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Original Article

Is intranasal dexamethasone effective in reducing sore throat following surgery?

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Abstract

Objectives: Postextubation, individuals may experience the discomfort of a sore throat. Our main aim of the study was to investigate if intranasal dexamethasone is successful in reducing postoperative sore throat occurrence. **Materials and Methods:** The study involved 96 adult individuals who were scheduled for elective eye surgery at Faiz Medical Center, which is affiliated with Isfahan University, between July 2020 and March 2021. The individuals were assigned by chance to two cohorts of 48 people each, with one cohort getting dexamethasone (IND) through the nose and the other cohort getting normal saline (INS) through the nose right after the endotracheal tube insertion. The presence of symptoms such as aching throat, cough, and hoarseness after surgery was recorded and examined with version 23 of the SPSS software. **Results:** Upon analysis, it was observed that there were no statistically significant alterations in demographic attributes, tracheal intubation variables, duration of surgery, and postoperative outcomes ($P < 0.05$). Within the IND cohort, a notable 80.2% decrease in the occurrence of sore throat was noted immediately following the surgical procedure, along with a 34% reduction within the initial 6 hours of hospital stay ($P < 0.001$). Moreover, dexamethasone also decreased the occurrence of cough and hoarseness by 31.7% and 38.2% during recovery, as well as 19% and 25.4% within the initial 2 h upon admission to the ward ($P < 0.001$). **Conclusion:** The current study showcased the preventive impact of dexamethasone intranasally in decreasing the occurrence of sore throat in the early stages of postoperative period. Nevertheless, its efficacy diminished after 6 h. Furthermore, the intranasal application of dexamethasone exhibited the ability to alleviate hoarseness and cough within the first 2 h following surgical intervention.

Keywords: *Complications, Dexamethasone, Intubation tracheal, Nasal administrations, Ophthalmologic surgical procedure*

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Introduction

Postoperative sore throat (POST) is a frequently encountered and distressing consequence following surgical procedures that often occurs in individuals and often occurs in people who have undergone intubation. Studies have shown that the occurrence of postoperative sore throat (POST) varies significantly, with reported rates ranging from 12.1% to 70%. This complication is associated with injury resulting from tracheal intubation, which may include damage to epithelial and mucous cells, harm to the vocal cords, as well as the formation of blood clots. Other factors have been identified as contributing to the development of POST, such as the use of an oversized tube, the shape of the cuff, and the pressure exerted by the cuff [1].

The satisfaction and activity of patients are negatively impacted by POST following their discharge from the hospital [2]. Several investigations have been conducted within the realm of anesthesiology, yet a definitive intervention to prevent POST has not been established. Prior research has shown the impact of dexamethasone in alleviating event of POST when administered through different approaches [3-8]; such as intravenous administration, nebulization or by applying dexamethasone to the cuff of an endotracheal tube [9-11]. Dexamethasone, a powerful glucocorticoid, possesses notable anti-inflammatory and analgesic properties, along with antiemetic effects [12]. The preoperative use of intravenous dexamethasone 8mg has been shown to decrease

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the occurrence and intensity of postoperative sore throat in individuals undergoing general anesthesia with endotracheal intubation [13]. Intranasal administration of medications is a preferable method of drug intake due to its enhanced efficacy and reduced adverse effects compared to oral and injectable forms. This route of administration ensures a quicker onset of action and improved bioavailability, as it bypasses the liver metabolism before entering the systemic circulation [14]. The intranasal administration of dexamethasone exhibits a blood bioavailability that is equivalent to intravenous form of it. Consequently, the utilization of dexamethasone intranasally could be regarded as a minimally invasive approach for managing Inflammation throughout the body or averting future episodes of nausea with or without vomiting. The nasal mucosa serves as a highly vascular route for delivering substances directly to the brain via the olfactory nerve sheath. This process facilitates systemic absorption and enables a swift onset of action. This process not only aids in systemic absorption but also enables a swift onset of action. Moreover, this pathway effectively hinders the initial metabolism that occurs in the digestive system and hepatic, consequently prolonging the duration of effectiveness and potentially improving the capacity for tolerance toward administration through a vein [15-17]. Intranasal corticosteroids modulate both the initial and delayed inflammatory reactions By suppressing the production of cytokines, pro-inflammatory factors, enzymatic inflammatory factors, lymphocyte production, and delayed onset hypersensitivity [18].

