

# Effect of Warm Saline on Bleeding During Sinus and Septum Surgery

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## ABSTRACT

**Objective:** To assess the effect of warm saline on bleeding and surgical field visibility during endoscopic sinus surgery and septorhinoplasty.

**Methods:** The study included 100 patients, of both males and females, aged 28-58 years, classed I and II by the American Society of Anesthesiologists (ASA), and assigned for elective functional endoscopic sinus surgery and septorhinoplasty under general endotracheal induced hypotensive anesthesia, at King Hussein Hospital, King Hussein Medical City (KHMC), Amman, Jordan, during the period Jan.2014-Feb.2015. Patients were assigned using sealed envelopes into two groups: group I (n=50): patients received warm saline of up to 48 Degree Celsius (DC) during surgery for packing and irrigation and group II (n=50): patients received room temperature normal saline of up to 20 DC, with the use of vasoconstrictors (in functional endoscopic sinus surgery and septorhinoplasty) and microdebriders (only in functional endoscopic sinus surgery).

**Results:** Blood loss was 201.43ml in group I, while room temperature normal saline administration (group II) was correlated with 257.34 ml of blood loss ( $P < 0.05$ ).

**Conclusion:** The administration of topical warm saline of up to 50 DC attained a significant decrease in blood loss and duration of surgery. It enhanced the surgical site visibility and increased the surgical satisfaction during functional endoscopic sinus surgery and septorhinoplasty.

**Keywords:** Bleeding, Saline: regular, warm. Surgery: septum, sinus.

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## Introduction

Functional endoscopic sinus surgery is commonly performed in the management of chronic rhinosinusitis.<sup>(1)</sup> Bleeding is a frequent unavoidable complication that is induced by disturbed vision of injured blood vessels.<sup>(2)</sup> The endoscopically magnified surgical site in Functional Endoscopic Sinus

Surgery (FESS) transforms a little drop of blood into a lake of blood.

Bleeding during functional endoscopic sinus surgery and septorhinoplasty may disturb the surgeon vision and the surgeon will handle suction commonly increasing the risk of more operative site manipulation, more bleeding and prolonged surgery duration. It also increases the risk of potential insults of the

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blood vessels of the eye and intracranial hazards.<sup>(3)</sup>

The most important cause of bleeding during FESS is the capillaries, so mean arterial blood pressure may affect the intensity of bleeding.<sup>(4)</sup> To decrease bleeding during FESS and septorhinoplasty and to enhance vision, surgeons use methods such as hypotensive anesthesia, raising the head of the bed during surgery and local vasoconstrictors.<sup>(5)</sup>

Warm water irrigation is a potent technique of managing intense, life-threatening epistaxis.<sup>(6)</sup>

Warm water irrigation using temperature of up to 50 DC, causes vasodilatation and edema of the nasal mucosa avoiding the risk of necrosis.<sup>(7)</sup> This mucosal edema produces local pressure on the injured vessels, initiating and speeding the clotting mechanism.<sup>(8)</sup>

Vasodilatation may reduce the flow and the intraluminal blood pressure. Warm water irrigation permits the cleaning of the endoscopic lens from vapor and dirt.<sup>(9)</sup> Irrigation with warm saline during operation may enhance operative site of visibility by a hemostatic action.

The objective of our investigation was to assess the effect of topical warm saline on bleeding and operative field characteristics during FESS and septorhinoplasty.

## Methods

The study included 100 patients, aged 28-58 years, of both males and females, classed I and II by the American Society of Anesthesiologists (ASA) and scheduled for elective functional endoscopic sinus surgery for chronic rhinosinusitis and septorhinoplasty at King Hussein Hospital, KHMC, Amman, Jordan, during the period from Jan.2014 to Feb.2015, after obtaining written informed consent from all patients and approval from the Royal medical services ethical and research committee. Table I. Patients with past performed FESS or septorhinoplasty, benign or malignant nasal tumors, any bleeding diathesis, severe anemia or hypertension were excluded from this investigation.

Patients were divided randomly using sealed envelopes into two groups. Group I (n=50),

patients received warm saline which was prepared by putting sterile normal saline (9%) into a container which was placed in a medical warmer with a temperature up to 48 DC. The warm saline was administered for packing and irrigation intraoperatively. Group II (n=50), patients received normal saline at room temperature (20 DC) for packing and irrigation intraoperatively. The irrigation was administered 20 ml every 10 minutes, for the entire duration of surgery. Vasoconstrictors (10 ml of adrenaline diluted solution of 1/100.000 during 10 minutes interval) were used in functional endoscopic sinus surgery and septorhinoplasty but microdebriders were used only in functional endoscopic sinus surgery.

