"RANDOMISED CLINICAL TRIAL TO ASSESS THE EFFECT OF PRE OPERATIVE TOPICAL TRANEXAMIC ACID ON INTRAOPERATIVE BLEEDING FOR QUALITY OF SURGICAL FIELD DURING FESS IN PATIENTS WITH CHRONIC RHINOSINUSITIS"

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ABSTRACT

Title: Randomised clinical trial to assess the effect of pre operative topical tranexamic acid on intraoperative bleeding for quality of surgical field during fess in patients with chronic rhinosinusitis.

Objective: To assess the effect of pre operative local application of TXA by grading the quality of Surgical Field at 15, 30 , and 45 min after the start of surgery using Boezaart Grading.

Methods: A hospital based one year randomized clinical trial with a sample size of 70 patients. Depending on the group assigned, nasal cavity was packed 10 mins prior to start of surgery with pledgets soaked in Tranexamic acid in intervention group and xylometazoline soaked pledgets in the control group and the operating surgeon was assessed the surgical field at 15/30/45 mins from start of surgery and to assess the effect of local application of TXA on duration of surgery

Results: The mean Boezaart grading of surgical field at 15 min in interventional and control group was found to be 2.43 & 2.51 respectively; at 30 min in interventional and control group was found to be 3.17 & 2.97 respectively and at 45 min in interventional and control group was found to be 3.43 & 3.51 respectively. This indicated a better surgical field score in intervention group, though it was not statistically significant. Between interventional & control group, there is a significant change from 15-30 min & 30-45 mins ($p<0.05$), however, it is not significant when seen between 15-45 min. This is indicative of good control of bleeding throughout the duration of surgery in intervention group as compared to control group.

Conclusion: Topical application of tranexamic acid is effective for haemostasis during surgical procedures with no associated side effects.

Keywords: Topical TXA, FESS, Haemostasis in FESS

LIST OF ABBREVIATIONS

GLOSSARY	ABBREVIATIONS
AAO-HNS	American Academy Of Otolaryngology-Head And Neck Surgery
EPOS	Europian Position Paper On Rhinosinusitis And Nasal Polyps
FESS	Functional Endoscopic Sinus Surgery
ESS	Endoscopic sinus surgery
IV	Intravenous
ARS	Acute Rhinosinusitis
CRS	Chronic Rhinosinusitis
CRSwNP	Chronic Rhinosinusitis with Nasal Polyposis
CRSsNP	Chronic Rhinosinusitis sans Nasal Polyposis
EACA	Epsilon Amino Caproic Acid
TXA	Tranexamic Acid
GABA	Gamma- Aminobutyric Acid
CRASH – 2	Clinical Randomisation Of An Antifibrinolytic In Significant Haemorrhage
ATACAS	Aspirin And Tranexamic Acid For Coronary Artery Surgery
WOMAN	World Maternal Antifibrinolytic Trial
CABG	Coronary Artery Bypass Graft Surgery
TIVA	Total intravenous anaesthesia
CNS	Central nervous system

g	**Grams**
mg	**Miligrams**
kg	**Kilograms**
ml	**Millilitres**
sec	**Seconds**
min	**Minutes**

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INTRODUCTION

Rhinosinusitis broadly covers numerous disease entities under its umbrella such as Acute rhinosinusitis, Chronic rhinosinusitis and Nasal polyposis[1]. Even though it is a very common disease, rhinosinusitis presents various challenges during its management to a otorhinolaryngologist. The prevalence of disease as per various epidemiological studies is 5-12% of the general population affecting the quality of life , productivity and causing a great financial burden in the form of absence from work and multiple medical consultations . Rhinosinusitis can be classified on the basis of symptom duration as well as by the severity of the symptoms. The AAO-HNS classifies rhinosinusitis as acute when the symptoms last less than four weeks , subacute for symptoms lasting 4-12 weeks and chronic for symptoms lasting more than 12 weeks[2] .

Chronic sinusitis differs from recurrent rhinosinusitis which is defined as four or more episodes of ARS within one year with patient showing complete resolution of their symptoms between each episode[2]. Based on severity EPOS uses a 10 point visual analogue scale. Scores are then categorized as 0-3(mild) , 3-7(moderate) and 7-10(severe). A score more than 5 suggests that patient's quality of life is affected due to the disease.

Clinically a patient is diagnosed with chronic rhinosinusitis when he presents with at least two major or one minor symptom in accordance with the criteria given by AAO-HNS[3].

MAJOR CRITERIA	MINOR CRITERIA
Purulence in nasal cavity	Headache
Facial pain, pressure, congestion, fullness	Fever
Nasal obstruction/blockage	Halitosis
Fever(ARS only)	Fatigue
Hyposmia/anosmia	Dental Pain
	Cough
	Ear pain and fullness

Surgical management of CRS for cases refractory to medical treatment is becoming an increasingly popular. With the Nasal endoscope (Hopkins rigid rod system) the access to superior and middle meatii is made easy which permits visual examination of the sinus drainage pathways, posterior nasal cavity and the nasopharynx. Along with endoscopic examination, use of radiological modalities such as CT scanning, the study of the disease has become more accurate.

The nasal cavity has complex anatomy in a very small space. During FESS even a small amount of bleed obstructs view of the surgical field which increases chances of complications like loss of vision, double vision and trauma to branches of carotid artery. Common methods which are used to improve visualization are packing with local vasoconstrictors, hot saline wash and induced hypotension[4] .

Tranexamic acid is now being suggested for haemostasis in case of epistaxis[5.] Interaction between clotting factors, platelets and thrombin activation helps in the formation of a platelet plug which is the stabilized by conversion of fibrinogen to fibrin. Fibrin cross linking helps in achieving haemostasis[6]. Fibrinolysis is a process in which the fibrin cross linking is broken down because of active plasmin, causing clot degradation[7].TXA is lysiene analogue which competitively inhibits interaction between fibrin and plasminogen, thus preventing the clot breakdown. Routes of administering TXA are oral/IV/topical. Oral bioavailability ranges form 30%to 50% and it's renal clearence is more than 95%. Combined use of IV and local application of tranexamic acid during elective FESS has also shown to have a better surgical field score. The intravenous use of Tranexamic acid may lead to increased risk of thromboembolic events. Topical application of Tranexamic acid is found to be much safer and theoretically having minimal side effects. The present study aims to reconfirm the advantages, possible side effects of local application of tranexamic acid.

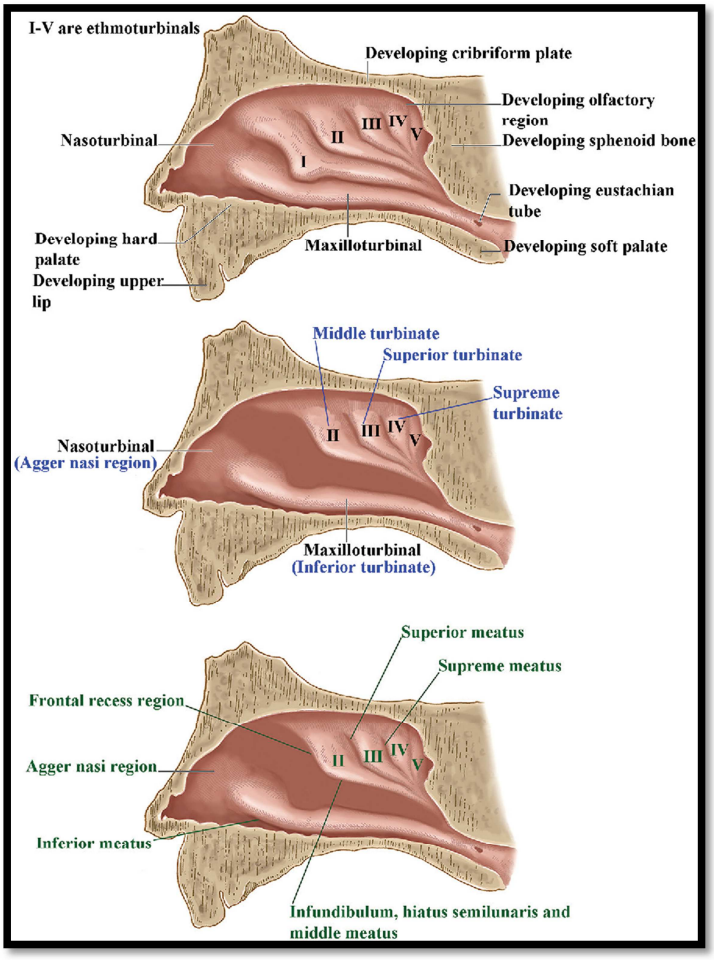
OBJECTIVE

- To assess the effect of pre operative local application of TXA by grading the quality of Surgical Field at 15, 30 , and 45 min after the start of surgery using Boezaart Grading .
- To assess the effect of local application of TXA on duration of surgery

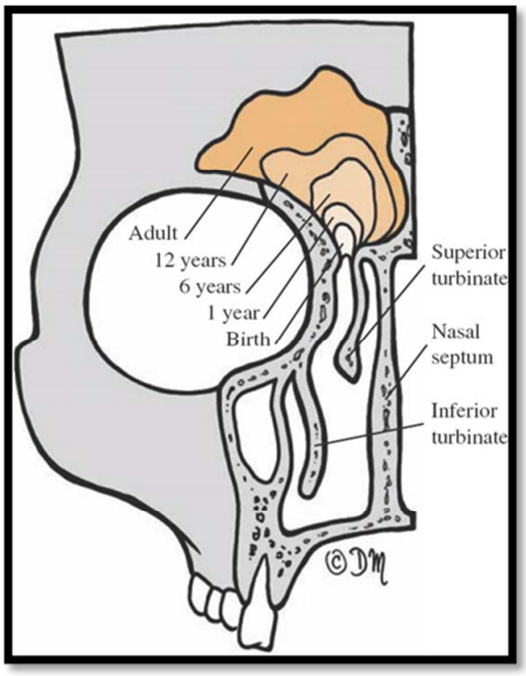
REVIEW OF LITERARURE

ANATOMY OF PARANASAL SINUSES-

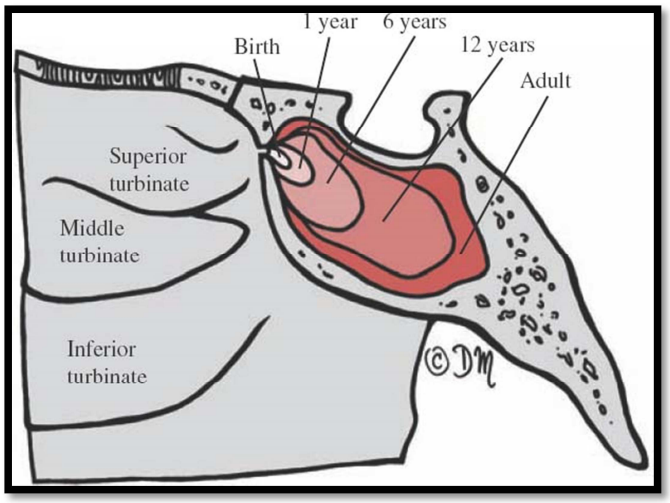
Ethmoturbinals are series of folds which are seen on the lateral wall of nose around eighth week of embryonic life. In the initial stages of development six to seven folds emerge, but only three to four remain as development continues. During this process furrows are seen between the ethmoturbinals which go on to form the maetii and recesses.



