

Effects of Topical Triamcinolone Acetonide Application after Sinonasal SurgeriesMayank Yadav¹, M. Khalid Farooqui², T.S. Anand³¹Department of ENT, SHKM Govt. Medical College, Nalhar, Nuh, Haryana, India²ENT Specialist, Kota, Rajasthan, India,³Department of ENT, LHMC, New Delhi, India**Correspondence Author:** Mayank Yadav, Department of ENT, SHKM Govt. Medical College, Nalhar, Nuh, Haryana, India.**Conflicts of Interest:** Nil.**Abstract**

Postoperative synechiae, mucosal oedema, pain and crusting are common complications after sinonasal surgeries. Various studies have been conducted to evaluate the effects of certain drugs in alleviating the above mentioned problems. Topical application of steroids has shown promising results. A prospective controlled study was conducted at a tertiary care centre in the national capital of India.

30 patients with bilateral sinonasal diseases were included in the study. These patients underwent bilateral sinonasal surgical intervention and received bilateral anterior nasal packing. On the test side 2 ml of 40mg/ml aqueous suspension of Triamcinolone acetonide was used to impregnate Vaseline, Ciprofloxacin soaked nasal dressing and on control side only Vaseline and Ciprofloxacin impregnated nasal dressing was used. Nasal endoscopies were performed in each patient preoperatively, 2 weeks postoperatively and 4 weeks postoperatively to assess condition of sinonasal cavities and Modified POSE score was used to score the health status of bilateral sinonasal cavities separately in terms of mucosal oedema, synechia and crusting. Visual analogue scale was used to compare pain on both sides 48 hours, 1 week, 2 weeks and 4 weeks postoperatively.

Significantly healthier sinonasal cavities were found on the side of Triamcinolone acetonide application as compared to the control side on consecutive Modified POSE scoring at 2 weeks (3.20 Vs 4.40; p value=0.0002) and at 4 weeks (2.43 Vs 3.30; p value=0.0038), resulting into the conclusion that placement of Triamcinolone acetonide impregnated nasal packing improves endoscopic findings in patients with sinonasal pathologies, after nasal and sinus surgeries.

Keywords: Topical Steroids, Triamcinolone Acetonide, Sinonasal Surgeries, Modified POSE scoring.**Introduction**

After every surgery wound healing is a significant determinant of successful outcome for the surgery. For ages different surgeons and pioneers have tried different and sometimes very imaginative interventions to smoothen and to speed up the wound healing.

Common complications encountered during nasal and sinus surgeries are- postoperative synechiae formation, stenosis or narrowing of meatus, mucosal edema, crust formation, polypoidal changes, infection and persistent inflammatory changes in the open sinus cavities.

Various drugs have been and are still being tried to counter these complications. Studies have been conducted to demonstrate the beneficial effects of oral and nasal steroids on surgical outcomes after surgeries like

Functional endoscopic sinus surgery¹ and administration of pre and postoperative systemic steroids have been found to be beneficial in cases of sinus surgeries.

Some recent studies have pointed towards implicating newer drugs to counter the common postoperative complications like synechia formation. An anticancer drug- Mitomycin C has been found to be particularly effective in reducing postoperative synechia formation, that too by virtue of its single or multiple local applications at the surgical site.^{2,3,4}

Several drugs are being tried to minimize the complications associated with nasal and sinus surgeries, David W.J.Cote et al conducted a randomized controlled trial to find out the effect of topical corticosteroid on the nasal and sinus symptoms after the endoscopic sinus surgeries. The steroid used was Triamcinolone and to apply it locally, it was impregnated in nasal dressing which was used postoperatively to pack the nasal cavities.⁵ Intranasal Triamcinolone acetonide has been found to be beneficial in minimizing nasal secretory response and reducing inflammation in medical treatment of rhinosinusitis.

