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Research Article

Comparing RAMPED Position Versus Supine Position for Functional Endoscopic Sinus Surgery (FESS); A Single-Blind, Randomized, Prospective Study

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Abstract

Background and Aim: Functional endoscopic sinus surgery (FESS) is a procedure for surgical treatment for patients with chronic sinusitis and chronic polypus rhinosinusitis. Both the bloodless surgical field and surgical field clarity are required during the procedure. We aimed to study whether the RAMPED positioning could reduce blood loss and improve surgical field clarity during FESS.

Methods: A number of 50 patients with chronic rhinosinusitis (CRS) with and without nasal polyposis of American Society of Anaesthesiologists (ASA) grade I/II, scheduled for FESS were included in the study. They were blindly selected and randomized into two groups, 25 in each, SG (Supine Group) and RG (RAMPED Group). The total blood loss, intraoperative haemodynamic stability, surgical field clarity, consumption of sevoflurane and remifentanil, and total surgical time were assessed and compared between the two groups. Fischer test and student t. test were used to analyze the demographic and continuous variables respectively.

Results: The estimated blood loss in RG was 256.4 ± 96.8 ml as compared to to314.7 ± 107.3 ml in SG (P-value 0.0493). Better Fromme-Boezaart scoring system (FBS) for the surgical field was recorded in RG as compared to SG (1.67 ± 0.52 in RG versus 2.46 ± 0.73 in SG) (P value ≤ 0.000).

Conclusion: Our study concluded that the use of RAMPED position during FESS is associated with improvement in the surgical field, a decrease in blood loss and short operative time compared to the supine position.

Keywords: *Functional Endoscopic Sinus Surgery; FESS; Supine; RAMPED; Rhinosinusitis; Sinusitis*

Introduction

Functional endoscopic sinus surgery (FESS) is the surgical procedure that has been used as a treatment of choice for nasal polyposis and chronic rhinosinusitis that is not responsive to aggressive medical treatment. Study by Damm., *et al.* has shown improvement in the quality of life in 85% of patients with a mean follow up time of 31.7 years [1]. The term of FESS was firstly used by Kenedy., *et al.* in 1985 [2]. Due to the narrow surgical field and high vascularity of sinonasal mucosa, a small amount of bleeding could impair the surgical field and affect the success of the surgery outcome during FESS procedure [3]. Different techniques have been used to control blood loss and improve surgical fields such as preoperative corticosteroids, intraoperative local vasoconstrictive infiltrates, hypotensive anaesthetic technique, and reverse Trendelenburg positioning (RTP). Some surgeons believe that the supine position during FESS permits steady orientation of sinus anatomy and skull base [4,5].

The RAMPED position has been used to facilitate endotracheal intubation in morbidly obese patients. It can be achieved by either placing a stack of blankets or specially designed pillows under the patients' head and shoulders, blanket method, or by elevation of the upper portion of operating table, table-ramp method. By this position, the patient's external auditory meatus and the sternal notch will be in the same horizontal plane [6,7]. We hypothesized that RAMPED positioning could reduce blood loss and improve surgical field clarity during FESS. The secondary objectives were the total blood loss, intraoperative heart rate (HR) and mean arterial blood pressure (MAP), consumption of sevoflurane and remifentanil, and the total surgical time.

Materials and Methods

This prospective, randomized, single blind, comparative study was conducted during the period from April 2019 to February 2020. Ethical approval was obtained from the Hospital Ethical Committee. Informed written consent was obtained from all the patients participated in the study. A total of 50 patients with CRS with and without nasal polyposis, aged 18 - 60 years with American Society of Anesthesiologists (ASA) classification of Grade I/II, presented for primary FESS procedure were included in the study. Exclusion criteria included patients with a history of coagulation disorders, severe or uncontrolled cases of hypertension and cardiovascular disease, patients undergoing sino-nasal tumor resection, or patient unwilling to participate in the study.