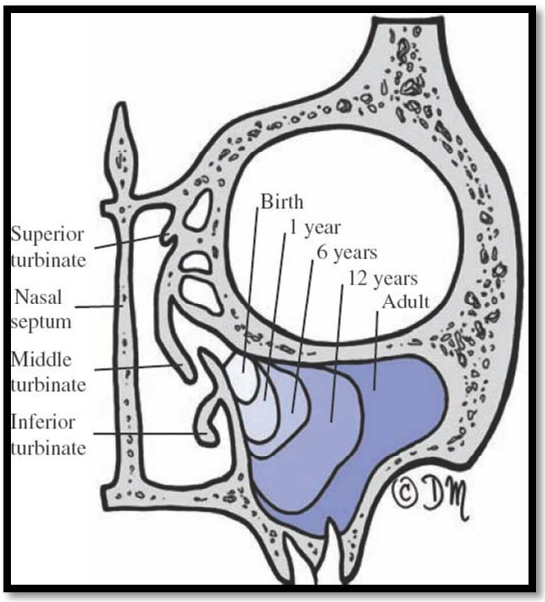
The frontal recess pneumatizes anteriorly into the frontal bone thereby forming frontal sinus. It generally is not seen till five to six years of age.



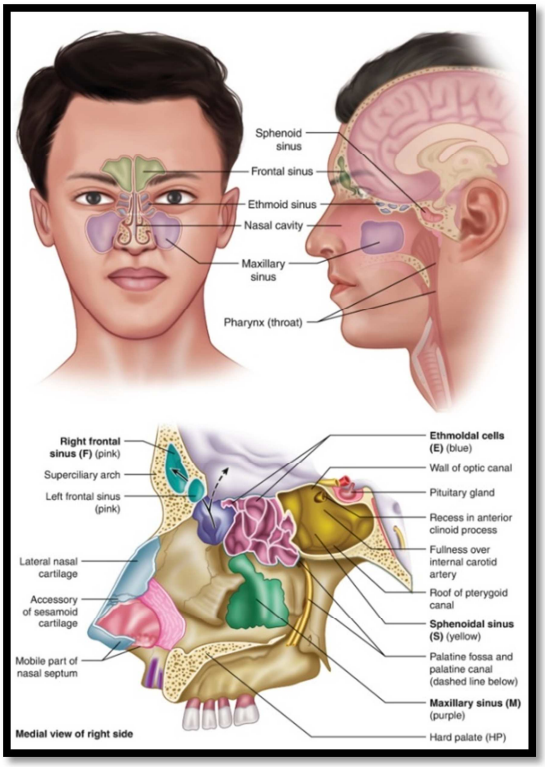
In the third month of gestation, the sphenoid sinus starts to form. It pneumatizes completely by end of sixth/seventh year of life, end point being pneumatization of anterior ethmoid process and pterygoid processes.



In the tenth week of intrauterine life, developing maxillary sinus is first seen. A biphasic pattern of growth is seen in the development of maxillary sinus i.e once at three years and the at seven to eighteen years of age. By adulthood Ethmoid sinuses consist of one to fifteen cells, progressing from three to four cells seen at birth.



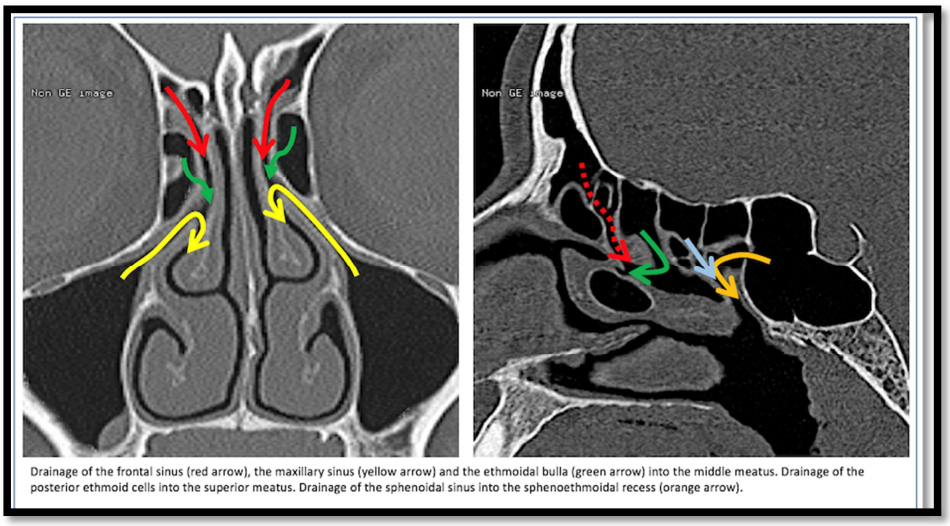
The lining epithelium of paranasal sinuses is formed by pseudostratified ciliated epithelium which combines with mucosa in the nasal cavity. The main functions of paranasal sinuses are to reduce the weight of skull, provide vocal resonance, act as a buffer to facial trauma by providing a cushion of air and protecting the important structures within by maintaining the temperature and humidity of the air which is inspired.



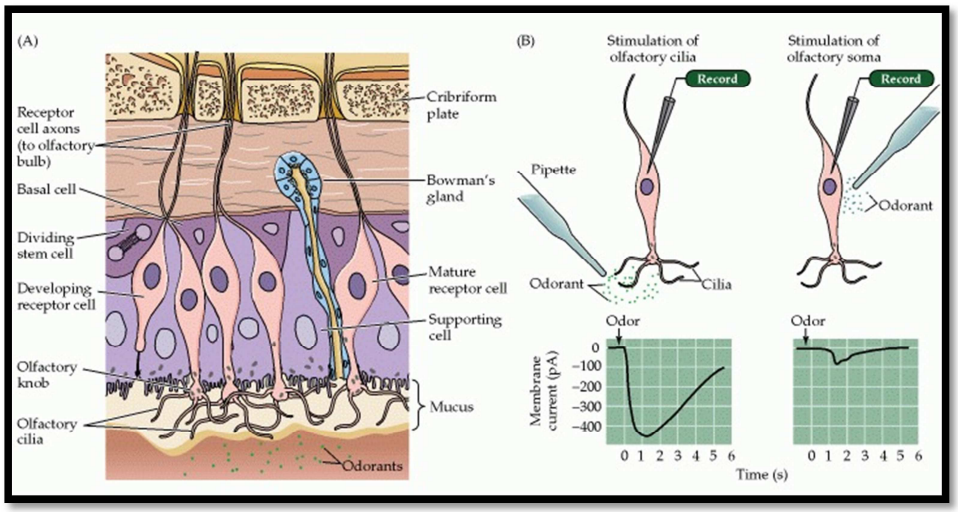
PHYSIOLOGY OF PARANASAL SINUSES-

Lining epithelium of nasal cavity and sinuses is formed by pseudostratified ciliated epithelium. The cilia in the columnar epithelium beat at 1000 times/min in synchronicity with surrounding cells but it's underlying mechanism is not very well understood. During normal function cilia beat in a low viscosity serous periciliary fluid. The depth of this fluid around the cilia is of importance. It should be adequate enough so a to prevent entanglement of these ciliary tips yet not so deep that they propel mucous along drainage tracts into pharynx, where it stimulates swallowing movement. The serous periciliary fluid contain a few scattered islands containing vesico-elastic mucous which generally float on the surface. These floating islands contain contaminants which have been dissolved or entrapped from the air which is inspired.. Cilia are very sensitive, especially to the secretions surrounding them in the nasal cavity. They beat optimally at 35-40 C but the beat frequency varies with the temperature and humidity[8]

The mucous travels across the epithelium at 6-10 cells/sec but the speed of mucociliary transport is site dependent with wide variations. Around 40 ml mucous is secreted in normal resting state every day from 160 cm of the lining mucosa[9]. Mucociliary transport helps in removal of microorganisms and various other noxious materials. It also aids in providing local immunity since the mucous contains macrophages/basophils/mast cells/leucocyte and eosinophils. These cells discourage microbial colonization and help improve local immunity against infection.



The area between the medial surface of superior turbinate, roof and its partially corresponding area on the septum is lined by the olfactory epithelium .The mucous lining nasal cavity and controlling ionic milieu of olfactory cilia is produced by bowman's glands which are distributed throughout epithelium. Basal cells and sustentacular cells are also present in olfactory epithelium which help with abovesaid function. The olfactory epithelium has several million sensory neurons. Odorant binding proteins bind and solubilize hydrophobic molecules, which increases their concentration up to 1000 times to that of ambient air.



The Odorant binding proteins may also remove the odorant molecules after transduction, which occurs after specific interaction between the molecules and receptor proteins on the surface of olfactory cilia. The exact mechanism by which various smells are recognized and determined is not known but possible theories include a specific odorant exciting a specific receptor which are then aggregated/grouped , the differing solubility of odorant allows for a temporo spatial distribution of odorant across olfactory mucosa or a response to molecule's vibration spectra within it's electron tunnel which is formed by receptor and associated G-protein.

The nose and paranasal sinuses also warm and humidify the inspired air. This is achieved by radiation/ conduction/ convection with blood which flows opposite to direction of inspired air. Particles more than 30 micometers are removed because of the contact time between air & mucosa and turbulence in nasal cavity which vary with the rate of inspiration. Vibrissae or the nasal hair are seen in a criss-cross pattern along lateral wall of nasal which help trap larger particles.

MANAGEMENT OF CRS -

CRS is a condition where there is chronic inflammation involving mucosa lining nose and paranasal sinuses presenting clinically with nasal obstruction, discharge from nose, disturbance in olfaction, pressure sensation in the face/ pain in the face and headache. Sine the disease has non specific symptoms, objective evaluation of the patient using endoscope / radiological modalities like CT scanning is done. The disease affects around 10 percent of the population in the western world.

According to current guidelines , the patients with chronic rhinosinusitis are subjected to medical management with surgery reserved for refractory cases, however

due to heterogenicity of the disease and lack of uniform and standardized end points clinically as well as diagnostically , there is a lack of standard selection criteria for surgical intervention. Currently patients refractory to medical management for three is weeks taken as an indication for surgery by consensus. In patients with CRSwNP/CRSsNP and sinusitis due to fungal allergens, FESS is the treatment of choice.

Use of endoscope for surgery of patients with CRS was pioneered by Messerklenger in 1985 which has since then become popular. FESS is based on the theory that removal of the tissue obstructing the maeatii will facilitate ventilation and drainage of sinuses. The regenerated mucosa over the raw surface post surgery lacks good mucociliary function thus removal of tissue should be minimal. The mucosa lining the nasal cavity has a rich blood supply. The limited space and bleeding due to manipulation of tissues lead to obstructed vision during the surgery which leads to poor surgical outcomes and increases the chance of complications[10,11].

Haemostasis is commonly achieved by local application of a vasoconstrictor. The combination of epinephrine and lidocaine has been used commonly for this purpose. Use of epinephrine is associated with complication like sudden rise in bloop pressure, tachycardia and arrhytmias. Thus it is used in a fixed dosage combination. A dose of 1:200000 has been advocated for achieving the same[12].