Topical steroids used preoperatively have been evaluated and showed a lesser rate of bacterial growth postoperatively, again suggesting a beneficial role in postoperative outcome.⁶

As such the international consensus is in favour of recommending intranasal steroid sprays as a first line therapy in allergic rhinosinusitis⁷, however in the postoperative timeframe, the use of topical corticosteroid sprays, in an effort to prevent recurrence of chronic rhinosinusitis with polyposis, has met with mixed results.⁸ In addition, it has been previously suggested that the use of nasal packs to deliver topical antibiotics in the postoperative time period may be of value.⁹

This study was conducted at a tertiary care hospital in the capital region of India, using Triamcinolone acetonide, which is a long acting depot preparation of Triamcinolone. Its sterile aqueous suspension was used for local application after nasal and sinus surgeries by impregnating the nasal dressing by this suspension, the dressing used for nasal packing was ribbon gauze which is non absorbable. The effect of the drug was evaluated using the modified POSE score to see for any stenosis, oedema, crusting and synechia formation. Thus the study aimed at identifying the role of topical corticosteroids postoperatively.

Aims and Objectives

1. To compare postoperative pain and mucosal oedema in Vaseline, ciprofloxacin tape gauze dressing impregnated with Triamcinolone acetonide versus commonly used Vaseline, ciprofloxacin tape gauze dressing after nasal and sinus surgery.
2. To compare postoperative crusting and synechia formation in Vaseline, ciprofloxacin tape gauze dressing impregnated with Triamcinolone acetonide versus commonly used Vaseline, ciprofloxacin tape gauze dressing after nasal and sinus surgery (To evaluate the effect of local application of Triamcinolone acetonide after nasal and sinus surgeries.)

Materials and Methods

This study was a prospective randomized controlled trial conducted at lady hardinge medical college and associated hospitals in national capital of India, extending over a period of 2 years. A total of 30 patients of either sex between age group 15 to 55 years undergoing nasal and sinus surgeries were included in the study. The study was approved by the institutional ethical committee. Informed consent was taken from all patients for the planned procedure and topical use of Triamcinolone acetate.

Exclusion criteria were anaemic patients, pregnant women, patients with major systemic illness like pulmonary tuberculosis, uncontrolled diabetes mellitus, chronic respiratory, cardiac or hepatic illness.

Patients who were operated for septoplasty as a sole procedure and patients undergoing unilateral surgical intervention were also excluded from study.

Surgical Procedure

At the start of surgery the nasal cavities were packed for 15 minutes with ribbon gauze soaked in 4% xylocaine with adrenaline in 1:3000 concentration. Intravenous sedation was given 15 minutes prior to surgery using pethidine (50-75mg) and phenargen (25mg). Local infiltration used prior to surgery was 2% xylocaine with adrenaline in a concentration of 1:60000 or 1:100000.

Sinonasal surgeries dealing with bilateral pathologies where bilateral surgical intervention was done were followed by anterior nasal packing with ribbon gauze impregnated with Vaseline, ciprofloxacin and Triamcinolone acetonide (2ml) aqueous suspension for one side and Vaseline, ciprofloxacin impregnated ribbon gauze for other side. Each patient served as his or her own control for evaluation of Triamcinolone acetonide's effect. The anterior nasal packing was left in nasal cavities for 48 hours, during which period the patient received post operative care in form of prefixed medications including an antibiotic, an analgesic and an antihistamine in tablet form.

Subjects: participating subjects were randomly selected from the patients undergoing sinonasal surgeries at LHMC and associated hospitals. A total of 72 patients were initially included as potential participants in the study and 30 patients completed the required follow up period. Detailed history of each patient was elicited, Likert 6 point symptom scale which is a psychometric scale, was used to grade important presenting symptoms of sinonasal

pathologies like nasal obstruction, nasal discharge, post nasal drip and head ache. Patients were also subjected to routine preoperative investigations.

Assessment

Subjective Outcome

Subjective outcome measure of pain was done by visual analogue scale at 48 hours, 1 week, 2 weeks and 4 weeks post operatively. Thus a visual analogue scale that measures from 0 (pain not present) to 10 (extremely severe pain) was used to assess the pain on both test and control sides separately.

