drug allergy especially to any of the involved items in the entire procedure.

The delivered volatile anesthetic concentration (25%-200%) was adjusted according to the systolic blood pressure (65mmHg-140mmHg) and discontinued at 70mmHg, while 5 mg ephedrine was given for any MAP <60mmHg. Whereas the dose of Remifentanile 10mcq/kg/hr were set according to the induced hypotension response.

Quality of the surgical field:

The quality of the surgical field in terms of blood loss and dryness, was rated every 20 minutes by the same attending surgeon who was blind of the pharmacological treatments, using the Boezaart. (Fromme-Boezaart score) a six-point scale ranging from slight bleeding to severe bleeding.

Statistical Analysis

The collected data were processed using Microsoft office Excel and SPSS v.23 computer programs. The confidence interval was set to 95% and the margin of error accepted was set to 5%.

T.test a P-value of less than 0.05 was considered significant. The quantitative data were presented as mean ± standard deviation.

3. Result and Discussion

This study was conducted as prospective, cross-sectional study among patients undergone rhinoplasty. The patients were conveniently allocated into two parts. With the total size of the sample being 31 of them were male and 69 were female with mean ±S.D age of 27.215± 4.826years, and mean ±S.D weight of 60.712± 8.299kg.

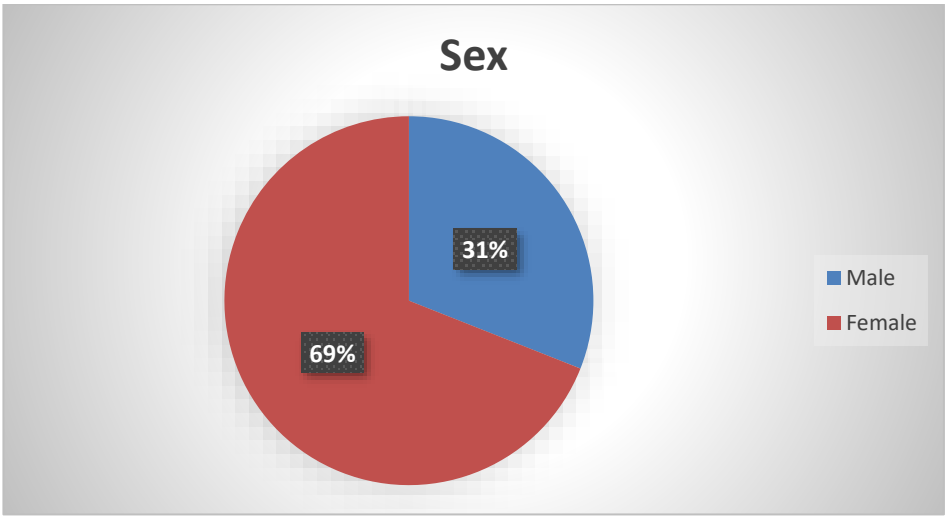

Figure (1): Gender distribution of participants

Table (1): Descriptive data of participants.

Measure	N	Minimum	Maximum	Mean	Std. Deviation
Age	100	18	40	27.215	4.826
Weight	100	45	100	60.712	8.299

Table (2): Hemodynamic Variables during Surgery

Measures	group	N	Mean	Std. Deviation	P .value	T .test
Tstart-Ttarget(mnt)	iso	50	10.97	5.606	0.007	significant
	sevo	50	8.07	4.927		
Tstart_Tend (mnt)	iso	50	108.710	23.791	0.246	Non-significant
	sevo	50	114.214	23.387		
Blood lose during procedure	iso	50	160.244	34.490	0.232	Non-significant
	sevo	50	152.043	33.729		
Use of ephedrine	iso	50	1.69	0.382	0.623	Non-significant
	sevo	50	1.65	0.429		

Tstart–Ttarget MAP values were 10.97 and 8.07 minutes

In groups I/R, S/R, respectively. Tstart–Ttarget MAP was significantly longer in

Group I (P<0.05).