Local infiltration of the combination of epinephrine can lead to significant temporary changes in the haemodynamics. It most commonly causes a reduction in blood pressure with increase in heart rate during general anesthesia. This effect can be due to beta 2 receptor agonist activity of epinephrine. Reduction in blood pressure can be very pronounced in some patients, especially in those suffering with cardiac diseases. The plasma level of epinephrine is not dependant and variable on the dose

used for infiltration in the mucosa of nasal cavity[13]. Cardiomyopathy induced due to injection of an acceptable dose of adrenaline in patients with no known cardiac abnormality have also been reported. Anesthesia techniques such as TIVA have shown to be superior to balanced anesthesia and hypotensive anesthesia foe achieving hemostasis during FESS. Other non-invasive techniques such as administering pre operative oral steroids/use of oxymetazoline or xylometazoline/adjusting position of operating table. Drugs like xylometazoline/oxymetazoline are commonly used for reducing congestion in nasal cavity. They belong to category of imidazoline derivatives, which function by stimulating beta 2 receptors which lead to collapse of venous sinusoids in submucosa leading to vasoconstriction. This vasoconstrictive action leads to reduction in congestion and helps in improving access to meatii in nose/ helping in achieving hemostasis. The action of these drugs is of very short duration and transient nature, they also cause systemic rise of blood pressure which may cause diffuse ooze intra operatively. Anti-fibrinolytic are the only available drugs which help in the reduction of bleeding with a reasonable safety profile.

Previously three antifibrinolytic drugs were most commonly used[14]. EACA and TXA are lysine analogues. They bind to plasminogen and inhibit it's interaction with fibrin which prevents degradation of the fibrin clots. Aprotinin belongs to reversible type of serine protease inhibitor class of drugs and it leads to inactivation of free plasmin. Tranexamic acid is considered to be better tolerated & tenfold more potent when compared to EACA[15]. Aprotinin is restricted to usage in cardiac surgery. TXA is known to reduce the need of blood to be transfused as well as the volume of blood lost by thirty to forty percent[16,17]. For fibrinolysis inhibition a minimum tissue concentration of 10 microgram/ml of TXA is needed[18]. A plasma level of 10 microgram/ml can be achieved by administering an IV dose of 10-15 mg/kg body

weight[19]. During cardiac surgeries a higher dose of TXA is administered. In some cases hyperexcitability can be seen. A possible explanation for this complication can be action of lysine analogues such as TXA which also act by means of competitive antagonism to inhibitory neurotransmitter activity on glycine and GABA receptor in the CNS.

Tranexamic acid may be administered topically, intravenous or orally. Oral bioavailability ranges from 30%-50% and renal clearance of tranexamic acid is more than 95%. It's half life in an adult's circulatory system is around 3 hours although it's half life in tissues may be up to 17 hours[20] . Tranexamic acid has found use in various clinical indications but evidence of its usage in some scenarios may be considered ambiguous at best. Following proven benefit and good tolerability of tranexamic acid in bleeding disorders , the impact of tranexamic acid in trauma and a broad range of surgical interventions has to be studied.

CRASH-2 trial was conducted to establish its benefit in trauma patients . According to the trial a total of 20,211 patients were randomized to either receive loading dose of 1gm IV TXA over a duration of 10 minutes, followed by an IV dose of 1gm TXA over 8 hours or a matching placebo[21]. An absolute mortality reduction of about 1.5% and relative risk of about 9% was seen. Death related to bleeding were reduced when TXA was given within 3hrs of initial injury but it's percentage increased if TXA was administered more the 3hrs thereafter. The study population of this trial were patients with a relatively lower severity of injury or penetrating trauma.

In the TAMPITI trial, a higher chance of thromboembolic events was seen as compared to the placebo group. This finding is in agreement to a retrospective study indicating association of TXA with an increased odds of venous thromboembolism. In cases of head injury, no convincing evidence has been found in relation to tranexamic

acid and reduced bleeding. It is also very commonly used during cardiac procedures.

In the ATACAS trial study population comprised of patients planned for CABG(on cardiopulmonary bypass/on pump and off pump). They were randomized into TXA group and placebo group. In TXA group, after the induction of anesthesia an IV dose of 50-100 mg/kg of TXA(high dose) was maintained for 6-8hrs. It revealed a reduction in total volume of blood lost/ need for transfusion of blood or the need for re-exploration without increasing risk of thromboembolic events/death within 30 days of the procedure[22].

Largest trial conducted to study the efficacy and safety of TXA in the prevention as well as treatment of post partum hemorrhage was the WOMAN trial. It's study population included patients undergoing caesarian section and normal vaginal delivery. The trial compared a placebo with an IV loading dose of 1gm TXA in women who were diagnosed with post partum hemorrhage. A second Iv dose of TXA was administered in cases where bleeding was encountered even after 30min or if it stopped and started again within 24hrs of the first dose. Death because of bleeding was reduced significantly in the TXA group when it was administered within 3hrs of giving birth[23,24,26]. This 3 hour window of maximal efficacy is in accordance with the use of tranexamic acid in trauma patients in the CRASH-2 trial[21].

TXA is well tolerated generally, but some adverse effects both of mild and severe intensity are noted. Mild side effects complaints such as hypersensitivity reactions/ allergic skin reactions, gastrointestinal complaints such as vomiting and diarrhea although severe adverse reactions have also been noted. An overly rapid intravenous infusion may lead to hypotension. Trials such as HALT-IT indicated that chances of venous thromboembolic events were about twice as high in the TXA group when compared to placebo[26]. Usage of high dose TXA as in cases of cardiac surgery

with CABG is sometimes associated with seizures, most likely in a dose dependent manner[27,28]. It may also induce toxicity in patients suffering from chronic kidney disease and/or in patients receiving renal transplant.

Topical application of TXA may reduce volume of blood lost comparably to IV prophylactic use with reduced risk of systemic side effects. It can also help prevent re-exploration due to hematoma/clot formation post-operatively. To understand the efficacy of topical TXA, two randomized controlled trials were conducted. The study population included patients undergoing reduction mammoplasty and mastectomy. The method of application was to moisten the surface of wound with TXA in a concentration of 25mg/ml so as to leave a thin film of fluid over the surface. The pockets which are made during the implantation of pacemaker/defibrillator are very similar to those created during plastic surgery. Parsi et al. used undiluted TXA(100mg/ml) and a placebo for irrigation of 100 such pockets each. They found the need for intervention due to hematoma formation in only 2 out of 100 (4%) irrigated with TXA as compared to 12 out of 100 (24%) in case of placebo irrigation. In a study conducted to evaluate the efficacy of tranexamic acid gel for management of epistaxis, an active gel, 15 ml in volume containing 10% TXA was used. In the placebo TXA was replaced by glyceine. The entire nasal cavity of the side with active bleeding was filled with this gel using a pre filled syringe. The filling was stopped when the patient felt sensation of gel running down their throat. The patients were then instructed not to blow it out for 30 minutes. A lower frequency of rebleeding was noted in the patients receiving TXA gel. In another study 10 ml (undiluted, 100mg/dl) was poured in nasopharynx following which it was left for 5 minutes during adenoidectomy after which for a duration of 5 min gradual suctioning of nasopharynx was performed which resulted in reduction of volume of blood lost by 27%.

MATERIALS AND METHODS

STUDY DESIGN: A hospital based randomised clinical trial.

STUDY PERIOD: September 2022 to August 2023

STUDY POPULATION: All patients with diagnosis of Chronic Sinusitis coming to ENT & HNS OPD at Dr. Prabhakar Kore Charitable hospital, Belgaum

SAMPLE SIZE: 70

The minimum sample size formula based on two proportions is

$$n = \frac{(z_\alpha + z_\beta)^2 \bar{p}(1-\bar{p})}{d^2}$$

where p_1 and p_2 are the proportions of the two groups.

$$p = \frac{p_1 + p_2}{2} \text{ and } d = p_1 - p_2$$

z_α is linked with the level of significance and z_β is linked with the power of the test. For 5% level of the significance z_α = 1.96 and z_β = 0.84 for 80% power of the test.

Ref:

The parameter considered in the calculation is the percentage of Patients in grade II, in control and intervention groups while assessing the surgical field quality in 16 – 30 minutes duration

By taking proportion of success, p_1 = 70.0% and p_2 = 26.7% the sample size obtained is 21.

There would be two groups with size of 21. However, for increasing the strength of the study each group would comprise of 35 patients. A total sample size of 70 would be taken

SAMPLING PROCEDURE:

- Patient coming to ENT & HNS OPD at KLE's Prabhakar Kore Hospital and MRC were examined, a detailed history was taken. Nose examination was done using suitable size Thudicum's Nasal Speculum.
- After clinical diagnosis patient was explained about his/her condition and was counselled to undergo FESS.
- Consenting patients were randomised into control and intervention groups.
- The anterior nasal packing in patients of the intervention group was done with TXA soaked pledgets 10 mins before the start of surgery. The procedure was repeated in the control group xylometazoline soaked pledgets.
- The intra operative bleeding was assessed by assessing the quality of surgical field at 15 , 30 and 45 mins from the start of the surgery using the Boezaart Grading.
- The effect of local application of TXA on the duration of surgery will also be assessed by noting the starting time of the surgery and ending time of the surgery.

SAMPLING TECHNIQUE – Randomisation

- A jar containing 6 sheets will be taken 3 each of Control and Intervention group, every patient fulfilling the inclusion criteria will be asked o pick a sheet from the jar and will be assigned to the respective group, The jar will be refilled as soon as all the 6 sheets are picked up

INCLUSION CRITERIA:

- A candidate of FESS (According to the definition given by American Association Of Otorhinolaryngology and Head and Neck Surgery)
- Age 18 -60 years
- Haemoglobin >=10 mg/dl
- PT/INR/ApTT to be within normal limits

EXCLUSION CRITERIA:

- Non Consenting individuals
- Patients of Acute/Chronic Renal Failure
- Patients giving a history of Cardiac Disease(Status post CABG/Stenting ,CHF)
- Patients giving history of any thrombotic event
- Uncontrolled Diabetes/Hypertension

RESULTS

Seventy patients with CRS were operated upon at department of ENT & HNS of KAHER's Jawaharlal Nehru Medical College between September 2022 to August 2023. The patients were divided into two random groups: Intervention (Tranexamic Acid soaked pledgets) and Control (Xylometazoline soaked pledgets). The nasal cavities of the patients were packed with either of the two groups as a part of pre op prep for the patients 10 mins prior to the surgery. All the intra operative observations with regard to bleeding and time taken for completion of surgery are described under the following headings.