Objective Outcome

Nasal endoscopy was used as the single most important outcome measure of disease activity in our study. It is an excellent way to assess disease presence and severity. Nasal endoscopy was done preoperatively and postoperatively at 2 weeks and 4 weeks and relevant findings like mucosal oedema, crusting and synechiae formation were recorded on Modified Peri-operative Sinus Endoscopy scale (Modified POSE scale). POSE scale used in the study is not original POSE scale as a few components of the scale are altered as per the requirement of the study, so this scoring system will be termed as "Modified POSE score". [Annexure 1]

Scoring Details

The presence of synechiae between the middle turbinate and the lateral nasal wall or lateralisation of the middle turbinate are noted, with the presence of either being scored as 1 and the absence scored as 0.

In assessment of middle meatus and natural maxillary ostium, if the ostium is narrowed by synechiae or oedema, it is scored as 1. Complete obstruction is scored as 2.

In maxillary sinus contents, the presence of oedema within the sinus or nonpurulent / nonallergic mucin is scored as

1. The presence of purulence or allergic mucin is scored as 2.

In ethmoid cavity assessment, for crusting, grading is done as 0 for absent, 1 for mild (few isolated) and 2 for extensive (diffuse or occluding).

The mucosal swelling assessment was split up into three sequential categories, namely, mucosal edema, polypoidal change and polyposis.

For mucosal edema scoring, 0 would correspond to the ability to easily discern underlying bony contours of the cavity, 1 would correspond to loss of discernible underlying bony contours in some positions of the cavity and 2 would correspond to diffuse loss of discernible underlying bony contours within the ethmoid cavity.

Polypoid change would be scored as 1 when the severe oedema began to have discernible outpouchings beginning to narrow or fill the cavity and 2 when these discernible outpouchings fill the ethmoid cavity. Thus it would be unexpected to see polypoid change without having a score of 2 for mucosal oedema. Similarly, it would be unexpected to see frank polyps recorded without first having a score of 2 for polypoid change.

Polyposis is reported as absent (0), extending beyond the middle meatus but not to the inferior turbinate (1) and beyond the upper border of the inferior turbinate (2).

Secretions are scored as absent (0), thin or mucoid (1) and purulent / allergic (2).

As septoplasty was a commonly done procedure in our study, so condition of septum was also included in our scoring along with the scoring for presence or absence of hypertrophied inferior turbinates.

Score 0 was given for normal non deviated septum.

Score 1 was given for deviated septum not touching the lateral wall of nasal cavity.

Grossly deviated septum, completely blocking the nasal passage or touching the lateral wall of nasal cavity or

having synechia was scored as 2. The side opposite to the deviation of septum was always given 0 score.

In inferior turbinates assessment normal inferior turbinates were given score 0, score 1 was given for hypertrophied inferior turbinates not completely obstructing the nasal passage. Grossly hypertrophied inferior turbinates, completely obstructing the nasal passage or touching the nasal septum or having synechia with nasal septum were scored as 2.

Results Analysis

Our patient sample was comprised of 22 (73.33%) males and 8 (26.67%) females. Maximum number of patients were in the age group of 15 to 20 years followed by age group 20 to 25 years.

Common symptoms associated with sinonasal pathologies were recorded at their initial presentation, four most common presenting symptoms were nasal obstruction, nasal discharge, post nasal discharge, headache. Likert's 6 point symptom scale was used for subjective grading of the severity of these symptoms.

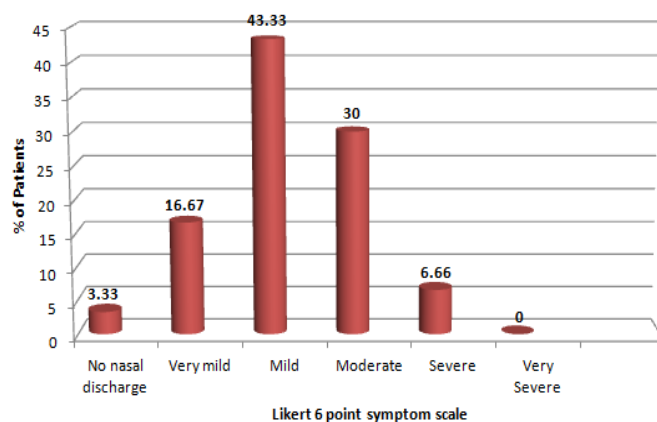


Figure-1: (Frequency Of Nasal Discharge Severity)