All patients were informed about the study and written consent was taken. Preoperative evaluation, including medical history and physical examination was performed as usual. The Lund-Mackay (LM) staging system was used to review the Computer tomography (CT) imaging in axial, coronal, and sagittal planes. All patients were premedicated with ondansetron 4 mg and dexamethasone 8 mg intravenously. All patients received intravenous midazolam, at a dosage of 0.5 - 2.0 mg before shifting to the operating room. The surgical procedures were performed by the same surgeon using FESS instruments and microdebrider without using of any blood stopper such as topical or infiltrate vasoconstrictors or haemostatic substances to the surgical site during operation.

Patients were randomly selected and assigned to 1 of the 2 groups, 25 patients in each (SG and RG) using a computer-generated randomization program. The results of the randomization were kept in a sealed opaque envelope in the operating room and a designated anaesthesia nurse picked randomly per patient in holding area. Supine group (SG) consisted of the patients who were operated in conventional supine position while RAMPED group (RG) consisted of those patients whom were operated in RAMPED position.

Following connection to standard ASA monitoring, anaesthesia was induced in all patients with bolus dose of remifentanil, propofol 1.5 - 2 mg/kg, and rocuronium 0.6 mg/kg. Endotracheal reinforce tube was used to secure patients airway. After leaving of the surgeon outside the operation room the SG were kept in supine position, while RG patients were positioned in RAMPED position using table-ramp method. In this position, the upper portion or the upper 1/4 of the table was elevated by 15-degree. The rest of the table was in the complete flat position. So, only the upper shoulder, neck, and head of the patient were elevated. Then, the patients were completely draped and covered with anaesthesia staff, surgeon assistant, and scrub nurse to make it blind from assigned surgeon. Anaesthesia was maintained with inhalational sevoflurane and intravenous infusion of remifentanil.

The surgical field clarity (based on surgical view, frequent suction, and blood loss as per Fromme-Boezaart scoring system (FBS) (Table 1), intraoperative HR and MAP, consumption of sevoflurane and remifentanil, and surgical time all are assessed and recorded. The primary outcome of the study was the improvement in the surgical field clarity and the decrease in blood loss. The secondary objectives were the total blood loss, intraoperative heart rate (HR) and mean arterial blood pressure (MAP), consumption of sevoflurane and remifentanil, and total surgical time.

Boezaart Score	Description
0	No bleeding, virtually bloodless field.
1	Slight bleeding, blood suctioning is not required.
2	Mild bleeding, occasional suctioning without interference of surgical field
3	Moderate bleeding, suctioning is usually used; bleeding threatens surgical field but improves after suction.
4	Heavy bleeding, suctioning is frequently used; bleeding threatens surgical field directly after suction is removed.
5	Severe bleeding, bleeding appears faster than suctioning and is uncontrollable.

Table 1: *Fromme-Boezaart score.*

For data entry and analysis, the Statistical Package for Social Sciences 21.0 (IBM, Armonk, New York, USA) was used. For the purpose of sample size calculation, the FBS was used as the primary outcome of this study. To achieve a 2-sided type 1 error of 0.05% with a power of 80%, a total number of 50 patients, 25 in each group, would be enough. A number of 56 patients were enrolled in the study and due to exclusion of 3 patients each group, 50 patients were included in the study, 25 patients in each group (Figure 1). Considering the anatomy and vascularity of paranasal sinuses, a grade 3 of FBS is expected during the FESS procedure. For significant changes in the clarity of FBS, a 20% change in the score, or 1 point, was required. The categorical data are presented as a number and ratio and were subjected to Fisher's exact or Chi-square test for analysis. The continuous data are presented as mean and standard deviation and were subjected to student t. test. The statistical significance was considered at $p \leq 0.05$.