AGE DISTRIBUTION

Age of patients included in the study was between 18- 60 years with a mean age of 35.47±11.78 years in the intervention group and 40.00±14.49 years in the control group. The maximum number of patients in the age group of <=30 years in both the interventional as well as the control group, whereas the least number of patients in both the groups was found in the age group of >=51 years. Within the interventional group, patients of age group 31-40 years & 41-50 years had equitable distribution of patients. There was no difference between two groups with respect to age distribution (Table 1, Figure 1)

Table 1: Comparison of Intervention group and Control group with age

Age groups	Intervention group	%	Control group	%	Total	%	Chi-square	p-value
<=30yrs	13	37.14	11	31.43	24	34.29	1.2870	0.7320
31-40yrs	9	25.71	7	20.00	16	22.86		
41-50yrs	9	25.71	10	28.57	19	27.14		
>=51yrs	4	11.43	7	20.00	11	15.71		
Mean	35.47		40.00		37.80			
SD	11.78		14.49		13.35			
Total	35	100.00	35	100.00	70	100.00		

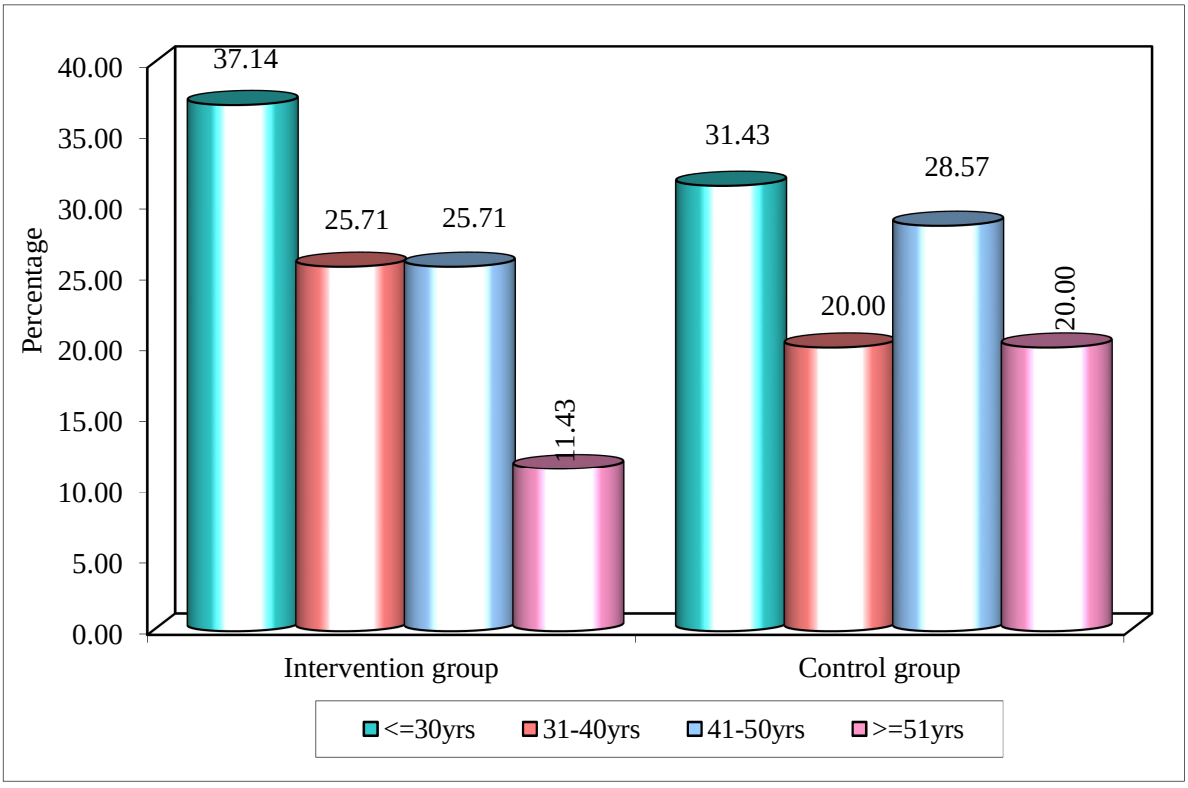


Figure 1: Comparison of Intervention group and Control group with age

GENDER DISTRIBUTION

Maximum numbers of subjects in both the groups were males, accounting for 68.57% (24) in the interventional group and 71.43% (25) in the control group. However, there were only 31.43% (11) in the interventional group and 28.57% (10) in the control group. On analysis there was no significant difference between two groups with respect to gender distribution (Table 2, Figure 2)

Table 2: Comparison of Intervention group and Control group with gender

Gender	Intervention group	%	Control group	%	Total	%	Chi-square	p-value
Male	24	68.57	25	71.43	49	70.00	0.0680	0.7940
Female	11	31.43	10	28.57	21	30.00		
Total	35	100.00	35	100.00	70	100.00		

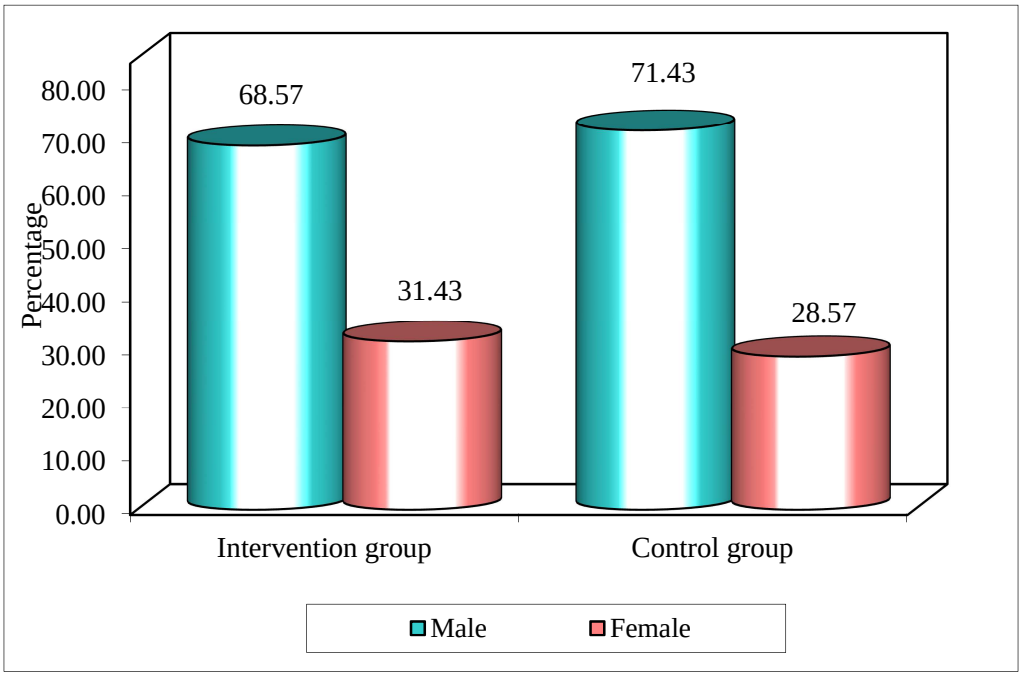


Figure 2: Comparison of Intervention group and Control group with gender

COMPARISON WITH RESPECT TO DIAGNOSIS

The patients diagnosed with CRS(CRSsNP or CRSwNP) were included in the study and were randomised into Control and Intervention group . The intervention group comprised of 40% patients with CRSsNP and 60% patients with CRSwNP as compared to control group which comprised of 45.71% patients with CRSsNP and 54.29% patients with CRSwNP (Table 3, Figure 3).

Table 3: Comparison of Intervention group and Control group with diagnosis

Diagnosis	Intervention group	%	Control group	%	Total	%	Chi-square	p-value
CRSsNP	14	40.00	16	45.71	30	42.86	0.2330	0.6290
CRSwNP	21	60.00	19	54.29	40	57.14		
Total	35	100.00	35	100.00	70	100.00		

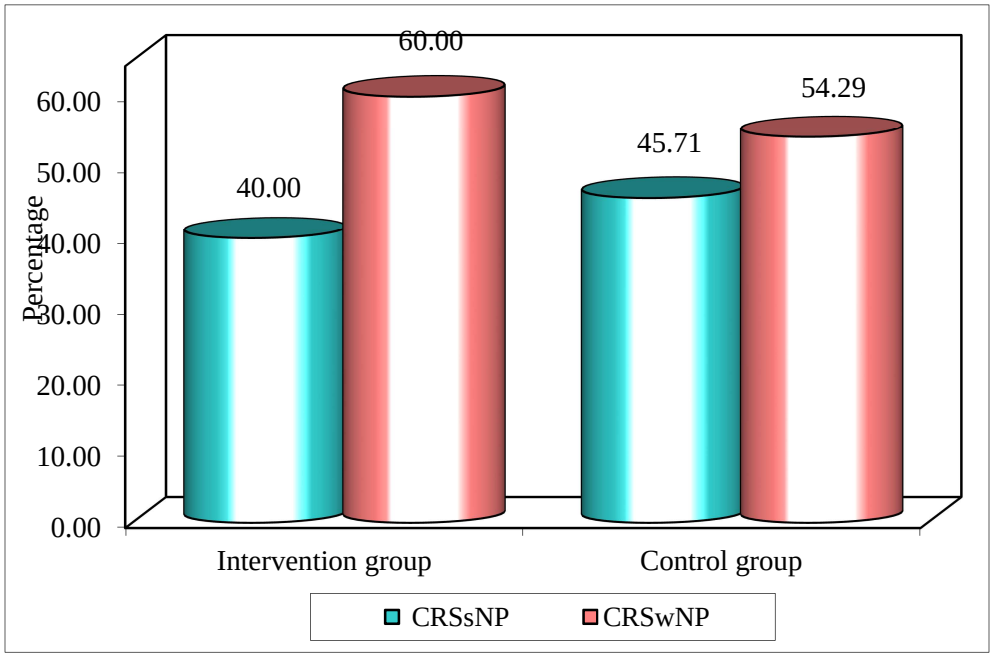


Figure 3: Comparison of Intervention group and Control group with diagnosis

DISTRIBUTION OF DATA

The data was not normally distributed as confirmed by the Shapiro Wilk test (Table 4). Therefore, the non-parametric tests were applied.

Table 4: Normality of Boezaart Grading of Surgical Field at different treatment times in Intervention group and Control group by Shapiro-Wilk test

Treatment	Groups	Shapiro-Wilk	df	Sig.
15 minutes	Intervention group	0.6300	35	0.0001*
	Control group	0.6370	35	0.0001*
30 minutes	Intervention group	0.6850	35	0.0001*
	Control group	0.8110	35	0.0001*
45 minutes	Intervention group	0.6300	35	0.0001*
	Control group	0.7070	35	0.0001*
15Min-30Min	Intervention group	0.6680	35	0.0001*
	Control group	0.6350	35	0.0001*
15Min-45Min	Intervention group	0.5790	35	0.0001*
	Control group	0.6590	35	0.0001*
30Min-45Min	Intervention group	0.5460	35	0.0001*
	Control group	0.6350	35	0.0001*
Time in minutes	Intervention group	0.8460	35	0.0001*
	Control group	0.8530	35	0.0001*

*$p<0.05$

GRADING OF SURGICAL FIELD

The mean Boezaart grading of surgical field at 15 min in interventional and control group was found to be 2.43 & 2.51 respectively.

The mean Boezaart grading of surgical field at 30 min in interventional and control group was found to be 3.17 & 2.97 respectively.

The mean Boezaart grading of surgical field at 45 min in interventional and control group was found to be 3.43 & 3.51 respectively.

Between the interventional & control group, there is a significant change from 15-30 min & 30-45 min ($p<0.05$), however, it is not significant when seen between 15-45 min.

The grading of surgical field is better in interventional group as compared with control group for entire duration of surgery, if not better at individual time points irrespective of diagnosis (Table 5 , Figure 4).