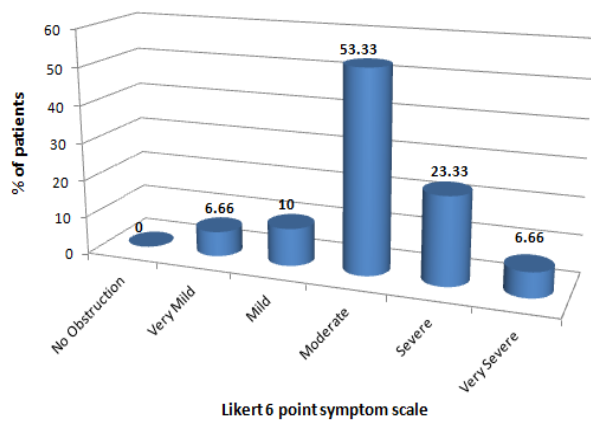


Figure 2: Frequency of Nasal Obstruction Severity.

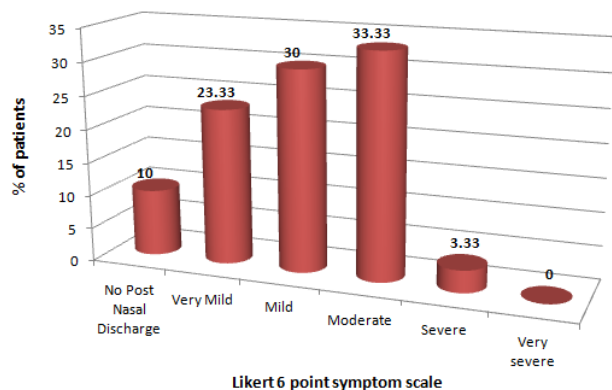


Figure 3: Frequency of Postnasal Discharge Severity.

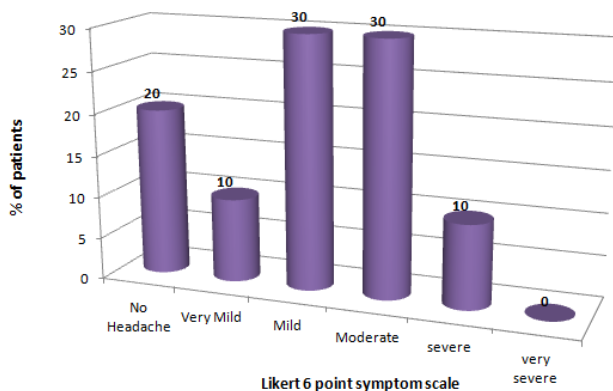


Figure 4: Frequency of Headache Severity

Surgical procedures performed in our study were mainly-septoplasty, maxillary antrostomy, ethmoidectomy,

Sphenoidectomy, frontal sinusotomy, inferior turbinate reduction, middle turbinate reduction.

Endoscopic assessment of sinonasal condition was done using modified POSE score preoperatively (pre triamcinolone application), 2 weeks and 4 weeks postoperatively.

TABLE 1: Peroperative Modified POSE score

	Range	Mean± S.D.	SEM	p-value
Test side	6-14	9.23±2.16	0.39	0.6932
Control side	6-13	9.00±2.39	0.44	

Difference between the two sides is not statistically significant.

TABLE 2: Postoperative Modified POSE score at 2 weeks.

	Range	Mean± S.D.	SEM	p-value
Test side	1-5	3.20±0.89	0.16	0.0002
Control side	2-7	4.40±1.38	0.25	

Difference between the two sides is statistically significant.

TABLE 3: Postoperative Modified POSE score at 4 weeks

	Range	Mean± S.D.	SEM	p-value
Test side	1-4	2.43±0.97	0.18	0.0038
Control side	1-6	3.30±1.24	0.23	

Difference between the two sides is statistically significant.