Table 3: comparison of mean arterial pressure between two groups

Measures	groups	N	Mean	Std. Deviation	P .value	T test

MAP,START TO T TARGET	Iso	50	75.15	6.124	0.000	Significant
	Sevo	50	68.03	5.174		
MABP_20	Iso	50	68.67	3.055	0.000	Significant
	Sevo	50	64.47	4.279		
MABP_40	Iso	50	64.54	3.743	0.000	Significant
	Sevo	50	61.07	3.566		
MABP_60	Iso	50	60.42	2.781	0.311	Non-significant
	Sevo	50	59.78	3.475		
MABP_80	Iso	50	56.15	2.897	0.105	Non-significant
	Sevo	50	54.29	4.174		
MABP_100	Iso	50	54.32	4.503	0.246	Non-significant
	Sevo	50	53.45	2.749		
MABP_END	Iso	50	49.57	2.890	0.523	Non-significant
	Sevo	50	49.66	2.517		

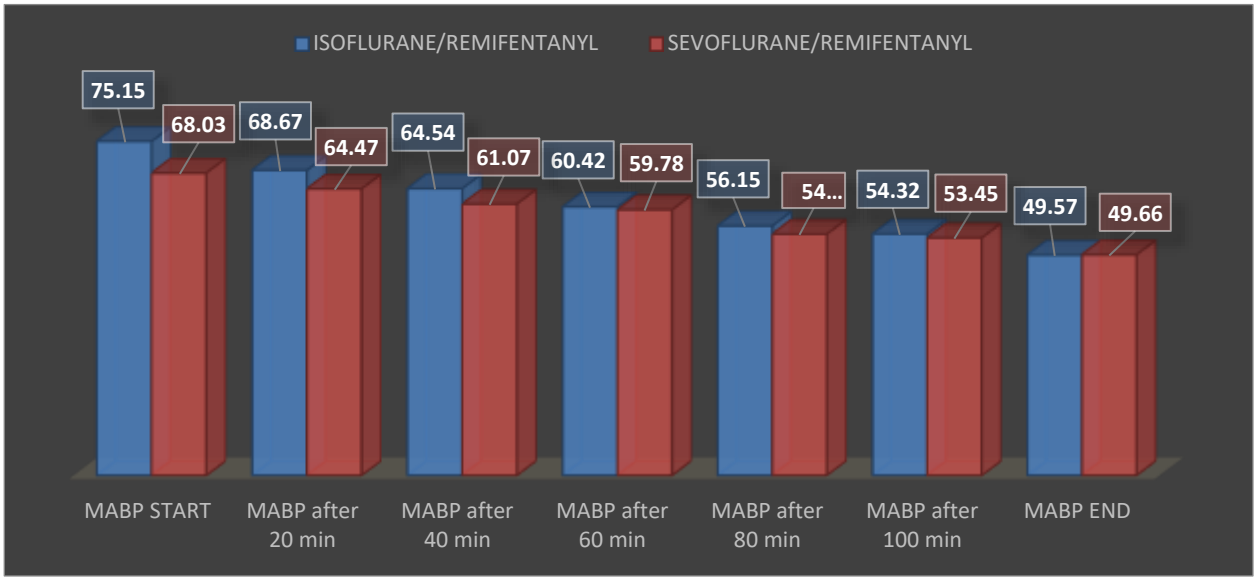

Figure 2: Comparison Of Mean Arterial Pressure Between Two Groups

The data of Table (2) indicate that there was statistically significant association between the different study groups and MAP readings at Start, 20, 40 minutes

(Figure 2).