Table 5: Comparison of Intervention group and Control group with Boezaart Grading of Surgical Field at different treatment times by Mann-Whitney U test

Times	Intervention group			Control group			U-value	Z-value	P-value
	Mean	Median	Mean rank	Mean	Median	Mean rank			
15 minutes	2.43	2.00	34.00	2.51	3.00	37.00	560.00	-0.6108	0.5413
30 minutes	3.17	3.00	38.11	2.97	3.00	32.89	521.00	1.0689	0.2851
45 minutes	3.43	3.00	34.29	3.51	3.00	36.71	570.00	-0.4933	0.6218
15Min-30Min	0.74	1.00	40.23	0.46	0.00	30.77	447.00	1.9681	0.0500*
15Min-45Min	1.00	1.00	35.50	1.00	1.00	35.50	612.50	-0.0059	0.9953
30Min-45Min	0.26	0.00	30.50	0.54	1.00	40.50	437.50	-2.0497	0.0404*

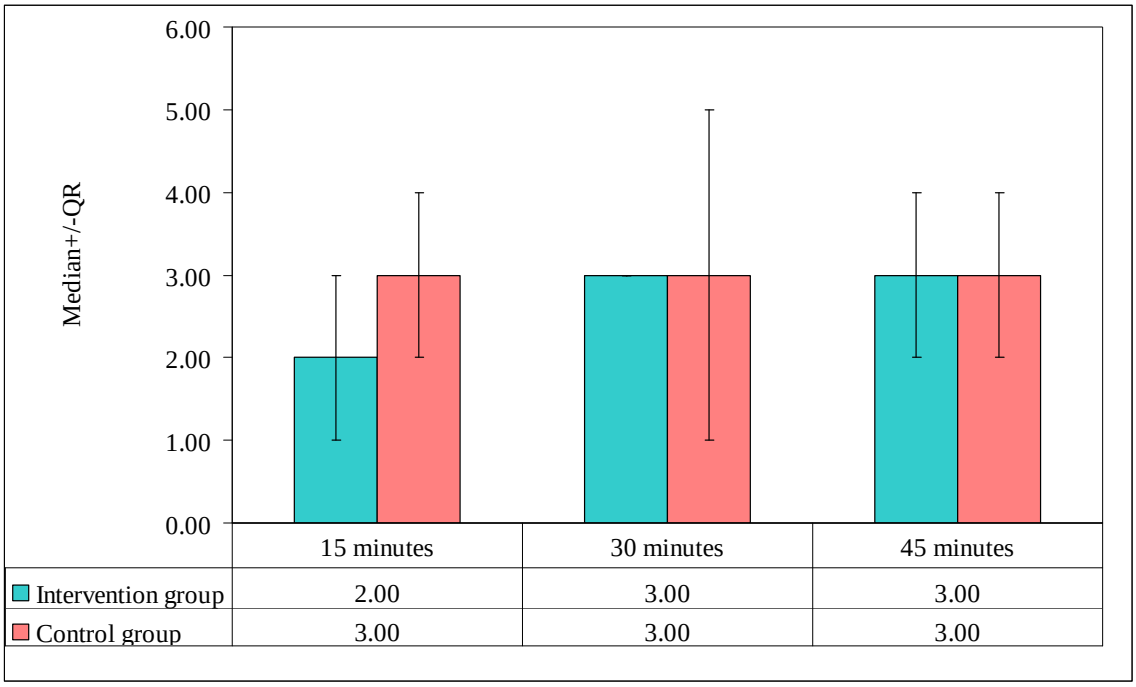


Figure 4: Comparison of Intervention group and Control group with Boezaart Grading of Surgical Field at different treatment times

VARIATION IN SURGICAL FIELD GRADING WITHIN EACH GROUP

Percentage of change within the interventional group between 15- 30, 15-45 min and 30-45 min was found to be -30.59%, 41.18% and 8.11% respectively, which was found to be statistically significant.

Percentage change within the control group between 15- 30, 15-45 min and 30-45 min was found to be 18.18%, 39.77% and 18.27% respectively, which was statistically significant. The increase in the grade was more in the intervention group but not statistically significant (Table 6, Figure 5).

Table 6: Comparison of different treatment times with Boezaart Grading of Surgical Field in Intervention group and Control group by Wilcoxon matched pairs test

Group		% of change	Z-value	p-value	Friedman test	p-value
Intervention group	15Min-30Min	-30.59	4.3724	0.0001*	52.9181	0.0001*
	15Min-45Min	-41.18	4.9365	0.0001*		
	30Min-45Min	-8.11	2.6656	0.0077*		
Control group	15Min-30Min	-18.18	3.5162	0.0004*	48.6391	0.0001*
	15Min-45Min	-39.77	4.8599	0.0001*		
	30Min-45Min	-18.27	3.8230	0.0001*		

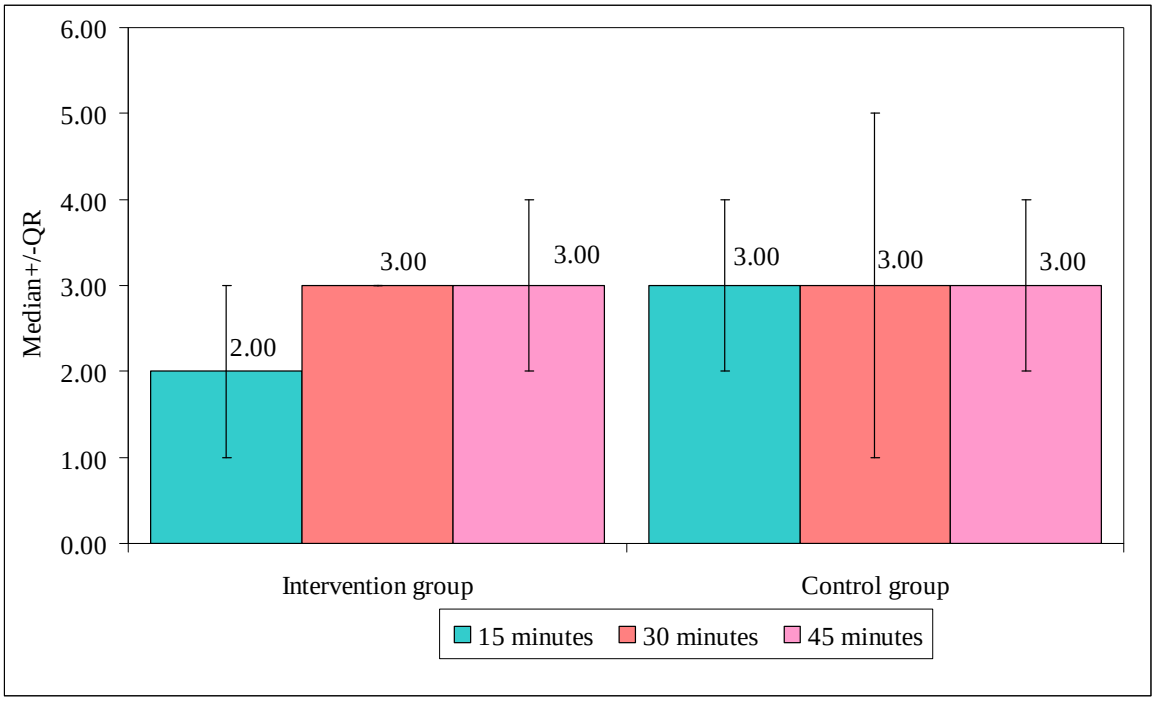


Figure 5: Comparison of different treatment times with Boezaart Grading of Surgical Field in Intervention group and Control group

VARIATION IN DURATION OF SURGERY

The mean surgical/operating time as seen in the intervention group was 98.29 min whereas in control group it was 105.43 min. On analysis it is found that the operating time was lesser in intervention group as compared with control group (Table 7, Figure 6) supporting hypothesis that topical application of TXA helps in reduction of bleeding and thereby reducing total duration of surgery.

Table 7: Comparison of Intervention group and Control group with Time in minutes by Mann-Whitney U test

Times	Intervention group			Control group			U-value	Z-value	P-value
	Mean	Median	Mean rank	Mean	Median	Mean rank			
Time in minutes	98.29	14.35	28.84	105.43	12.45	42.16	379.50	-2.7310	0.0063*

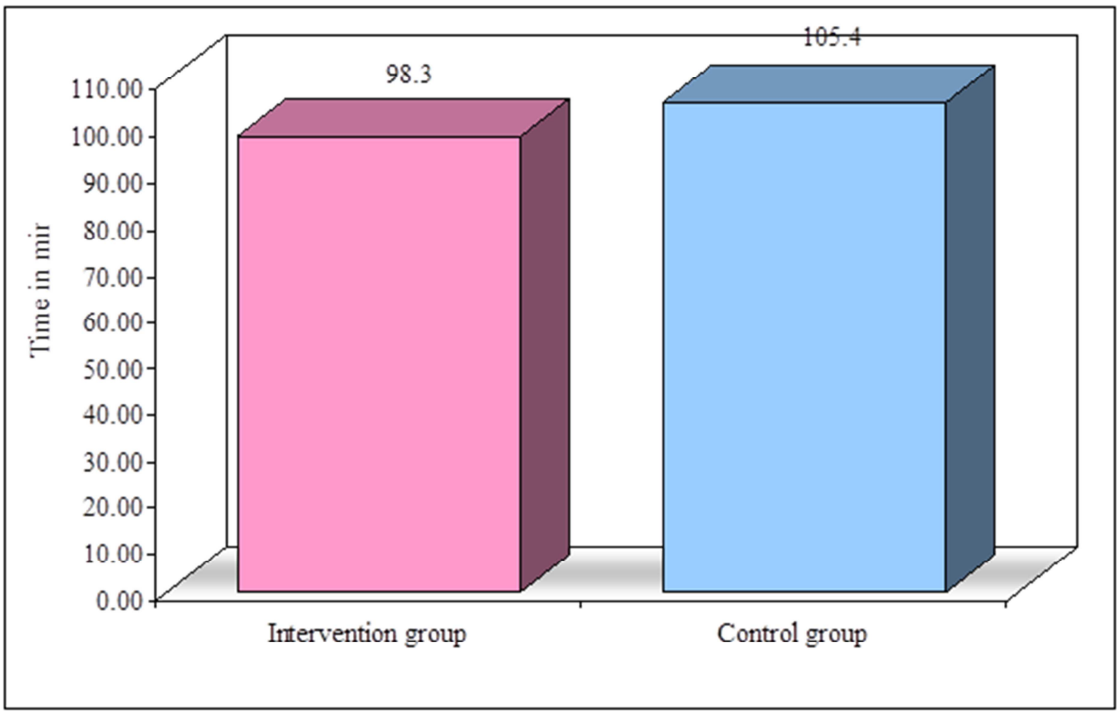


Figure 6: Comparison of Intervention group and Control group with Time in minutes

DISCUSSION

Any Endoscopic surgical procedures like FESS will have tissue damage resulting in blood loss where in there is impaired visibility which may further lead damage of adjacent blood vessels during the procedure. It presents as a challenge for the treating otolaryngologists /anesthesiologists.[29-33]

Even though bleeding is not an uncommon complication during a surgical intervention, the lack of clear visibility to the treating surgeon increases the operative time period in addition to the increased suction and manipulation of the surgical field, all of which may further increase rate of complications.[31] Manipulation increases the chances of damage to the vessel, especially the capillaries (in case of endoscopic sinus surgeries) along with damage to the adjacent structures such as the (but not limited to) vasculature of the eye, increase in chances of airway obstruction because of aspiration of blood clots[29,30] and intracranial complications.[31,34-38] Further, high vascularity adds to increased levels of bleeding.[39,40]

Such tissue damages may lead to release of enzymes, like tissue plasminogen activators which are responsible for conversion of tissue plasminogen to their plasmin form wherein there is increased amount of fibrinolysis as well as activation of the fibrinolytic system, which is found to be in action during the intra operative stage as well as during the early postoperative stage.[30,41]