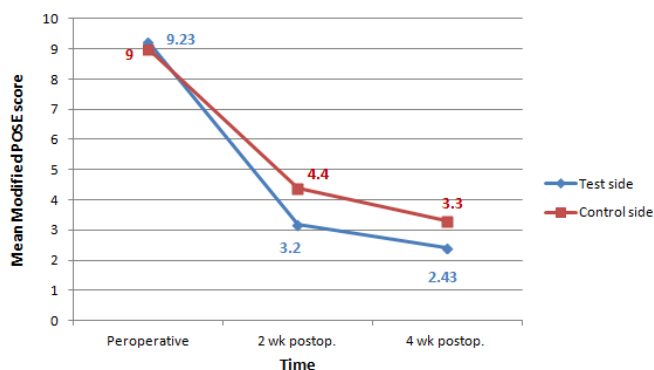


Figure 5: Mean Modified POSE scores Per-operative, 2 and 4 weeks post-operatively

Post operative assessment of pain by visual analogue scale was done on 48 hours, 1 week, 2 weeks and 4 weeks postoperatively and a statistically significant difference was noted on 1 and 2 weeks post operatively.

TABLE 4: VAS score 48 hours postoperatively.

Side	Mean score at 48 hrs. postoperatively (Range 0-10)	p-value
Test side	6.90	0.8678
Control side	6.93	

The difference is not considered statistically significant.

TABLE 5: VAS score 1 week postoperatively

Side	Mean score at 1 week postoperatively (Range 0-10)	p-value
Test side	3.63	0.0001
Control side	4.70	

The difference is statistically significant.

TABLE 6: VAS score 2 weeks postoperatively.

Side	Mean score at 2 weeks postoperatively (Range 0-10)	p-value
Test side	1.73	0.0008
Control side	2.23	

The difference is statistically significant.

TABLE 7: VAS score 4 weeks postoperatively.

Side	Mean score at 4 weeks postoperatively (Range 0-10)	p-value
Test side	0.73	0.1894
Control side	0.93	

The difference is not statistically significant.

Discussion

Successful outcome of any nasal or sinus surgery depends heavily on reducing postoperative scarring, edema and crusting that have propensity to inhibit natural ciliary function and sinus drainage. In this prospective controlled study we have used a long acting depot preparation of triamcinolone acetonide in a non absorbable nasal packing i.e. tape gauze dressing.

Development of intranasal corticosteroids is based on the fact that topical administration of corticosteroids can reduce the total dose of required systemic steroids.¹¹

In different studies conducted worldwide, intranasal steroids were also found to be useful in postoperative persistent CRS.^{13,14,15}

The corticosteroids have a known effect of reducing inflammation and oedema. In nasal and sinus surgeries the inflammation and oedema causes raw mucosal surfaces to come in contact with each other and thus promotes the synechiae formation. The inflammation, oedema, crusting, synechiae can cause blockage of ostiomeatal complex resulting in the aggravation of sinus pathology. Badia L, Lund V confirmed in their study that topical corticosteroids are the medical treatment of choice for nasal polyposis.¹⁰

The use of nasal packing after sinonasal surgeries is another important topic for research. Recently newer bioresorbable nasal dressings are also being used but Weitzel EK et al¹⁶ concluded in their study that for the purpose of preventing adhesions resorbable packs appear

to have no benefit over either non resorbables or no packing.

We have used conventional non resorbable tape gauze nasal packing in our study as it is inexpensive, easy to obtain, easy to insert and medications can be easily applied on it, making it ideal nasal packing for use in general population.