Upon reviewing the existing literature, no previous study has examined the impact of prescribing IND on alleviating the POST. Hence, we initiated the present study to fill this void.

Materials and methods

Study design

The study design for this research project was formally recorded at the Iranian Clinical Trials Center with the identification code IRCT20180416039326N7 on May 31, 2019. The study was carried out according to Helsinki declaration and the CONSORT guidelines [19]. The research included 96 individuals, separated into two groups of 48 each.

The study took place since July 2020 until March 2021 at the Faiz Eye Medical Center, Isfahan, Iran. The Ethical Committee of Isfahan University granted the research permit bearing the identification number Ir.mui.med.rec. 1397.374. Additionally, before their participation, all patients duly provided informed consent.

Participants

Inclusion and exclusion criteria

This research recruited individuals who fulfilled the eligibility requirements, which encompassed being above 18 years old and possessing an ASA class I–II. These individuals were considered potentially eligible for ophthalmic surgery and had duly given their consent in writing. This study did not include individuals who had experienced throat discomfort or a recent respiratory infection, recent use of painkillers or steroids, a history of hypersensitivity to dexamethasone, or had a feeding tube. Additionally, patients who required multiple attempts for tracheal intubation, or had a tracheal intubation duration exceeding 5 hours or less than 1 hour, were also excluded from the study. Patients who experienced bouts of vomiting throughout the research stages were likewise ruled out from the statistical examination of the data.

Interventions

Upon arrival in the surgical suite, each patient was subjected to routine monitoring procedures, which included an electrocardiography, pulse oximetry, capnography, and sphygmomanometer. The anesthetist nurse who prepared the medications under investigation was not affiliated with the study team. The drugs were divided into two sets of syringes, one containing dexamethasone ampule (8 mg in a volume of 2 mL) and the other containing normal saline (with a volume of 2 mL).

In both cohorts, the administration of anesthesia in two distinct groups involved the utilization of identical medication with a standardized dosage. Before intubation, ventilation under the mechanical control was conducted for a duration of 3 min using a face mask and 100% oxygen. Subsequently, laryngoscopy was conducted on all participants in both cohorts using a laryngoscope that was fitted with Macintosh blade size 3. Subsequently, the patients were intubated with a PVC tube that featured a cuff with low pressure and high volume and had a diameter of internal either 7 or 7.5 mm, depending on the gender of the patient.

The classification of views obtained through direct laryngoscopy according to the structures seen is known as the Cormack-Lehane system [20]. Following the insertion of the tracheal tube, the tube cuff was inflated to a pressure of 20 cm of water using an aneroid manometer, in order to verify the absence of any air leakage. Subsequently, within the IND cohort, dexamethasone (8 mg/2 mL, Alborz Darou) was administered at a dose of one milliliter (equivalent to 4 milligrams) in each nostril. In contrast, within the INS cohort, a quantity of normal saline measuring 1 ml was administered in each nostril. All steps of anesthesia intervention were carried out by an anesthesiologist who had no knowledge of the type of drug that was administered. Upon completion of the surgery, the residual neuromuscular blockade effects were reversed by the use of atropine and neostigmine at dosages of 20 and 40 μg/kg, respectively. In a conscious individual, the cuff of the tube was depressurized, followed by the extracted the tracheal tube.

Following this, the patient was administered 100% oxygen via a mask. Subsequently, the individuals were moved to the recovery unit, where they received standard monitoring.