Adequate research data is available in terms of techniques which help in reducing intraoperative bleeding to help overcome the most common problem, which is inadequate visualization of surgical field. The most common techniques employed are controlled hypotension, use of topical vasoconstrictors, preoperative steroid

administration to reduce the burden of persisting allergic conditions as well as the use of tranexamic acid.[31,42]

TXA is an synthetic, hydrophilic, anti-fibrinolytic shows tendency to bind to the lysine binding sites over plasmin and plasminogen to reduce bleeding. TXA is known to act by inhibiting conversion of plasminogen into plasmin, wherein saturation of binding sites leads to separation of plasminogen from superficial fibrin, thereby preventing fibrinolysis.[29,30,43,44,45]

Traditionally, TXA is used in the management of primary menorrhagia, cardiothoracic surgery, thrombocytopenia, hemophilia, Von Willebrand disease and bleeding of digestive as well as urinary systems.[46]

Systemic infusion of TXA has been associated with side effects such as nausea, vomiting, loose stools, skin reactions, dizziness, hypotension, seizures, problems with vision such as blurring of vision/disturbance in colour vision and increased chances of thromboembolism.[39,46,47,48] Topical application has been popularised in parotid surgery, coronary artery bypass & in case of hemophiliacs.[29,49]

This study is consisting of 70 patients with equitable distribution of 35 patients each in the interventional group & control group, we found the mean ± S.D age to be 35.47 ± 11.78 years & 40.0 ± 14.49 years amongst the interventional & control group subjects respectively. On comparing the two groups, there is no significant difference for age distribution. Similar results were recorded by Baradaranfar MH et al.,[39] wherein mean age of patients was 38.6 years in tranexamic acid group & 40.7 years in saline(p=0.51).

Another study carried out by Shehata et al.,[31] consisted of patients within the age of 20 to 50 years, wherein they recorded mean ± SD age of patients in the

tranexamic group to be 35.88 ± 10.3 in TXA group, 36.52 ± 10.9 in hot saline group and 31.56 ± 12.1 in normal saline group. They found no significant difference between the three groups

Jahanshahi J et al.,[43] amongst 60 patients with chronic sinusitis recorded the mean age of the patients to be 35.77±10.78 with a minimum and a maximum age of 18 and 60 years respectively.

In this study, more number of subjects in age group of <=30 years in both the interventional as well as the control group were seen, whereas the least number of subjects in both groups was found in age group of >=51 years. Within the interventional group, patients of age group 31-40 years & 41-50 years had equitable distribution of patients. Higher incidence of patients in the age group of 30 years and below can be because of various factors such as increasing exposure to indoor allergens such as house dust mites, furred pets at home, fungal hyphae as well as outdoor allergens such as ambient air pollution, allergens such as silica / metal shaving at working place and increased prevalence of smoking.

We found a prevalence of male subjects across the interventional as well as the control group .The interventional group had 24 males subjects (68.57%) and the control group had 25 male subjects (71.43%). In contrast, the ratio of female patients was about 33% in comparison to the male subjects. We recorded 11 female subjects (31.43%) in interventional group and 10 female subjects (28.57%) in control group. On comparing these two groups, there is no statistically significant difference with respect to gender distribution.

Similarly, Baradaranfar et al.,[39] recorded 70% male patients in the saline group & 73.3% male patients in the TXA group (p=0.77). Study done by Shehata et al.,[31]

also showed a definite male predominance, wherein there were 60% males (45) and 40% females (30), which was in agreement with the results of this study.

Similarly, Jahanshahi J et al.,[43] had 36 (60%) male subjects and 24 (40%) female patients in their study

Irrespective of the age, geographic area, diagnosis or underlying etiology, all the studies found a definite male predominanc. Various causative factors can be the reason for male predominance, nonetheless the increased incidence can be due to increased exposure of males to outdoor activities (incl. field work) wherein there is greater exposure to pollutants.

Across both the interventional as well as the control group, we found that majority of the patients, approximating to 54-60% were diagnosed with CRSwNP, with a slightly higher incidence in interventional group when compared to control group. Quantitatively amongst the 35 interventional group subjects, 21(60%) were diagnosed with CRSwNP, whereas remaining 14(40%) were diagnosed with CRSsNP. Similarly, amongst the 35 control group subjects, 19(54.29%) were diagnosed with CRSwNP, whereas remaining 16(45.71%) were diagnosed with CRSsNP.

There are various intraoperative bleeding scoring systems that have been put forward; however to prevent confusion we used the Boezaart[32] grading scale to objectively evaluate the surgical field for the study. It is a 6-point scale which ranges from no bleeding to severe bleeding.

We assessed the normality of Boezaart[32] grading scale at different treatment times in Intervention group and Control group by Shapiro-Wilk test to understand the statistical significance at different time intervals across the two groups as well as in

the terms of the change within the time duration of 15 min interval each across the groups. Irrespective of the time interval or difference it was statistically significant ($p<0.05$).

A comparative analysis across Intervention as well as Control group with Boezaart[32] Grading of Surgical Field at different treatment times showed us the following results as pointed below

- The mean Boezaart[32] grading of surgical field at 15 min in interventional and control group was found to be 2.43 & 2.51 respectively.
- The mean Boezaart[32] grading of surgical field at 30 min in interventional and control group was found to be 3.17 & 2.97 respectively.
- The mean Boezaart[32] grading of surgical field at 45 min in interventional and control group was found to be 3.43 & 3.51 respectively.
- Between the interventional & control group, there is a significant change from 15-30 min & 30-45 min ($p<0.05$), however, it is not significant when seen between 15-45 min.

On comparing the two groups, the mean surgical grade is lower in intervention group at 15 min & 45 min whereas it is lower in control group which not statistically significant ($p<0.05$).

Baradaranfar et al.,[39] also assessed the mean surgical field quality score based on Boezaart grading and reported a mean score of 3 in saline group & 2.73 in TXA group, in agreement with our study results of better surgical field in the interventional group.

Shehata et al.,[31] reported mean bleeding score of 1.92, 1.96 and 2.64 in patients using tranexamic acid, managed with hot saline and in patients managed with

normal saline. Shehata et al.,[31] also had used Boezaart[32] grading scale in their study and reported less bleeding(Statistically significant) in patients using tranexamic acid an in patients managed with hot saline against patients managed with normal saline . However they did not report any statistically significant difference with respect to surgical field grading and volume of blood loss between the group of patients being managed with TXA and those being managed with Hot Normal Saline.

Moise et al.,[51] studied effect of TXA in patients undergoing ESS. They reported that total volume of blood loss (both intra op and post op)in TXA group was 50% of the volume of blood list in saline group. Further, they found that bleeding was three times less post removal of pack in TXA group.

A similar comparative analysis was carried out by Jahanshahi J et al.,[43] wherein they assessed quality of surgical field based on Boezaart[32] scale across both the groups at 15, 30 and 45 minutes after start of surgery was carried out. They reported that after 15 minutes from start in the intervention group 76.7% (majority) of patients and 43.3% patients in control group were in grade 2. In intervention group, there was no patients in grade 4 at 15 min from start whereas in control group 13.3% patients were seen in grade 4(p=0.002). at 30min from start 70% (majority) in intervention and 26.7% patients in control were in grade 2. At thi point of time, in control group 53.3% (majority) were in grade 3(p=0.003). at 45 in from start in intervention group most patients were in grade 2 whereas in control group most were in grade 3, but the difference was not significant (p=0.163).

In our study, in addition to above parameters, we also assessed the mean level of change of surgical field grading in **the interventional and control groups** at time intervals of **15-30 min, 30-45 min and 15-45 min**. It was statistically significant only at the difference of 15-30 min & 30-45 min in the intervention group. This is

indicative of good control of bleeding throughout the duration of surgery in the intervention group as compared to control group.

Expression in terms of percentage of change **within the interventional group** between time period of 15-30 min, 15-45 min and 30-45 min was found to be -30.59%, -41.18% and -8.11% respectively, which was statistically significant.

Similar assessment **within the control group** between 15- 30 min, 15-45 min and 30-45 min was found to be -18.18%, -39.77% and -18.27% respectively, which was found to be statistically significant. These findings are suggestive of better visualization of surgical field and better control of bleeding at the start of surgery in the intervention group. As the surgery progresses the field of visualization as well as bleeding control is similar in both the groups.

Other studies wherein the efficacy of oral tranexamic acid was reported includes the study by Yaniv et al.,[50] who assessed 400 patients undergoing FESS with septoplasty and conchotomy and reported that patients who were administered oral TXA prior to surgery had considerably less bleeding intra operatively and post-operatively.

A similar study was conducted by Jabalameli et al.,[29] .Patients undergoing FESS were randomized to TXA and placebo group. TXA group was administered with topical TXA (1000 mg in 20 ml saline)2. A reduction in volume of blood lost was reported in TXA group.

Athanasiadis et al.,[52] assessed 30 patients who underwent FESS. The subjects were divided into three groups (2.5 g EACA, 100 mg TXA, or 1 g TXA sprayed on one side of the nose and saline on the other). TXA group patients revealed significantly improved surgical environment at 2, 4, and 6 min from start of surgery.

It was also reported that administering a dose of 1 g TXA gave better outcomes in terms of field of surgery when compared to a dose of 100 mg TXA.

In terms of the operative time, the mean time in intervention group and control group was found to be 98.29 min & 105.43 min respectively indicating that total operating time was less (statistically significant) in intervention group as compared with control group , indicating TXA being effective in hemostasis .

Similar results were observed by Jahanshahi J et al.,[43] where total quantity of blood lost was around 100.10 ml in intervention group and 170.49 ml in control group. They concluded that quantity of blood lost during all periods was lower in intervention group when compared to TXA group.

Another similar study carried out by Shehata et al.,[31] found total duration of surgery to be 75.92 ± 7.64 min in the TXA group, whereas in hot saline group it was found to be 74.22 ± 7.54 min and 98.54 min in the normal saline group ($p = 0.0002$) and this showed significant differences between both groups A and B and group C. The superiority of hot saline superseded tranexamic acid but normal saline was not as efficacious as the other two groups.

In our study subjects did not show any major complications/noticeable hemodynamic changes post operatively.

Even though many studies have been conducted on topical TXA in different types of surgery but no systemic absorption or side effects have been reported which strongly advocates the use of tranexamic acid.[43,44,54,55]

Limitations of our study include - Limited sample size, Single-center study and Lack of comparative studies for a better understanding of the trial response.

Therefore, we advocate Multi-Centric, Large sample sized study with a fixed Pre operative/Intra operative protocol to maintain intraoperative hemodynamics to add valuable data to the available literature for future use of topical tranexamic acid as an effective anti-fibrinolytic agent during surgeries.

CONCLUSION

We found topical application of tranexamic acid is effective for hemostasis during surgical procedures with no associated side effects. The establishment of a clear surgical field is of utmost importance in surgery, to finish the planned treatment while minimizing the amount of manipulation, all of which affects the operating time and the treatment outcome.

Presently less literature is available on topical use of tranexamic acid during surgeries and therefore, more studies are needed on this subject for authenticated results.