Table 4: Comparison Of Pulse Rate In Two Groups

Measures	groups	N	Mean	Std. Deviation	P .value	T .test
HR_TStart- T target	iso	50	96.45	3.987	0.000	significant
	sevo	50	86.79	3.512		
HR - after 20 min	iso	50	86.47	3.154	0.000	significant
	sevo	50	73.92	5.313		
HR after 40 Min	iso	50	75.28	2.744	0.000	significant

	sevo	50	72.17	3.047		
HR after 60 min	iso	50	72.39	1.956	0.896	Non-significant
	sevo	50	72.45	2.589		
HR after 80 min	iso	50	64.56	1.512	0.512	Non-significant
	sevo	50	65.52	3.089		
HR after100 min	iso	50	64.12	6.095	0.862	Non-significant
	sevo	50	64.28	2.288		
HR_Tend	iso	50	60.40	2.303	0.193	Non-significant
	sevo	50	59.27	5.655		

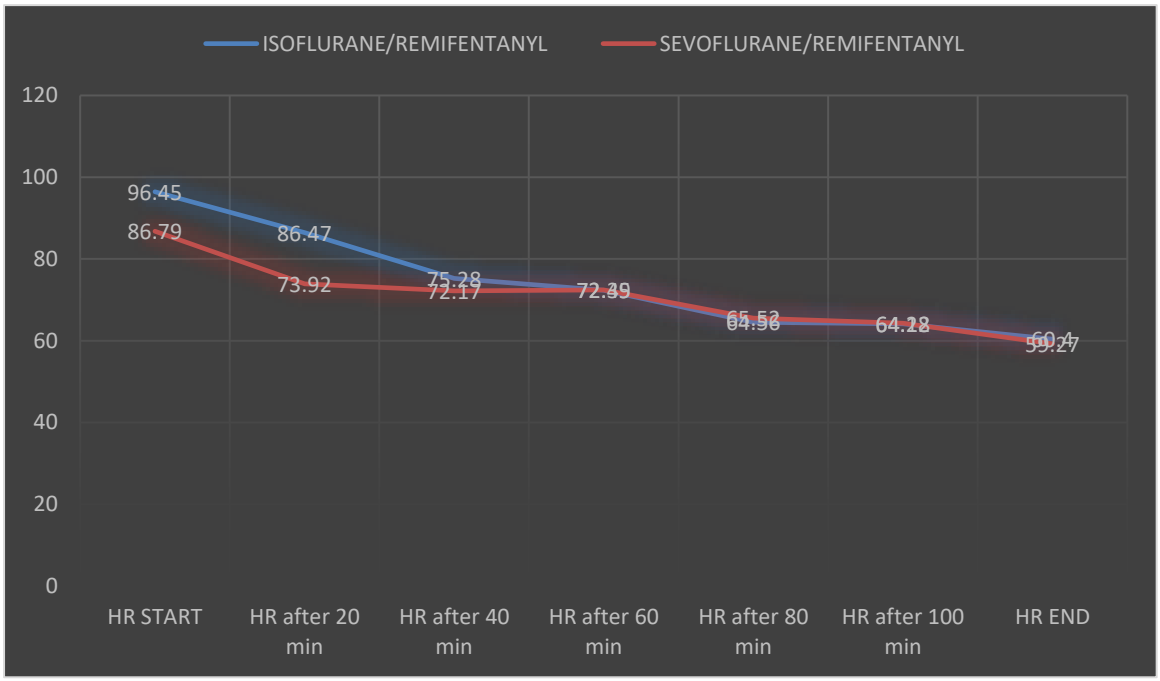

Figure 3: Comparison Of Pulse Rate In Two Groups

The data of Table (3) indicate that:

There was statistically significant association between the different study groups and HR readings at Start, 20, 40 minutes after starting surgical excision. (Figure 2)

Table 5: surgical field rating score

SFR		**groups**		**Total**
		iso	**sevo**	
	NO Bleeding	12	19	31
		38.70%	61.29%	100.0%
	Slight bleeding. No suctioning	22	15	37
		59.45%	40.54%	100.0%
	Slight bleeding. Occasional suctioning	16	16	32
		50.0%	50.0%	100.0%
Total		50	50	100
		50.0%	50.0%	100.0%