To facilitate the transfer of patients to the ward, a modified Aldrete score system ranging from 0 to 10 was employed. Participants who scored equal to or more than 9 were deemed suitable for transfer to the ward [21,22]. An anesthesiologist outside the research team, distinct from the individual who managed anesthesia, evaluated the participant for symptoms such as POST, cough, and hoarseness for 24 h.

The subjects under investigation were categorized into two groups: those who did not report any symptoms and those who

reported experiencing all of these symptoms. The prevalence of sore throat following surgery was assessed by determining the proportion of individuals who encountered the condition to all participants enrolled in the research.

Outcome measures

Our research primarily focused on evaluating the frequency of POST as the principal endpoint. Additionally, the research also examined secondary outcomes such as the incidence of hoarseness, cough, and the quantity of intubation endeavors. Furthermore, a view of laryngoscopy was carried out utilizing the criteria of Cormack–Lehane.

Randomization and blinding

The nurse responsible for individual allocation in the study cohort utilized a table of random numbers generated by the computer. The outcomes of this allocation were carefully safeguarded in sealed, nontransparent envelopes. Before the patient was brought into the operating theater, a separate nurse, not associated with the research group, allocated the patient to either the intranasal dexamethasone cohort or the intranasal saline cohort according to the designated number. Throughout the research period, the participant, the data collector, and the anesthesiologist remained blinded to the patient's drug assignment.

Sample size

Prior studies have indicated that the frequency of throat discomfort can fluctuate by 30% with the administration of dexamethasone [23]. Given that a 20% alteration in the occurrence of POST 1 h after removal of tracheal tube is deemed clinically important, each group needed 44 participants (given a notable threshold of 0.05 and power of study 80%). Factoring in a 10% of dropout rate, a total of 96 patients were deemed necessary.

Statistical analysis

Finally, the collected data were entered into SPSS software, version 23 (IBM SPSS, Armonk, NY, USA), The data were presented as mean ± standard deviation or frequency (percentage of frequency). To assess the statistical variances between cohorts, the *t*-test was utilized to assess differences among variables including age, weight, length of tracheal intubation, and surgical procedure.

The Chi-square test was employed to assess the dissimilarity between sex, status of ASA, and Cormack–Lehane grading between groups. Furthermore, the occurrences of POST, hoarseness, and cough within 24 h postsurgical procedure were examined through statistical analysis using the Chi-square and Fisher's exact test, as considered suitable, in order to identify any disparities among the various groups. The Kolmogorov–Smirnov test results provided evidence supporting the assumption that the data adhered to a normal distribution. A significance level of 5% (95% confidence interval) was employed to determine whether to accept or reject the null hypothesis. Notably, any $P < 0.05$ was deemed to be statistically notable within the context of this research.