Anesthesia was induced and maintained with insertion of a suitable size of an endotracheal tube in both procedures. After induction, nasopharyngeal pack with gauze was placed to avoid blood drooling down to the pharynx. Mean arterial blood pressure was kept between 50 and 60 mmHg by administration of nitroglycerine infusion (5-10 mcg/kg/min) with incremental boluses of 5 mg labetalol.

Intraoperatively, blood loss was calculated by counting the blood soaked gauze pieces, multiplying them by the predicted volume of blood they have, and in the same time calculating blood loss in suction bottles and calculating it after subtraction of irrigation fluid. The surgical site was initially suctioned clear of blood and graded by the surgeon using the scale of Boezaart *et al.*<sup>(2)</sup> (Table II). This endoscopic site of visibility grading system was the initial outcome measure. The surgeon used the endoscope intra-and at the end of surgery to discover any fresh bleeding. Any inflamed remnant polyp during FESS was removed and the patient was followed up for any further bleeding. Any spot with bleeding during SRP was cauterized and again followed up for further bleeding. All patients were packed with Merocell for the next 24h. The topical irrigation effect of hemostatic agent (warm saline) during FESS and septorhinoplasty was evaluated in this investigation. Quantitative data was analyzed by ANOVA test and Chi-square test. P-value less than 0.05 was considered significant

## Results

There were no differences between the two groups in terms of patient's demographics. Table I. Gender incidence demonstrated no preponderance between males and females as there were 54 males (54%) and 46 females (46%).

Regarding the Boezaart bleeding grading scale, less bleeding grade score was in group I and more bleeding grade score was in group II. Scores 1 and 2 were more frequent in group I (24% and 56%, respectively) than in group II (0% and 48%, respectively). Scores 3 and 4 were more common in group II (40% and 12%, respectively) than in group I (20% and 0%, respectively). Scores 1,3 and 4 were different significantly ( $P < 0.05$ ) between the groups while scores 2 and 5 were not significantly different ( $P > 0.05$ ) between group I and group II. Fortunately, score 5 was 0% in both groups (Table III).

There were no significant differences between the two groups in terms of the mean arterial blood pressure during surgery which was maintained at mean of  $54 \pm 5$  mmHg (Table IV). Surgical satisfaction regarding the significant decrease in intraoperative bleeding was 88% in group I compared to group II (32%) ( $P < 0.05$ ) (Table V).

The duration of surgical procedure demonstrated significant increase in group II (92.66 min) in comparison to group I (83.34 min) ( $P < 0.05$ ) (Table IV). The volume of blood loss was significantly more in group II (257.34 ml) compared to group I (201.43 ml) ( $P < 0.05$ ) (Table III). We noticed that bleeding during septorhinoplasty was more but not significant than during FESS.

## Discussion

The visibility of the operative site was believed to be the most crucial factor of success during FESS and septorhinoplasty. Many techniques are used to decrease bleeding during sinus surgery and septorhinoplasty to clear the operative site and to decrease the risk of hazards in surgery.<sup>(2,10)</sup> Induced hypotension may

decrease bleeding in patients undergoing nasal surgery.<sup>(2)</sup> Warm water irrigation was initially known for management of epistaxis. The hemostatic mechanism of warm water irrigation is not obvious and may be due to: edema and narrowing of the intranasal lumen with pressure on the injured vessel; reducing the flow and the intraluminal blood pressure caused by mucosal vasodilatation and cleaning of nasal blood coagulates. Warm water irrigation for epistaxis is easy, potent, less painful and less traumatic to the nose than nasal packing; therefore, this method was initiated to decrease intraoperative bleeding. Warm water irrigation with  $40^{\circ}$ – $42^{\circ}$  saline decreases diffuse oozing from sinonasal mucosa and intracranial bleeding from small vessels. Another advantage of warm water irrigation is that it allows the cleaning of the endoscopic lens.<sup>(10)</sup>

Topical warm saline irrigation is an easy and noninvasive method to optimize bleeding fields producing hemostasis. This investigation included a similar population so that a similar anesthetic regimen may be used. In this investigation we used vasoconstrictors in functional endoscopic sinus surgery and septorhinoplasty while microdebriders were used only in FESS. The outcome of the investigation concludes the potency of topical warm saline in achieving a bloodless operative site during FESS and septorhinoplasty. The outcome was not dependent on patient's characteristics or hemodynamic variables as mean arterial blood pressure to avoid bias. All surgical interventions were done by the same surgical and anesthesia team with the same method. Regarding the quality of the operative field, there were significant differences between groups I and II in favor of topical warm saline.