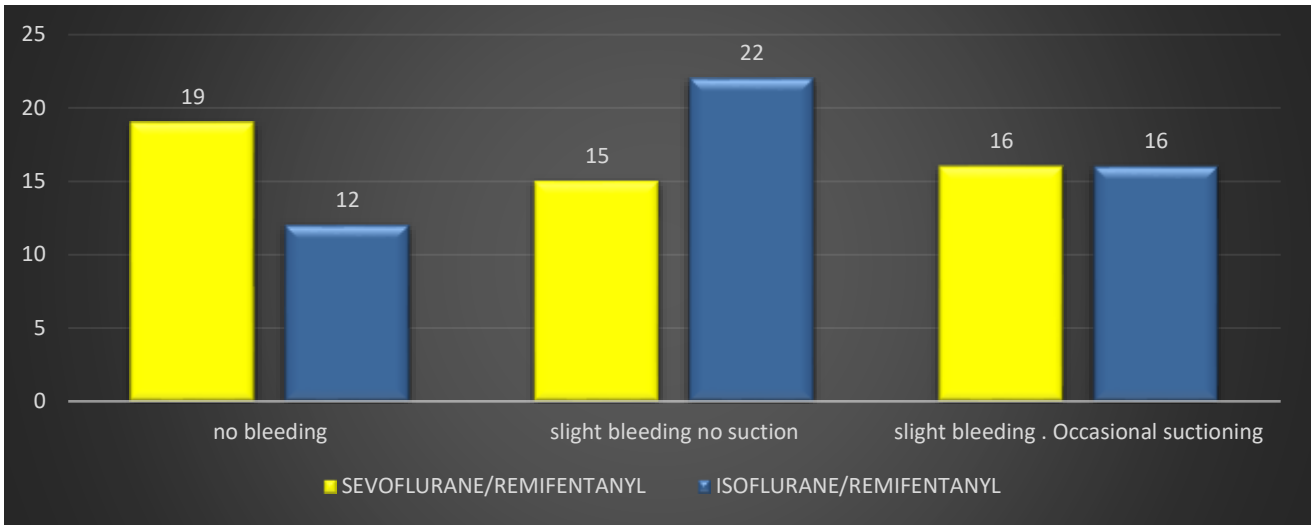

Figure (4) : surgical field rating score

The surgical field rating is done by the surgeon, shows NO significant difference between both groups as show in table (4) and graph (3)

Table (6) surgeon satisfaction

Groups		**SURGEONS_SATISFACTION**	
		Partial Satisfaction	**Complete Satisfaction**
Groups	Iso	19	30
		54.28%	46.15%
	Sevo	16	35
		45.71%	53.84%
Total		35	65
		100.0%	100.0%

The mean total surgeon satisfaction score shows on significant statistical difference between both two groups. (Table 5).

Analysis and Discussion

Unlike all the other previous studies, this article, in addition to remifentanil infusion, isoflurane inhalation (group I) or sevoflurane inhalation (group S) was used for maintenance of anesthesia, which has cardioprotective and neuroprotective properties. Remifentanil decreases heart rate and MAP by its central vagotropic effect and by stimulating peripheral μ receptors, causing peripheral vasodilatation and consequent decrease in systemic vascular resistance [(5)]

Furthermore, both isoflurane and sevoflurane usage, was found to be dropping in the amount of intraoperative bleeding that consequently decreases field visibility. Comparing the field visibility and surgeons' satisfaction there were similar results in both groups. Therefore, you may find No statistically significant differences among the two groups were found. The diversity in results of different studies may be due to different patient groups, surgical procedures, and durations of surgery.

Hemodynamic variability

The difference between the MAP and mean pulse rates from TSTART (time from surgical incision) to the 40th minute intraoperatively in both groups were statistically significant ($p<0.05$). This is expected as isoflurane has a cardiovascular stimulation property.