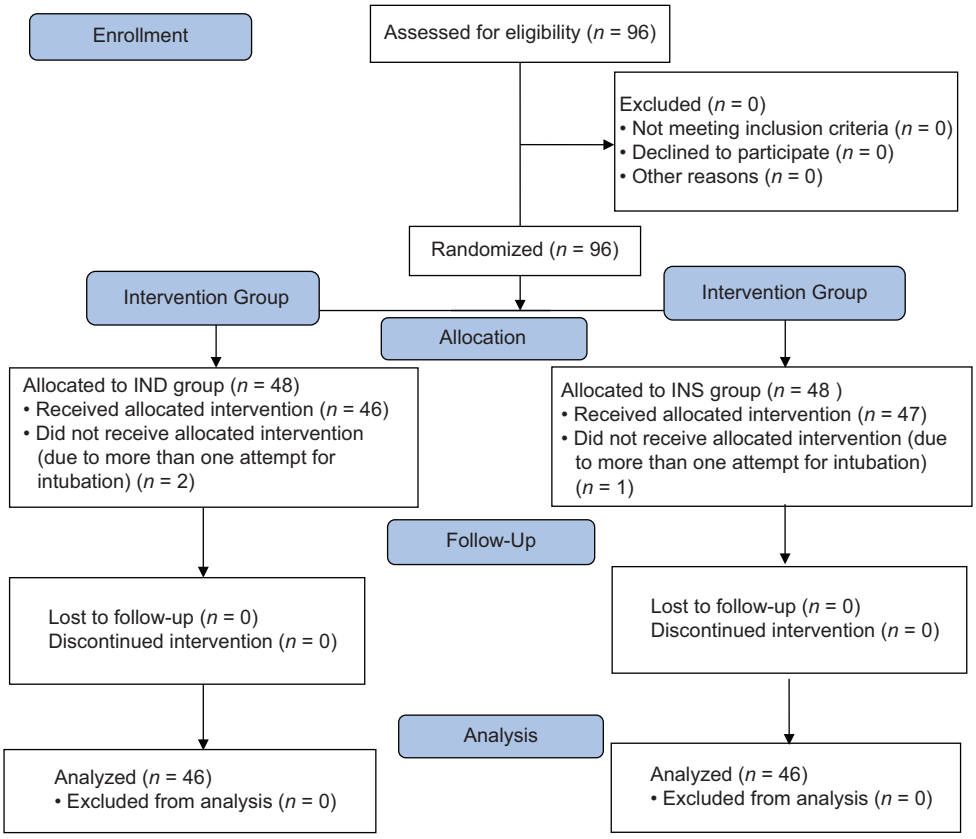

Figure 1: Consort diagram of study [19].

Results

During the present research, two participants from the IND group and one participant from the INS group were excluded from the study's analysis as a result of more than one attempt for intubation [Figure 1].

The INS cohort included 53.2% female and 46.8% male, and the IND cohort consisted of 51.2% female and 48.8% male. The average age in the IND and INS cohorts was 63.1 ± 12.5 years and 64.6 ± 11.6 years, respectively, with $P > 0.05$ [Table 1].

As shown in Table 2, no notable disparities were found among the cohorts in terms of intubation time, surgery time, grade of C-L, and recovery time ($P > 0.05$). Nevertheless, the IND group showed a notably shorter average recovery time compared to the INS group, with 29.8 ± 15.68 min versus 35.2 ± 84.04 min ($P = 0.010$).

Within IND cohort, the occurrence of sore throat was diminished by 80.2% in the 1st h postsurgery (during recovery) and by 34% within the first 6 h of hospitalization in the ward ($P < 0.001$). Although the IND cohort exhibited a reduced occurrence of POST in the ward after a span of 6 h, no notable statistical distinction was observed among the cohorts (P value exceeds than 0.05). Moreover, the occurrence of cough and hoarseness during recovery decreased by 31.7% and 38.2% respectively, and within the first 2 h after transfer to the ward, there was a reduction of 19% and 25.4% compared to the INS cohort ($P < 0.001$). Subsequently, although these symptoms were less frequent in the IND cohort, there was no notable difference in the remaining time periods (P value exceeds than 0.05) [Table 3].

Table 1: Patient demographic variables across two distinct cohorts

Variable	INS cohort (*n*=47), *n* (%)	IND cohort (*n*=46), *n* (%)	*P*
Gender			
Female	25 (53.2)	24 (51.2)	0.922*
Male	22 (46.8)	22 (48.8)	
Age (years)	64.6±11.6	63.1±12.5	0.118**
BMI (kg/m^2)	25.78±4.11	24.74±3.72	0.845**
ASA			
I	21 (44.7)	28 (60.9)	0.118*
II	26 (55.3)	18 (39.1)	
Co-existing disease			
DM	2 (4.3)	2 (4.3)	0.720*
HTN	5 (10.6)	5 (10.6)	
DM and HTN	9 (19.1)	9 (19.1)	

*Chi-square test result, **Independent sample *t*-test result. BMI: Body mass index, DM: Diabetes mellitus, HTN: Hypertension, ASA: American Society of Anesthesiologists

Table 2: Analyzing of intubation variables, surgery duration, and the recovery time