SUMMARY

- The mean ± S.D age of interventional & control group was found to be 35.47 ± 11.78 years & 40.0 ± 14.49 years respectively with more number of patients being in age group of <=30 years in both the interventional as well as the control group.
- Maximum numbers of subjects in both the groups were males, accounting for 68.57% (24) in the interventional group and 71.43% (25) in the control group.
- In interventional group subjects, 21(60%) were diagnosed with CRSwNP, whereas remaining 14(40%) were diagnosed with CRSsNP. In the control group, 19(54.29%) subjects were diagnosed with CRSwNP, whereas remaining 16(45.71%) were diagnosed with CRSsNP, indicating that majority of subject in both the groups were diagnosed with CRSwNP.
- The mean Boezaart[46] grading of surgical field at 15 min in interventional and control group was found to be 2.43 & 2.51 respectively; at 30 min in interventional and control group was found to be 3.17 & 2.97 respectively and at 45 min in interventional and control group was found to be 3.43 & 3.51 respectively. This indicated a better surgical field score in intervention group, though it was not statistically significant.
- Between interventional & control group, there is a significant change from 15-30 min & 30-45 mins ($p<0.05$), however, it is not significant when seen between 15-45 min. This is indicative of good control of bleeding throughout the duration of surgery in intervention group as compared to control group.
- Percentage of change within the interventional group between 15- 30, 15-45 min and 30-45 min was found to be -30.59%, 41.18% and 8.11% respectively, which was statistically significant. Within control group between 15- 30, 15-

45 min and 30-45 min, it was found to be 18.18%, 39.77% and 18.27% respectively, which was statistically significant. These findings are suggestive of better visualization of surgical field and better control of bleeding at the start of surgery in the intervention group. As the surgery progresses the field of visualization as well as bleeding control is similar in both the groups

- In terms of the operative time, the mean time in the intervention group and control group was found to be 98.29 min & 105.43 min respectively indicating that total operating time was less (statistically significant) in intervention group as compared to control group, indicating TXA being effective in hemostasis.

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ANNEXURE I - INFORMED CONSENT FORM

"A RANDOMISED CLINICAL TRIAL TO ASSESS THE EFFECT OF PRE OPERATIVE TOPICAL TRANEXAMIC ACID ON INTRAOPERATIVE BLEEDING FOR QUALITY OF SURGICAL FIELD DURING FESS IN PATIENTS WITH CHRONIC RHINOSINUSITIS"

Name of Student/Principal Investigator:

Name of Guide/Co Investigators:

Objective:

- To assess the effect of pre operative local application of Tranexamic Acid by grading the quality of Surgical Field at 15, 30 , and 45 min after the start of surgery using Boezaart.
- To assess the effect of local application of Tranexamic acid on duration of surgery

Introduction: Chronic rhinosinusitis is characterised by inflammation of the mucosa, lining the paranasal sinuses and the nasal cavity leading to impairment of their function. For pattients refractory to medical treatment surgical management in the form of FESS is now becoming an increasingly popular treatment modality. One of the major challenges during FESS is controlling intra operative bleeding so as to improve the surgical field .This study aims to find a suitable intervention modality for the same.

Explanation of procedure: Patient coming to ENT & HNS OPD at KLE's Prabhakar Kore Hospital and MRC will be examined, a detailed history will be taken. Nose examination will be done using suitable size Thudicum's Nasal Speculum .After

clinical diagnosis patient will be explained about his condition and will be counselled to undergo FESS.Consenting patients will be randomised into control and intervention groups. The anterior nasal packing in patients of the Intervention group will be done with Tranexamic acid soaked pledgets 10 mins before the start of surgery , similarly the anterior nasal packing of the patients in control group will be done with xylometazoline soaked pledgets 10 min before the start of the surgery. The intra operative bleeding will be assessed by assessing the quality of surgical field at 15 , 30 and 45 mins after the start of the surgery using the Boezaart Grading. The effect of local application of tranexamic acid on the duration of surgery will also be assessed by noting the starting time of the surgery and ending time of the surgery.

Randomisation: A jar containing 6 sheets will be taken 3 each of Control and Intervention group, every patient fulfilling the inclusion criteria will be asked o pick a sheet from the jar and will be assigned to the respective group, The jar will be refilled as soon as all the 6 sheets are picked up

Withdrawal from participation in the study: Participation in this study is voluntary. You will be free to decide whether to participate in this study or continue participation once enrolled. In case you decide to withdraw your participation, you are free to do so. However, please convey the decision to the principal investigator.

Possible benefits from participating in the study: You will/will not have nor get any benefits by participating in this study. The data gathered will help the population at large.

Possible risks from participating in the study: There are no risks involved in participating in this study.

Privacy and confidentiality: The information collected from you will be coded, to prevent any person from identifying you. Your identity will never be revealed. The data collected from you will be kept confidential and only processed or aggregated data will be used for publication.

Financial incentives: You will not receive any payment for participating in this study.

Authorization for publication of aggregated data: Results obtained after processing of the aggregated data will be published for scientific purposes and or presented to scientific groups. However, your identity will never be revealed.

Questions:

If you have any question or complaints with regard to your right as study participant you may contact Dr. Harsha Hegde, Chairperson, Ethical committee of JNMC, 0831-2473777 Extension 4052.

Legal rights: By signing this consent form, we are not waving any of your legal rights.

CONSENT STATEMENT

I am making a voluntary decision to participate in the study **"A RANDOMISED CLINICAL TRIAL TO ASSESS THE EFFECT OF PRE OPERATIVE TOPICAL TRANEXAMIC ACID ON INTRAOPERATIVE BLEEDING FOR QUALITY OF SURGICAL FIELD DURING FESS IN PATIENTS WITH CHRONIC RHINOSINUSITIS**" My signature below indicates that I have decided to participate and I have read the information provided above or the information provided above has been read to me in the language that I understand best. I was given the opportunity to ask questions and that they have been answered to my satisfaction.

Name of the participant:

Signature or left thumb impression of the participant:

Name of the witness:

Signature or left thumb impression of the witness:

Name of the investigator:

Signature of the investigator:

ANNEXURE II - PROFORMA FOR DATA COLLECTION

Name and Signature of the student/principal investigator:

Signature of the guide: **Date:**

PROFORMA

"A RANDOMISED CLINICAL TRIAL TO ASSESS THE EFFECT OF PRE OPERATIVE TOPICAL TRANEXAMIC ACID ON INTRAOPERATIVE BLEEDING FOR QUALITY OF SURGICAL FIELD DURING FESS IN PATIENTS WITH CHRONIC RHINOSINUSITIS"

Date: I.P. No:

Name: Occupation:

Age: Phone No:

Sex:

Address:

CLINICAL PROFILE:

Chief Complaint:

History of Present Illness:

Past History:

Personal History:

Family History:

I) General Physical Examination -

Blood Pressure:

Pulse:

Respiratory Rate:

Pallor

Icterus

Clubbing

Cyanosis

Lymphadenopathy

Oedema

II) ENT Examination

1. **EAR EXAMINATION:**

	Right	**Left**
Pinna		
Pre auricular area		
Post auricular area		
Tragal Tenderness		
Mastoid Tenderness		
External auditory canal		
Tympanic membrane		

TUNING FORK TESTS:

Rinne's test: 256 Hz

512 Hz

1024 Hz

Weber's test:

Absolute Bone Conduction test

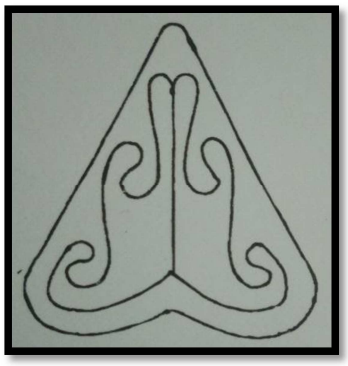
2. NOSE EXAMINATION:

External appearance

- Root
- Bridge
- Dorsum
- Alae
- Tip
- Columella

Cold spatula test

Anterior Rhinoscopy



Posterior Rhinoscopy

Paranasal Sinus Examination

	Right	Left
Frontal Sinus		
Ethmoidal Sinuses		
Maxillary Sinus		

3. THROAT EXAMINATION:

Oral cavity:

- Lips
- Labial and buccal mucosa
- Gingivolabial and gingivobuccal sulci
- Gingiva
- Teeth
- Hard palate

- Floor of mouth
- Anterior 2/3rd of tongue
- Retromolar trigone

Oropharynx:

- Soft palate
- Uvula
- Anterior pillar
- Tonsills
- Posterior pillar
- Posterior and lateral pharyngeal wall

Indirect Laryngoscopy

4. **NECK EXAMINATION:**

5. **CT- PNS FINDINGS:**

6. **DIAGNOSIS :**

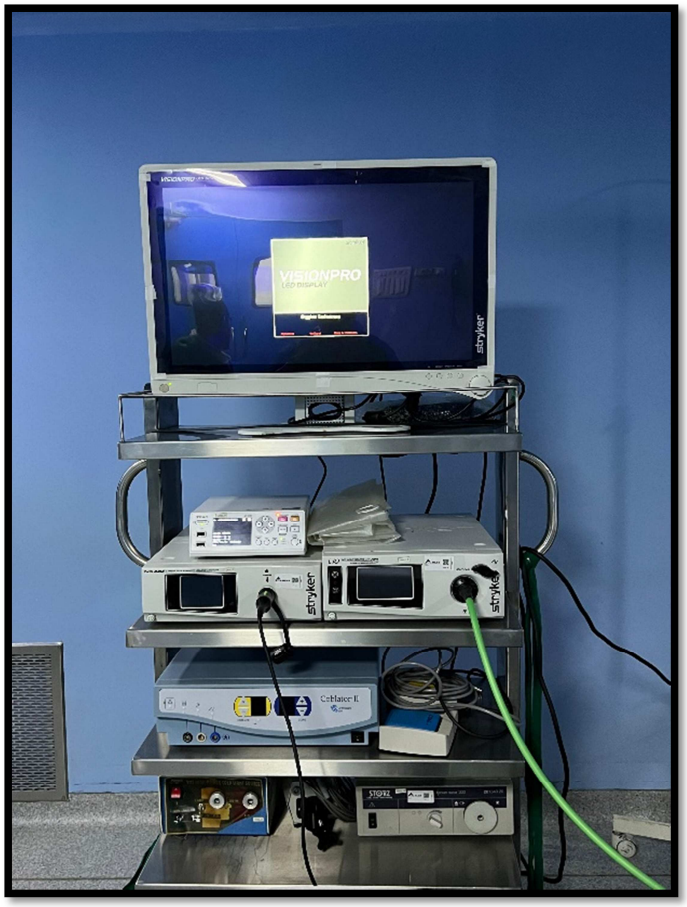
7. ANALYSIS OF THE SURGICAL FIELD :

	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5
15 min					
30 min					
45 min					