Weiskopf et al suggested that the cardiovascular stimulation induced by isoflurane and desflurane could be blunted by using opioids. In the current study, the use of remifentanyl infusion during the

operation may explain why no important fluctuations in heart rate were observed and why no significant differences in heart rate were found among the isoflurane and sevoflurane groups. (11)

The use of remifentanyl infusion may have blunted the sympathetic hyperactivity due to isoflurane.

None of the patients in both groups suffered from clinically significant bradycardia <50/min, with mean heart rate of 75+ 3.4 in isoflurane group and 71+ 3.6 in sevoflurane group.

The mean arterial pressure MAP preoperatively in group I was 75.12+10.973 whereas in group S it was 74.36+12.109 mmHg which were statistically comparable (p>0.05).

At Tstart minute the mean of MAP in group I/R was 75.15+6.1284and in group S/R was 68.03+5.174 mmHg which was statistically significant, (P<0.05).

At 20th minute, 40th minute also the differences between the two groups were statistically significant (p<0.05) (Table 3) According to our observations the onset of decrease in heart rate and MAP in S/R group was faster than I/R Group. TSTART-TTARGET was (10.97+5.606) in I GROUP, whereas (8.07+4.927) in S/R Group this may be due to difference in their blood: gas partition coefficient which is about 0.65 for sevoflurane and 1.4 for isoflurane, A low blood: gas partition coefficient indicates a rapid onset and offset. Solubility of an anesthetic agent in blood is quantified as the blood: gas partition coefficient, which is the ratio of the concentration of an anesthetic in the blood phase to the concentration of the anesthetic in the gas phase when the anesthetic is in equilibrium between the two phases. (9)

Only to find out other consistent studies, Groot et al. (2009) and Liu et al. (2011) report that both sevoflurane and isoflurane are effective in minimizing blood loss and maintaining adequate field visibility. Despite their differences in induction and recovery profiles, both anesthetic agents perform comparably in these aspects (14,15)

Relevant to the findings of our study, Evers et al. (2008) exhibited that sevoflurane typically makes a more rapid cardiovascular influence, including significant drop in HR and MAP, particularly during the induction process (16).

In contrast, Kain et al. (2003) and other studies indicate that isoflurane generally induces a slower onset of cardiovascular changes, which is corroborated by our findings of a more gradual decrease in HR and MAP with isoflurane/remifentanil

Last but not least the combination of remifentanil with either anesthetic agent enhances analgesia and contributes to overall hemodynamic stability. (17)

Research by Veyckemans et al. (2007) supports this by demonstrating that remifentanil improves analgesic efficacy and stabilizes cardiovascular parameters, thus complementing our results showing effective blood loss control and similar field visibility. (18)

4. Conclusion and future scope

Our comparative research between Isoflurane/Remifentanil and Sevoflurane/Remifentanil came to the conclusion that both combinations effectively achieved controlled hypotension. While Sevoflurane/Remifentanil showed an earlier onset of decreased heart rate and mean arterial blood pressure (MAP) in the first 40 minutes, while the two protocols met the primary objective of decreasing blood loss by creating a dry operative field for improved surgical visibility in rhinoplasty.

Recommendation

1. **Preference for Sevoflurane:** The study indicates that sevoflurane resulted in shorter operation times and reduced bleeding compared to isoflurane combined with remifentanil.
2. **Optimal Combination for Rhinoplasty:** In cases of rhinoplasty, the combination of sevoflurane with remifentanil appears to offer a favourable profile in terms of surgical efficiency and blood control.

3. **Clinical Efficiency:** Clinicians and anaesthesiologists should be aware of the clinical efficiency associated with the use of sevoflurane in combination with remifentanil.
4. **Patient-Specific Considerations:** While the study indicates overall advantages of sevoflurane, it's important to consider individual patient factors. This study also calls for further training and familiarization, research and study conduction and collaborative decision making.

Reference

[1] Freeman, B. & Berger, J., 2016. Anesthesiology core review-part two. 1st ed. Washington, DC: Cenveo® Publisher Services.