In terms of surgical satisfaction of the visibility of intraoperative operative site with reduction of blood loss, the proportion of satisfied surgeons in group I was 88% and in group II was 32%. This significant difference was similar to another study<sup>(11)</sup> which found

**Table I . Demographics.**

		<b>G I (warm irrigation)</b>	<b>G II (room temperature irrigation)</b>
Number of patients		50	50
Age(year){range(mean +/-SD)}		26-58(42+/-8.2 )	28-56(42+/-8.9 )
Sex (no, %)	M	(26,52%)	(28,56%)
	F	(24,48%)	(22,44%)
ASA (no, %)	I	(27,54%)	(29,58%)
	II	(23,46%)	(21,42%)
Weight(Kg){range(mean+/-SD)}		55-80(67.5+/-15.4 )	50-85(67.5+/-13.9)
Surgical procedure (no, %)	FESS*	(30,60%)	(25,50%)
	SRP**	(20,40%)	(25,50%)
Topical nasal saline temperature (DC)		48 DC	20 DC

\*Functional endoscopic sinus surgery

\*\*Septorhinoplasty

**Table II. Boezaart grading scale operative site bleeding.**

Grades	Assessment
0	No bleeding
1	Slight bleeding, no need for suctioning.
2	Slight bleeding, suctioning is needed sometimes.
3	Slight bleeding, suctioning is needed commonly. Bleeding endangers surgical site seconds after suction is removed.
4	Moderate bleeding, suctioning is needed commonly and bleeding endangers surgical site immediately after suction is removed.
5	Severe bleeding, suctioning is needed all the times, bleeding is faster than can be removed by suction and surgery usually not feasible.

**Table III. Bleeding score profile.**

Bleeding scores	Group I (n ,%)	Group II (n ,%)	P-value
	Warm irrigation	Room temp.irrigation	
1	(12, 24)	(0, 0)	<0.05
2	(28, 56)	(24, 48)	>0.05
3	(10, 20)	(20, 40)	<0.05
4	(0, 0)	(6, 12)	<0.05
5	(0, 0)	(0, 0)	>0.05
Calculated blood loss (ml)	201.43+/-14.7	257.34+/-20.6	<0.05

**Table IV. Surgery profile.**

parameter	Group I(mean+/-SD)	Group II(mean+/-SD)	P-value
	Warm irrigation	Room temp.irrigation	
MABP* (mean+/-SD)	54.02+/-5.11	54.14+/-5.09	>0.05
Duration of surgery(min) ( mean+/-SD)	83.34+/-8.75	92.66+/-9.51	<0.05

\*mean arterial blood pressure.

**Table V. Surgical satisfaction of the significant decrease in intraoperative bleeding.**

Surgical site evaluation	Satisfied (n ,%)	Not satisfied (n,%)
Group I	(44, 88)	(6,12)
Warm irrigation		
Group II	(16, 32)	(34,68)
Room temp.irrigation		
P-value	<0.05	<0.05

that the 50 DC saline irrigation was more potent for hemostasis compared to room temperature (25 DC) saline irrigation.<sup>(7)</sup> The mean duration of surgery was 83.34 min in group I and in group II it was 92.66 min, with a significant difference between the two groups, which was similar to another investigation<sup>(11)</sup> who found that 50 DC warm saline irrigation produces more hemostasis period and decreases surgical duration.

The mean volume of intraoperative measured blood was 201.43 ml in group I and 257.34 ml in group II, with significant differences between groups I and II. Ahmed *et al*, found in his study on FESS patients, that the use of hot saline of up to 50 DC for packing and irrigation without the use of vasoconstrictors or microdebriders was correlated with 216.75 ml of blood loss while the use of normal saline was correlated with 272.66 ml of blood loss.<sup>(8)</sup> Gan *et al*, showed in his investigation on FESS patients that the use of hot saline of up to 49 DC was correlated with blood loss of 1.7 ml/min while the use of normal saline of up to 18 DC was correlated with blood loss of 2.3ml/min.<sup>(12)</sup>

## Conclusion

Bleeding during FESS and septorhinoplasty is a great concern for the surgical team. Warm saline 48 DC irrigation is an easy, cheap, noninvasive, potent and cost-effective technique to optimize bleeding, although it was found that this was most clear when the duration of surgery was longer than 2 hours. It speeds up hemostasis and decreases surgical duration during FESS and septorhinoplasty. More investigations may conclude the adequate time required to attain the hemostatic action after the placement of warm saline and a larger size of patient population to clarify the safety of this agent.

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