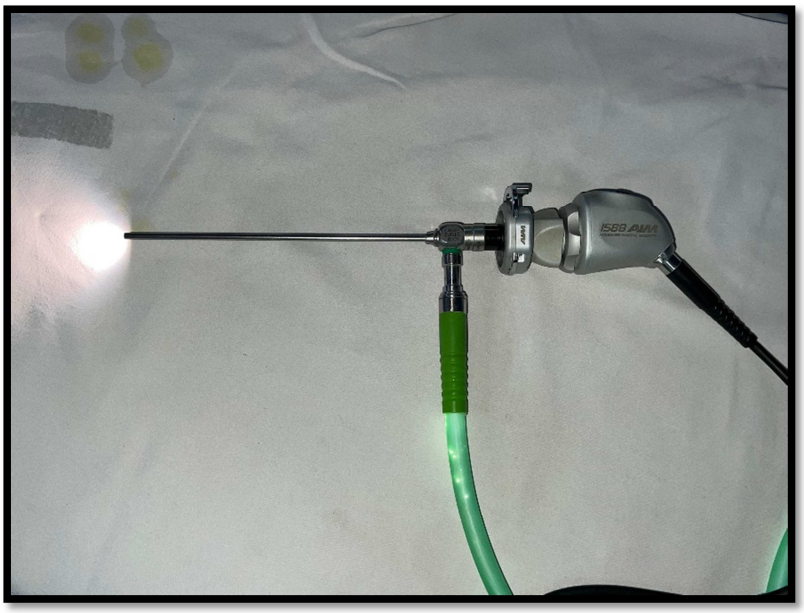
8. ASSESSMENT OF INTRAOPERATIVE BLEED :

Grade	Assessment
0	No bleeding (cadaveric conditions)
1	Slight bleeding, no suctioning required
2	Slight bleeding, occasional suctioning required
3	Slight bleeding, frequent suctioning required; bleeding threatens surgical field a few seconds after suction is removed
4	Moderate bleeding, frequent suctioning required, and bleeding threatens surgical field directly after suction is removed
5	Severe bleeding, constant suctioning required; bleeding appears faster than can be removed by suction; surgical field severely threatened and surgery usually not possible

ANNEXURE III – PHOTOGRAPHS

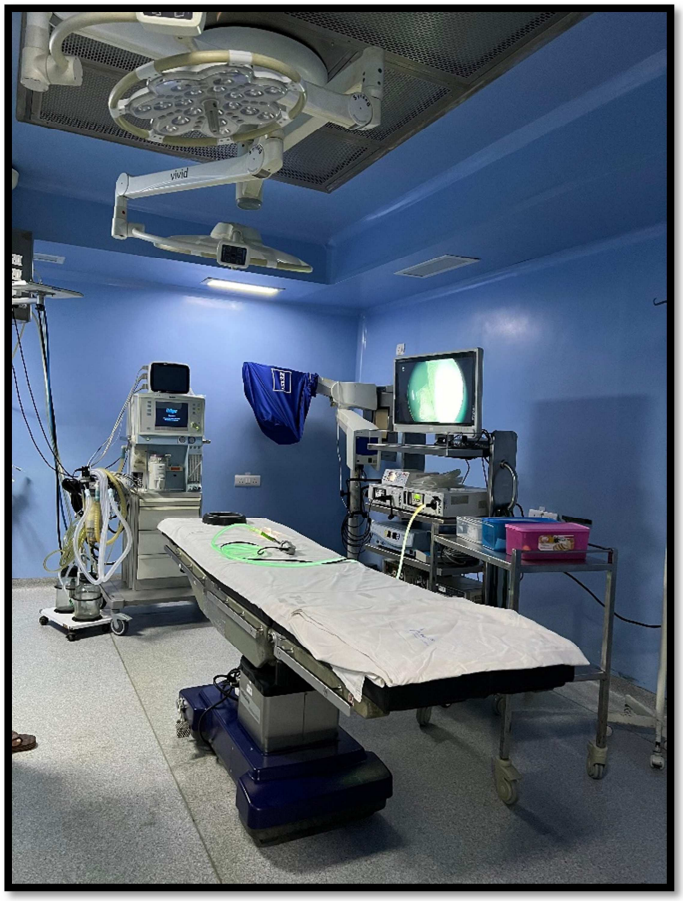


STRYKER VISION PRO AIM MONITOR WITH LIGHT SOURCE AND RECORDING UNIT



STRYKER VISION PRO AIM CAMERA HEAD WITH KARL STORZ

ENDOSCOPE SYSTEM



OPERATING ROOM SET-UP

ANNEXURE IV- MASTERCHART

					Boezaart Grading of Surgical Field				Duration of surgery		
Serial Number	Age	Sex	IPD Number	Diagnosis	Control/ Intervention	15 Minutes	30 Minutes	45 Minutes	Start	End	Time in minutes
1	37	M	1162093	CRSsNP	Intervention	2	3	3	9:05 AM	10:50 AM	105
2	60	M	1155867	CRSwNP	Intervention	3	3	3	9:00 AM	10:45 AM	105
3	48	M	1167169	CRSsNP	Control	3	3	3	9:00 AM	10:30 AM	90
4	48	M	1161146	CRSwNP	Intervention	3	3	4	10:00 AM	12:00 AM	120
5	62	F	1165116	CRSsNP	Control	2	2	3	9:10 AM	10:55 AM	105
6	37	M	1165244	CRSsNP	Control	3	4	4	9:00 AM	10:50 AM	110
7	48	F	1155811	CRSwNP	Intervention	2	3	3	8:00 AM	9:45 AM	105
8	39	M	1160205	CRSsNP	Control	3	3	4	8:00 AM	9:50 AM	110
9	20	M	1194883	CRSwNP	Intervention	3	3	4	11:00 AM	12:40 PM	100
10	34	M	1170406	CRSwNP	Intervention	3	4	4	9:30 AM	11:00 AM	90
11	28	M	1171634	CRSwNP	Control	2	3	3	9:00 AM	11:00 AM	120
12	27	M	1177920	CRSwNP	Control	3	4	4	8:30 AM	10:20 AM	110
13	47	M	1193673	CRSsNP	Control	3	3	4	8:30 AM	10:15 AM	105
14	41	M	1171710	CRSsNP	Intervention	2	3	3	8:00 AM	9:40 AM	100
14	47	F	1177227	CRSwNP	Intervention	2	3	3	8:30 AM	10:00 AM	90
16	42	F	1180829	CRSsNP	Intervention	3	4	4	8:15 AM	10:40 AM	155
17	65	M	1197064	CRSwNP	Control	2	2	3	8:00 AM	9:45 AM	105
18	41	M	1188233	CRSwNP	Control	3	4	4	8:30 AM	10:00 AM	90
19	31	F	1156675	CRSsNP	Intervention	2	4	4	9:05 AM	10:50 AM	105
20	35	F	1186934	CRSwNP	Control	3	3	4	8:15 AM	10:40 AM	155
21	39	M	1196706	CRSwNP	Control	2	3	4	11:00 AM	12:50 PM	110
22	48	M	1193840	CRSwNP	Control	2	2	3	9:45 AM	11:30 AM	105
23	30	M	1181691	CRSsNP	Intervention	3	4	4	9:25 AM	11:10 AM	105
24	40	M	1205825	CRSsNP	Intervention	3	3	4	9:10 AM	10:55 AM	105

25	21	M	1173776	CRSwNP	Intervention	3	3	3	8:00 AM	9:35 AM	95
26	29	M	1178175	CRSwNP	Intervention	2	2	3	11:45 AM	1:30 PM	105
27	46	M	1183328	CRSwNP	Control	3	3	3	8:00 AM	9:50 AM	110
28	33	M	1162351	CRSsNP	Control	3	4	4	9:00 AM	10:45 AM	105
29	19	M	1153595	CRSsNP	Control	2	3	4	9:35 AM	11:10 AM	95
30	57	M	1159394	CRSsNP	Intervention	3	3	4	9:00 AM	10:50 AM	110
31	19	M	1157517	CRSsNP	Control	2	3	3	8:00 AM	9:50 AM	110
32	42	F	1155014	CRSwNP	Control	3	3	3	9:00 AM	11:05 AM	125
33	22	F	1161944	CRSwNP	Intervention	2	2	3	9:10 AM	10:55 AM	105
34	29	M	1204865	CRSwNP	Intervention	2	3	3	8:20 AM	10:00 AM	100
35	19	M	1183512	CRSsNP	Intervention	2	3	4	8:00 AM	9:45 AM	105
36	30	M	1195606	CRSsNP	Control	3	4	4	8:30 AM	10:15 AM	105
37	33	M	1187582	CRSsNP	Intervention	3	3	4	8:00 AM	9:20 AM	80
38	32	M	1201487	CRSwNP	Intervention	2	3	3	8:00 AM	9:40 AM	100
39	33	M	1166121	CRSwNP	Control	2	2	3	8:30 AM	10:25 AM	115
40	21	M	1167631	CRSwNP	Control	2	3	3	8:00 AM	9:55 AM	115
41	25	M	1168112	CRSsNP	Intervention	2	3	3	9:00 AM	10:15 AM	75
42	47	F	1171889	CRSsNP	Control	3	3	4	9:25 AM	11:05 AM	100
43	65	F	1172000	CRSwNP	Control	3	4	4	9:00 AM	10:50 AM	110
44	42	M	1173222	CRSwNP	Intervention	3	4	4	9:30 AM	10:45 AM	75
45	50	M	1173135	CRSwNP	Control	2	2	3	8:00 AM	9:40 AM	100
46	18	M	1186236	CRSwNP	Intervention	2	3	3	9:00 AM	10:50 AM	110
47	30	M	1205831	CRSwNP	Intervention	3	4	4	8:00 AM	10:30 AM	90
48	26	F	1205010	CRSsNP	Control	2	3	4	8:30 AM	10:05 AM	95
49	55	F	1206474	CRSwNP	Intervention	3	4	4	10:30 AM	12:05 AM	95
50	25	F	1205850	CRSwNP	Intervention	2	3	3	8:15 AM	9:35 AM	80
51	44	M	1204291	CRSsNP	Control	3	3	4	9:00 AM	10:45 AM	105
52	36	F	1179522	CRSwNP	Intervention	2	3	3	10:45 AM	12:15 PM	90
53	18	M	1188603	CRSsNP	Control	2	2	3	8:20 AM	10:00 AM	100
54	33	M	1195437	CRSwNP	Control	3	3	3	9:50 AM	11:30 AM	100

55	23	F	1196989	CRSwNP	Intervention	2	3	3	12:30 PM	2:00 PM	90
56	20	M	1199406	CRSwNP	Control	2	2	3	9:00 AM	10:30 AM	90
57	22	M	1201693	CRSwNP	Intervention	2	3	3	8:00 AM	9:30 AM	90
58	41	M	1200864	CRSsNP	Intervention	2	3	4	9:00 AM	10:45 AM	105
59	48	F	1203323	CRSsNP	Control	2	2	3	9:00 AM	10:50 AM	110
60	61	M	1193819	CRSsNP	Control	3	4	5	9:10 AM	10:45 AM	90
61	33	F	1194963	CRSwNP	Intervention	2	3	3	9:00 AM	10:40 AM	100
62	27	M	1196810	CRSwNP	Control	2	2	3	10:55 AM	12:15 PM	80
63	18	F	1206161	CRSsNP	Control	3	3	3	9:25 AM	11:05 AM	100
64	50	F	1208945	CRSsNP	Intervention	3	4	4	8:15 AM	9:40 AM	85
65	55	F	10000776	CRSsNp	Control	2	3	3	9:00 AM	10:40 AM	100
66	54	M	10001692	CRSwNp	Intervention	2	3	3	8:00 AM	9:30 AM	90
67	55	M	1206578	CRSwNP	Control	3	4	4	10:30 AM	12:05 AM	95
68	49	M	10005807	CRSwNP	Control	3	4	4	9:00 AM	10:45 AM	105
69	32	M	1192613	CRSsNP	Intervention	2	3	3	10:30 AM	12:00 PM	90
70	65	F	1204561	CRSwNP	Control	2	2	3	9:00 AM	10:45 AM	105