In this study nasal packing was done for 48 hours in all the cases. The drug gets absorbed on the raw mucosal surfaces, making it a more convenient method of drug delivery than frequent and regular application of intranasal corticosteroid sprays. The risks of adverse effects associated with the use of systemic corticosteroids are also avoided. Recent advances in methods for determining the intranasally administered corticosteroids like triamcinolone in human plasma have added to a better understanding of benefits of the topical application of the drugs.¹²

Wright ED and Agrawal S¹ used POSE scoring to evaluate the impact of perioperative systemic steroids on surgical outcomes in patients with CRS with polyposis. In the study conducted by WJ Cote et al⁵, 2 ml of 40 mg/ml Triamcinolone acetonide solution impregnated

bioresorbable nasal dressing was used on test side and postoperative healing assessments of oedema, crusting, secretions and scarring were done at postoperative days 7, 14, 28 and at 3 and 6 months using validated Lund-Kennedy and POSE scores. A statistically significant difference was noted at the day 7 and day 14 in both the Lund-Kennedy ($p = 0.04$ and $p = 0.03$ respectively) and POSE scores ($p = 0.03$ and $p = 0.001$ respectively) for the treatment and control groups. The difference lacked statistical significance at postoperative day 28 (Lund-Kennedy, $p = 0.13$, POSE, $p = 0.27$), but a significant difference was detected between the groups at 3 and 6

months observations (Lund-Kennedy, $p = 0.007$ and $p = 0.02$, respectively ; POSE, $p = 0.049$ and $p = 0.01$ respectively)⁵, while in our study we used only Modified POSE scoring as a tool for objective assessment of the health status of the sinonasal cavities and we assessed the patients first for baseline values i.e. before using Triamcinolone acetonide packing and then 2 weeks and 4 weeks postoperatively.

We came across statistically significant differences both at 2 weeks postoperatively (Modified POSE, $p = 0.0002$) and 4 weeks postoperatively (Modified POSE, $p = 0.0038$). The baseline values were obtained preoperatively which showed no statistical significant difference between the test and control sides (Modified POSE, $p = 0.6932$).

Apart from this objective assessment we also included an important subjective measure i.e. Visual analogue scale for assessment of pain in bilateral nasal cavities separately on 48 hours, 1 week, 2 weeks and 4 weeks postoperatively. Although the readings we got were subjective but were important enough to conclude that there was statistically significant difference between the test and control sides on 1 week and 2 weeks postoperatively (Visual analogue scale, $p = 0.0001$ and $p = 0.0008$ respectively). The Triamcinolone acetonide side had lesser pain compared to the control side. Although the difference in pain lacked statistical significance on 48 hours and 4 weeks postoperatively (Visual analogue scale, $p = 0.8678$ and $p = 0.1894$ respectively).

Extensive literature is available regarding the risks of corticosteroid use. The well known side effects of corticosteroid use like Cushing's syndrome, weight gain, hypertension, Diabetes mellitus, peptic ulcer disease, atherosclerosis and increased risk of infections are mainly associated with its systemic use and higher doses. The corticosteroid Triamcinolone acetonide is used topically in our study giving us the benefit of avoiding the side effects,

although literature is available of clinical trials which tell about the vague side effects of Triamcinolone acetonide like dry mucosa, nasal irritation, sinus discomfort, throat discomfort, epistaxis, headache etc., but in our study we didn't observe any side effects related to the topical application of Triamcinolone acetonide.

The studies conducted by Camalis E¹⁸, Goforth P and Gudas CJ¹⁹ explained the mechanism of impaired wound healing associated with the use of corticosteroids and related it with the catabolic effects of cortisone and its analogs. The catabolic effects include protein breakdown, decreased new protein synthesis in various tissues including skin, muscle, bone and connective tissue and the inhibition of DNA synthesis and cell proliferation in various cell lines including fibroblasts, resulting in delayed formation of scar tissue and delayed epithelialisation.