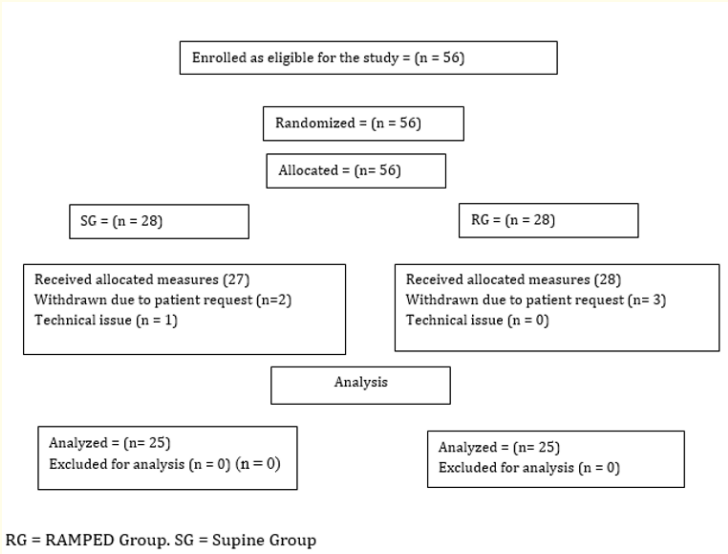

Figure 1: *Diagram for sample size of the study*

Results

A total number of 50 ASA physical status I or II patients, scheduled for FESS were enrolled in the study and randomly allocated into either SG or RG. The age, gender, body weight, ASA class, preoperative CT score and total surgical time (minute) were compared between

the two groups (Table 2). The surgical time in RG was 118 ± 16 compared to130 ± 20 in SG with significant statistical difference (P value 0.0233).

	SG (n = 25)	RG (n = 25)	P value
Age (Year)	31 ± 14.3	33 ± 13.7	0.6159
Sex Male: Female	14:11	16:9	0.7733
Weight (Kg)	64.4 ± 4.5	66.2 ± 5.5	0.2115
ASA I: ll	13:12	11:14	0.7775
CT scan (LM score)	11.32 ± 6.78	12.08 ± 7.31	0.7600
Surgical time (minute)	130 ± 20	118 ± 16	0.0233

Table 2: *The demographic data of two groups.*
CT: Computer Tomography; Kg: Kilogram; LM: Lund-Mackay Score; RG: RAMPED Group; SG: Supine Group.

The estimated blood loss (ml) in RG was lesser than SG (256.4 ± 96.8 ml vs 314.7 ± 107.3), with statistically significant difference (P value 0.0493). No statistical differences in intraoperative HR and MAP as well as the consumption of sevoflurane and remifentanil (Table 3).

Characters	SG (n = 25)	RG (n = 25)	P value
Intra-operative HR and MAP			
HR (beat/min)	62 ± 5.5	61 ± 4.7	0.4928
MAP (mmHg)	61 ± 7.3	63 ± 5.2	0.2701
Estimated total blood loss (ml)	314.7 ± 107.3	256.4 ± 96.8	0.0493
Surgical field (FBS)	2.46 ± 0.73	1.67 ± 0.52	0.0001
Consumption of Sevoflurane and Remifentanil			
Sevoflurane Consumption (Vol.%)	1.4+0.34	1.4 ± 0.21	1.0000
Remifentanil Consumption (mcg/kg)	10.1 ± 3.3	10.29 ± 4.5	0.8655

Table 3: *Intraoperative heart rate and blood pressure, estimated blood loss, clarity of surgical field, and consumption of sevoflurane and remifentanil.*
HR: Heart Rate; FBS: Fromme-Boezaart Score; MAP: Mean Arterial Blood Pressure; mcg: microgram; RG: RAMPED Group; SG: Supine Group.

The surgical field clarity based on bleeding and visibility was assessed by the surgeon using the FBS. Better surgical field was scored in RG as compared to SG (1.67 ± 0.52 in RG vs 2.46 ± 0.73 in SG with statistically significant difference (P value 0.000) (Table 3).

Discussion

FESS is the surgical procedure that has been used as a treatment of choice for nasal polyposis and chronic rhino-sinusitis that is not responsive to aggressive medical treatment. The term of FESS was firstly used by Kenedy., *et al*. in 1985 [1-3]. Due to the narrow surgical field and high vascularity of sinonasal mucosa, small amount of bleeding could impair the surgical field and affect the success and outcome of the procedure [4,5,8-10]. Different techniques have been used to control blood loss and improve surgical field such as, preoperative corticosteroids, intraoperative local vasoconstrictive infiltrates, deliberate hypotensive anaesthetic technique and RTP. Anaesthesia techniques and regimen were studied and, in some of them, undesirable adverse effects were noticed, especially in patients with cardiac diseases [11-23].