[2] El-Azzazi, D., 2011. Spotlights on Anesthesia, Intensive Care & Pain Therapy. 2nd ed. Cairo, Egypt: 17B EL-Obour Building, Salah Salem Street, 11371.

[3] Chang, H.S., Hongo, K. & Nakagawa, H., 2000. Adverse effects of limited hypotensive anesthesia on the outcome of patients with subarachnoid hemorrhage. Journal of Neurosurgery, 92, pp.971.

[4] Dodds, C., 2003. Hypotensive anaesthesia. In: Aitkenhead, A.R., Rowbotham, D.J. & Smith, G. (eds.) Textbook of Anaesthesia. 4th ed. Churchill Livingstone, pp.682-687.

[5] -Salama, H., 2014. Remifentanil/propofol total intravenous anesthesia versus remifentanil/isoflurane inhalation anesthesia for controlled hypotension in lumbar spine fixation surgery. Ain-Shams Journal of Anaesthesiology [Internet], 7(2), pp.134. Available at: [URL] [Accessed 26 August 2024].

[6] Lessard, M.R., Trepanier, C.A., Baribault, J.P., Brochu, J.G., Brousseau, C.A., Cote, J.J. et al., 1989. Isoflurane-induced hypotension in orthognathic surgery. Anesthesia & Analgesia, 69(3), pp.379–383.

[7] -Of, C., Blood, I., During, L., Surgery, S., Either, U., To, A. et al., 2017. Comparison of intraoperative blood loss during spinal surgery using either isoflurane, sevoflurane and combination propofol + remifentanil as AN. Journal Name, 6(3), pp.44–57. [URL]

[8] Aydin, G.B., Özlü, O., Alacakir, H. & Aksoy, M., 2008. Controlled hypotension: Remifentanil or esmolol during tympanoplasty. Mediterranean Journal of Otolaryngology, 4(2), pp.125–131

[9] Kurt, F., Derbent, A., Demirag, K., Eris, O., Uyar, M. & Islekel, S., 2005. Old method, new drugs: comparison of the efficacy of sevoflurane, isoflurane, and desflurane in achieving controlled hypotension in nasal surgery. Advances in Therapy, 22(3), pp.234–240.

[10] Dutton, R.P., 2004. Controlled hypotension for rhinoplasty surgery. European Journal of Anaesthesiology, 13(Suppl. 1), pp.66–71.

[11] Degoute, C., 2007. A guide to drug choice. Drugs, 67(7), pp.1053–1076.

[12] Testa, L.D. & Tobias, J.D., 1995. Pharmacologic drugs for controlled hypotension. Journal of Clinical Anesthesia, 7(4), pp.326–337

[13] Dongre, H., Sharma, V., Premendran, B., Dongre, A. & Tidke, S., 2008. The efficacy of esmolol and nitroglycerine in creating a dry operative field by producing controlled hypotension in nasal surgeries. Journal Name, 2(4), pp.26–33.

[14] Groot, H.W. et al., 2009. Comparison of sevoflurane and isoflurane anesthesia for minimally invasive surgery. Anesthesia & Analgesia, 109(4), pp.1132–1137

[15] Liu, C. et al., 2011. Intraoperative blood loss and surgical field visibility with sevoflurane versus isoflurane anesthesia: a meta-analysis. Journal of Clinical Anesthesia, 23(6), pp.477–483.

[16] -Evers, A.S. et al., 2008. Hemodynamic effects of sevoflurane versus isoflurane in adults. Anesthesiology, 108(6), pp.965–975

[17] Kain, Z.N. et al., 2003. Comparison of sevoflurane and isoflurane anesthesia for pediatric outpatient surgery. Anesthesiology, 98(6), pp.1350–1355

[18] Veyckemans, F. et al., 2007. The role of remifentanil in anesthesia: a review of its efficacy and safety. British Journal of Anaesthesia, 98(4), pp.452–462.