This side effect of impaired wound healing was deliberately used in our study to reduce the synechia formation after sinonasal surgeries and interestingly 6 patients developed postoperative synechia, all these patients had undergone septoplasty with functional endoscopic sinus surgery, out of these 6 patients 5 patients developed synechia on control side only and only 1 patient had synechia on both test and control sides. ($p = 0.0452$) The sides treated with Triamcinolone acetonide were found to have significantly lesser mucosal oedema and polypoid changes at 2 weeks and 4 weeks postoperatively than did the control sides. The clinical significance of these findings is not known; however, they may be attributed to the ability of Triamcinolone acetonide to affect wound healing by inhibiting fibroblasts that play an active role in the early stages of inflammation. To understand the optimum benefit of topical application of Triamcinolone acetonide, it is advisable to have more number of patients in the study group and more research

work is required. The technique of delivery of Triamcinolone acetonide needs to be refined, as the amount of drug dosage delivered in our study group is not very precise. The actual dose of drug being absorbed or delivered is not accurate and a more precise way of drug delivery warrants more research.

Orlandi RR et al¹¹ found no significant benefit in using postoperative anterior nasal packing, but still senior surgeons prefer to give anterior nasal packing to their postoperative patients. In department of ENT, LADY HARDINGE MEDICAL COLLEGE, we prefer to give postoperative anterior nasal packing to our patients.

Conclusion and Recommendations

In our study the topical application of 2ml of 40mg/ml aqueous suspension of triamcinolone acetonide through anterior nasal packing found to reduce postoperative mucosal oedema, crusting and synechia. One patient developed synechia on both sides and 5 patients developed synechia on control side only (p value= 0.0452).

The overall assessment of sinonasal cavities was done by using modified POSE scoring based on endoscopic findings. The test sides, packed with triamcinolone acetonide impregnated nasal dressing were found to have significantly healthier sinonasal cavities than the control side at 2 weeks (POSE score= 3.20 v/s 4.40, p value= 0.0002) and at 4 weeks postoperatively (2.43 v/s 3.30, p value= 0.0038).

The subjective measure of pain by visual analogue scale at 48 hours, 1 week, 2 weeks and 4 weeks postoperatively revealed statistically significant lesser pain in the test side compared to control side only at 1 week and 2 weeks postoperatively (p value = 0.0001 and 0.0008 respectively).

To conclude we have found the placement of triamcinolone impregnated nasal packing improves

endoscopic findings in patients with sinonasal pathologies after nasal and sinus surgeries and provide better patient satisfaction, also the drug and dressing both are inexpensive, application is easy, it doesn't require more time or extra surgical expertise and the drug has almost no chances of adverse effects with its topical use. Pharmacological trials are recommended in future to elicit the amount of the drug delivered from nasal packing.