Simple and safe techniques have been tried to achieve optimum condition. Positioning of the patients in RTP was studied in different angles [24-26]. The RAMPED position has been used to facilitate endotracheal intubation in morbidly obese patient. It can be achieved by either placing a stack of blankets or specially designed pillows under the patients' head and shoulders, blanket method, or by elevation of the upper portion of operating table, table-ramp method. By this position the patient's external auditory meatus and sternal notch will be in the same horizontal plane [6,7].

In our study a total number of 50 ASA physical status I or II patients, scheduled for FESS were enrolled in the study and randomly allocated into either SG or RG. The age, gender, body weight, ASA class, preoperative CT score and total surgical time were compared between the two groups with no statistical differences. The surgical time in RG was 118+16 compared to 130+20 in SG with significant statistical difference (P value 0.0233). Our result is different from Ko MT., *et al*. and Hathorn., *et al*. when they compared 10-degree and 15-degree of RTP to supine position, respectively [24,25].

In our study the estimated total blood loss was found to be significantly lesser in RAMPED position compared to supine position (P value 0.0493). This is supported by previous studies compared the RTP to supine position [24,25]. Also, our finding is similar to Gan EC., *et al*. during their study of 3 levels of RTP; 5-degree, 10-degree, and 20-degree RTP. They found that the 20-degree RTP was associated with the less blood loss [26]. MAP plays a major role in bleeding during FESS operation. It is determined by the systemic vascular resistance, cardiac output, and central venous pressure. The anesthetic and pharmacological techniques may produce a decrease in MAP resulting in serious adverse events [11-23]. The reduction in MAP that occur during RTP compared to supine position was found to be not significant. The reduction could be most likely due to the decrease in venous return. Also, the reduction of the arterial blood flow may play a role [24,25]. To avoid adverse complications of RTP during FESS procedure such as the decrease in cerebral perfusion in prolonged cases, and venous air embolism, which is a recognized complication of FESS for a tumor resection in head up position. RTP of more than 15-degree is not recommended. No statistical differences in intraoperative HR and MAP.

RTP position causes a decrease in the cardiac output as a result of pooling of the blood in lowered extremities and a decrease in venous return. Compensation occurred slight rise of HR [27]. It was found that the elevation of the head up by 20-degree decrease the nasal blood flow by 38,3% on doppler blood flowmetry [28]. This phenomenon also had confirmed that the major cause of blood loss is venous ooze but not arterial bleeding.

Different scoring systems were used for surgical field clarity and blood loss. However, most of the researchers preferred the FBS. It was firstly prescribed by Fromme., *et al*. during their study entitled; controlled hypotension for orthognathic surgery. Later on, the score was adopted by Boezaart., *et al*. and it based on bleeding and visibility of surgical field [11,29]. Our study revealed that the surgical field clarity based on FBS was better in RAMPED position compared to supine group with highly significant statistical difference (P 0.0001). This finding supports the previous studies conducted by MT., *et al*, Hathorn., *et al.* and Gan EC., *et al* [22-24]. During our assessment of sevoflurane and remifentanil consumption between the two groups, there was no significant difference was recorded.

Limitation of the Study

The limitations of this study include the lack of blinding of the anesthesia staff and cross analysis of surgical field clarity and blood loss between the polyps and non-polyps' patients. Also, our study lacks the comparing between RAMPED position and RTP position.

Conclusion

Multiple pre- and intraoperative methods can be combined to optimize the surgical field of view in FESS. RAMPED position in FESS procedure reduces the blood loss, improves surgical field clarity, and shortens the duration of operation. Also, it is a safe, simple, and costless method. Despite that, an excellent communication throughout the procedure between anesthesia and surgical teams is the key of achieving the best and safest surgical conditions and individualization of each patient should be started from preoperative plan.

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