Variable	INS cohort (*n*=47), *n* (%)	IND cohort (*n*=46), *n* (%)	*P*
C-L grading			
Grade 1	20 (42.6)	23 (50)	0.517*
Grade 2	21 (44.7)	15 (32.6)	
Grade 3	5 (12.7)	7 (15.2)	
Grade 4	0	1 (2.2)	
Intubation time (min)	79.60±30.94	82.75±32.9	0.793**
Surgical time (min)	72.23±31.15	67.38±29.4	0.461**
Length of stay in the PACU (min)	84.04±35.2	68.15±29.8	0.010**

*Chi-square test result, **Independent sample *t*-test result. C-L: Cormack–Lehane, INS: Normal saline, IND: Dexamethasone, PACU: Postanesthesia care unit

Discussion

The results of the study indicated that there was no notable statistical variance between the IND and INS cohorts in regard to demographic features, ASA classification, Cormack-Lehane grading, intubation duration, surgery duration, and complications associated with intubation.

During the recovery period and up to 6 h posthospitalization, the IND cohort showed a notable decrease in sore throat, as well as a significant reduction in cough and hoarseness up to 2 h after hospitalization when compared to the INS cohort.

Nevertheless, following these specific time intervals, despite the fact that the occurrence of these issues continued to be less frequent in the IND cohort in contrast to the INS cohort, there was no notable distinction among cohorts. Additionally, the duration spent in the recovery unit was notably reduced in the IND cohort in comparison to the INS cohort. During the literature review, no research was identified that specifically examined the influence of intranasal dexamethasone on postoperative symptoms such as throat pain, coughing, and voice changes. Consequently, in the subsequent discussion, studies focusing on the effects of intravenous dexamethasone on these symptoms were referenced.

Bagchi *et al*. conducted a study in which they observed that the administration of dexamethasone through intravenous route at a dosage of 0.2 mg/kg resulted in a diminishing of approximately 30% in the occurrence of sore throat following surgery within the 1st h after tube removal. The effectiveness of this approach was determined to be 60% based on their calculations [23].

In a review study, the positive impact of administering dexamethasone through intravenous in diminishing the occurrence of sore throat within the period of 1–24 h after intratracheal intubation [11]. A meta-analysis revealed a notable correlation between the administration of dexamethasone exceeding 0.1 mg/kg and a diminishing in the likelihood of sore throat following surgery [24].

On the other hand, in their research, Kajal *et al.* determined that the administration of dexamethasone intravenously and applying betamethasone gel over the cuff of tracheal tube are efficacious approaches in reducing POST [25]. Lee's research revealed that the application of dexamethasone gargle 0.05% on the oral mucosa proves to be an efficient method in preventing POST. This preventive measure primarily focuses on local pain receptors rather than having a widespread impact on the body. By directly acting on the pharyngeal mucosa, dexamethasone

Table 3: Comparison of the incidence of inappropriate side effects following endotracheal tube removal in two separate groups

Variables	Follow up	INS cohort (*n*=47), *n* (%)	IND cohort (*n*=46), *n* (%)	*P**
Sore throat				
In recovery	Half-hour	41 (87.2)	5 (10.9)	<0.001
	1 h	41 (87.2)	4 (8.7)	<0.001
In ward (h)	2	32 (68.1)	5 (10.9)	<0.001
	6	18 (38.3)	2 (4.3)	<0.001
	12	3 (6.4)	1 (2.2)	0.617
	24	1 (2.1)	1 (2.2)	1.00
Cough				
In recovery	Half-hour	27 (57.4)	4 (8.7)	<0.001
	1 h	19 (40.4)	4 (8.7)	0.001
In ward (h)	2	12 (25.5)	3 (6.5)	0.011
	6	3 (6.4)	2 (4.3)	1.00
	12	3 (6.4)	1 (2.2)	0.617
	24	1 (2.1)	1 (2.2)	1.00
Hoarseness				
In recovery	Half-hour	28 (59.6)	4 (8.7)	<0.001
	1 h	21 (44.7)	3 (6.5)	<0.001
In ward (h)	2	15 (31.9)	3 (6.5)	0.003
	6	7 (14.9)	2 (4.3)	0.159
	12	6 (12.8)	1 (2.2)	0.111
	24	0	1 (2.2)	1.00