References

- [1]. Wright ED, Agrawal S. Impact of perioperative systemic steroids on surgical outcomes in patients with chronic rhinosinusitis with polyposis: evaluation with the novel Perioperative Sinus Endoscopy (POSE) scoring system. *Laryngoscope*. 2007 Nov;117 (11 pt 2 suppl 115):1-28.
- [2]. Chung JH, Cosenza MJ, Rahbar R, Metson RB. Mitomycin C for the prevention of adhesion formation after endoscopic sinus surgery: a randomized, controlled study. *Otolaryngol Head Neck Surg*. 2002 May;126 (5) : 468-74.
- [3]. Anand VK, Tabae A, Kacker A, Newman JG , Huang C. The role of Mitomycin C in preventing synechia and stenosis after endoscopic sinus surgery. *Am J Rhinol*. 2004 Sep – Oct; 18 (5): 311-4.
- [4]. Konstantinidis I, Tsakiropoulou E, Vital I, Triaridis S, Vital V, Constantinidis J. Intra and postoperative application of Mitomycin C in the middle meatus reduces adhesions and antrostomy stenosis after FESS. *Rhinology*. 2008 Jun;46(2):107-11.
- [5]. David W J Cote, Erin D. Wright . Triamcinolone-impregnated nasal dressing following Endoscopic Sinus Surgery: A randomized, double blind, placebo controlled study. *Laryngoscope* 2010;120:1269-1273.
- [6]. Desrosiers M, Hussain A, Frenkiel S, Kilty S, Marsan J, Witterick I, Wright E. Intranasal corticosteroid use is associated with lower rates of bacterial recovery in chronic rhinosinusitis. *Otolaryngol Head Neck Surg*. 2007 Apr;136(4):605-609.
- [7]. Gawchik SM, Saccar CL. A risk benefit assessment of intranasal triamcinolone acetonide in allergic rhinitis. *Drug Saf* 2000;23:309-322.
- [8]. Dijkstra MD, Ebbens FA, Poublon RM, Fokkens WJ. Fluticasone propionate aqueous nasal spray does not influence the recurrence rate of chronic rhinosinusitis and nasal polyps 1 year after functional endoscopic sinus surgery. *Clin Exp Allergy*. 2004 Sep; 34(9): 1395-400.
- [9]. Shikani AH. Use of antibiotics for expansion of the merocel packing following endoscopic sinus surgery. *Ear Nose Throat J* 1996;75:524-526.
- [10]. Badia L, Lund V. Topical corticosteroids in nasal polyposis. *Drugs*. 2001;61(5):573-8
- [11]. Szeffler SJ. Pharmacokinetics of intranasal corticosteroids. *J Allergy Clin Immunol*. 2001 Jul; 108(1 Suppl): S26-31.
- [12]. Cesar IC, Byrro RM, de Santana e Silva Cardoso FF, Mundim IM, de Souza Teixeira L, de Sousa WC, Gomes SA, Bellorio KB, Bretas JM, Pianetti GA. Determination of Triamcinolone in human plasma by a sensitive HPLC-ESI-MS/MS method: application for a pharmacokinetic study using nasal spray formulation. *J Mass Spectrom*. 2011 Mar; 46(3): 320-6. doi: 10.1002/jms.1896
- [13]. Lavigne F, Cameron L, Renzi PM, Planet JF, Christodoulouopoulos P, Lamkioued B, Hamid Q. Intranasal administration of topical budesonide to allergic patients with chronic rhinosinusitis following surgery. *Laryngoscope*. 2002 May; 112(5): 858-64
- [14]. DelGaudio JM, Wise SK. Topical steroid drops for the treatment of sinus ostia stenosis in the postoperative period. *Am J Rhinol*. 2006 Nov-Dec; 20(6): 563-7.
- [15]. Kang IG, Yoon BK, Jung JH, Cha HE, Kim ST. The effect of high -dose topical corticosteroid therapy on prevention of recurrent nasal polyps after revision

endoscopic sinus surgery. Am J Rhinol. 2008 Sep-Oct; 22(5): 497-501. Epub 2008 Aug 4.

[16]. Weitzel EK, Wormald PJ. A scientific review of middle meatus packing/stents. Am J Rhinol. 2008 May-Jun; 22(3): 302-7.

[17]. Orlandi RR, Lanza DC. Is nasal packing necessary following endoscopic sinus surgery ? Laryngoscope. 2004 Sep ; 114(9): 1541-4.

[18]. Camalis E. Effect of glucocorticoids on type I collagen synthesis, alkaline phosphatase activity, and

DNA content in cultured rat calvariae. Endocrinology 1983;112:931-939.

[19]. Goforth P, Gudas CJ. Effects of steroids on wound healing: a review of the literature. J Foot Surg 1980;19:22-28.

Annexure 1: Modified Perioperative Sinus Endoscopy Score

MIDDLE TURBINATE		RIGHT	LEFT
NORMAL	0		
SYNAECHIAE / LATERALIZED	1-2		
MIDDLE MEATUS/MMA		RIGHT	LEFT
HEALTHY	0		
NARROWING/CLOSURE	1-2		
MAXILLARY SINUS CONTENTS	1-2		
ETHMOID CAVITY		RIGHT	LEFT
HEALTHY	0		
CRUSTING	1-2		
MUCOSAL OEDEMA	1-2		
POLYPOIDAL CHANGE	1-2		
POLYPOSIS	1-2		
SECRETION	1-2		
NASAL SEPTUM		RIGHT	LEFT
NORMAL	0		
DEVIATED/ SYNECHIAE	1-2		
INFERIOR TURBINATE		RIGHT	LEFT
NORMAL	0		
HYPERTROPHIED/ SYNECHIAE	1-2		

MAXIMUM SCORE = 20