*Fisher's exact test result. INS: Normal saline, IND: Dexamethasone

gargle allows the medication to specifically address the root cause of POST [26]. Research by Park *et al*. (2013) showed that in patients treated with dexamethasone gargle, the severity of chronic graft versus host disease (cGVHD) and levels of pain experienced by individuals with oral symptoms were found to be significantly reduced [27].

However, in contrast to these findings, Kamranmanesh and Gharaei carried out an investigation involving pediatric patients suffering from infection of the upper respiratory tract and scheduled for Laryngeal mask placement and intravenously administered a blend of dexamethasone and hydrocortisone at a dosage of 0.1 mg/kg for each drug. They concluded that this combination had no positive impact on POST. The variance in outcomes could be linked to the existence of upper respiratory tract infections in pediatric patients, potentially impeding the efficacy of corticosteroids [28].

Our research found that the use of intranasal dexamethasone resulted in a reduction in postoperative sore throat. This finding aligns with prior research conducted on the use of dexamethasone intravenously [7,11,25-27].

Prior research has documented the analgesic properties of topical dexamethasone [29]. The current study suggests that dexamethasone localized action plays a part in alleviating POST.

According to a review of articles carried out by Zhao *et al*., the findings indicated that the administration of dexamethasone intravenously was successful in reducing both postintubation hoarseness and cough symptoms [11].

The research conducted by Park and his colleagues revealed that the prophylactic administration of dexamethasone at a 0.2 mg/kg dosage is more effective than the 0.1 mg dosage in reducing the frequency and severity of hoarseness within the first hour and 24 hours after extubation [30].

During the duration of our study, the occurrence of hoarseness and cough was found to be less frequent in the cohort that received dexamethasone intranasally in comparison to the cohort that received intranasal saline. This finding aligns with previous research conducted on the subject [11,30].

Surender *et al*. conducted a study that showcased the significant enhancement in the recovery phase's quality following laparoscopic cholecystectomy through the intravenous administration of dexamethasone [31].

The results of a separate investigation suggest that there was no significant variance in the patient recovery process between the 8 mg and 24 mg doses of dexamethasone following mastectomy [32].

The results of this study align with previous research regarding the impact of dexamethasone on reducing recovery time [31,32].

Intranasal dexamethasone has demonstrated similar efficacy to intravenous dexamethasone in decreasing postoperative inflammation [33].

Advantages of intranasal administration of corticosteroids include their noninvasive nature, rapid onset of action, and often reduced incidence of side effects due to a more precise and focused delivery mechanism [34]. Topical steroids cause minimal adverse effects. The primary side effects associated with intranasal corticosteroids stem from local irritation, such as dryness, a burning sensation, and blood-tinged secretions [35].

The study is associated by several limitations, such as the limited sample size, the administration of a fixed dosage of dexamethasone, the absence of assessment regarding the potential adverse effects of intranasal dexamethasone, particularly its impact on blood sugar levels in diabetic subjects, and the restriction of the research to a single medical facility. Hence, it is advisable to carry out multicenter research with larger participant cohorts and various dosages of dexamethasone for intranasal administration.

Conclusions

The current study showcased the preventive impact of dexamethasone intranasally in diminishing the occurrence of sore throat in the early stages of postoperative period. Nevertheless, its efficacy diminished after 6 h. Furthermore, the intranasal application of dexamethasone exhibited the ability to alleviate hoarseness and cough within the first 2 h following surgical intervention.

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Data availability statement

The results of the present investigation are available upon request by contacting the corresponding author.

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Conflicts of interest

There are no conflicts of interest.

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