Dexamethasone reduces the severity of postoperative sore throat

[La dexaméthasone réduit la sévérité du mal de gorge postopératoire]

Siji Thomas MD, Suhara Beevi MD

Purpose: Dexamethasone may have potential advantages in the prevention of postoperative sore throat. We therefore undertook a study to evaluate the efficacy of intravenously administered dexamethasone in reducing the incidence and severity of postoperative sore throat in patients receiving general anesthesia with endotracheal intubation.

Methods: In a randomized, double-blind and placebo-controlled study, 120 patients receiving general anesthesia with endotracheal intubation were randomly assigned to two groups. Group 1 (control) patients received normal saline 2 mL *iv* and group 2 (D) patients received dexamethasone 8 mg *iv*. After surgery, visual analogue scale (VAS) scores at rest and with effort (swallowing movement) for postoperative sore throat were recorded by a blinded observer.

Results: The overall incidence of postoperative sore throat during the first 24 hr following surgery was lower in dexamethasone group (D) compared to the control group (C). Eleven (20%) patients in the dexamethasone group had postoperative sore throat, compared to 31 (56.3%) patients in the control group ($P < 0.01$). Postoperatively at one hour, three hours, six hours, 12 hr and 24 hr, the VAS scores for postoperative sore throat at rest and during effort were lower in the dexamethasone group (D) compared to the control group ($P < 0.01$) at corresponding time intervals.

Conclusion: Preoperative administration of dexamethasone 8 mg *iv* reduces the incidence and severity of postoperative sore throat in patients receiving general anesthesia with endotracheal intubation.

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Objectif *: La dexaméthasone pourrait avoir des avantages potentiels pour la prévention des maux de gorge postopératoires. C'est pourquoi nous avons entrepris une étude afin d'évaluer l'efficacité de la dexaméthasone administrée en iv dans la réduction de l'incidence et de la sévérité des maux de gorge postopératoires chez les patients recevant une anesthésie générale avec intubation endotrachéale.*

Méthode *: Dans une étude randomisée, en double aveugle et contrôlée par placebo, 120 patients recevant une anesthésie générale avec intubation endotrachéale ont été randomisés en deux groupes. Les patients du groupe 1 (témoin) ont reçu du sérum physiologique 2 mL iv et les patients du groupe 2 (D) ont reçu de la dexaméthasone 8 mg iv. Après la chirurgie, les scores de l'échelle visuelle analogue (EVA) au repos et à l'effort (mouvement de déglutition) pour les maux de gorge postopératoires ont été enregistrés par un observateur en aveugle.*

Résultats *: L'incidence globale de mal de gorge postopératoire durant les premières 24 h suivant la chirurgie était plus basse dans le groupe dexaméthasone (D) comparé au groupe témoin (C). Onze (20 %) patients du groupe dexaméthasone ont souffert de mal de gorge postopératoire, comparé à 31 (56,3 %) patients dans le groupe témoin ($P < 0,01$). A une heure, trois heures, six, douze et 24 heures postopératoires, les scores EVA pour le mal de gorge postopératoire au repos et à l'effort étaient plus bas dans le groupe dexaméthasone (D) que dans le groupe témoin ($P < 0,01$) aux intervalles de temps correspondants.*

Conclusion *: L'administration préopératoire de dexaméthasone 8 mg iv réduit l'incidence et la sévérité des maux de gorge postopératoires chez les patients recevant une anesthésie générale avec intubation endotrachéale.*

From the Department of Anesthesiology, Amala Institute of Medical Sciences, Thrissur, Kerala, India.

Address correspondence to: Dr. Siji Thomas, Valiamiyalil, Kainady Layout. Florican Road, Malaparamba, Calicut – 673 009, Kerala, India. Phone: +91-495-2372470; E-mail: sijithomas2k@yahoo.com

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POSTOPERATIVE sore throat is a common complaint in patients receiving general anesthesia with endotracheal intubation. The reported incidence of postoperative sore throat is up to 90%.[1] Sore throat is often the predominant postoperative complaint when surgical pain is well controlled, particularly by local/regional analgesia. Factors contributing to the development of sore throat include trauma to pharyngolaryngeal mucosa from laryngoscopy, placement of a nasogastric tube, or oral suctioning,[2] cuff design, pressure affecting tracheal mucosal capillary perfusion[3,4] and contact of the tracheal tube with the vocal cords and posterior pharyngeal wall resulting in edema or mucosal lesions.[5] The common measures for the prevention of postoperative sore throat include the use of endotracheal tubes with a low intracuff pressure,[4,6] smaller-sized endotracheal tubes,[5] topical lidocaine,[7] steroid coated endotracheal tubes,[8] and inhalation of steroids.[9]

Dexamethasone is a potent corticosteroid with analgesic, anti-inflammatory and antiemetic action.[10–12] Preoperative dexamethasone has been reported to reduce the incidence of postoperative pain and swelling following oral surgeries.[10–12] A previous study undertaken to evaluate the effect of dexamethasone on postoperative sore throat after endotracheal intubation did not address the numerous confounding factors responsible for sore throat.[13] With this background knowledge, a prospective, randomized, double-blind, placebo-controlled study was undertaken to test whether a reduction in the incidence and severity of postoperative sore throat could be achieved by preoperative administration of intravenous dexamethasone in patients receiving general anesthesia with endotracheal intubation.

Methods

After approval from local Ethics Committee and obtaining written informed consent, 120 patients of either sex requiring general anesthesia with endotracheal intubation for abdominal and lower limb surgeries, estimated to last one to three hours were enrolled in this prospective, randomized, double-blinded, placebo-controlled study. Included were patients of ASA class I and II, between 20-60 yr of age and weighing between 40–75 kg. Patients with a history of recent respiratory tract infection, risk factors for postoperative aspiration, cardiac, respiratory, hepatic or major renal diseases, obesity, diabetes mellitus, pregnancy, prior treatment with analgesics, use of corticosteroids and calcium channel blockers, and those with neuromuscular diseases were excluded. Finally, any contraindication to corticosteroid medications or failure of the patient to understand the study procedure resulted in exclusion.

The protocol for study and the use of visual analogue scale (VAS) were explained to all patients during their preoperative visit to the hospital. Patient randomization was done with the use of computer-generated codes. Only the pharmacist and the statistician knew the identity of the study medication. Procedures were in place to break the codes in the event of any adverse reaction. Patients were to receive one of the two assigned study medications: group 1 (control) patients received normal saline 2 mL *iv*, group 2 (D) patients received dexamethasone 8 mg *iv* (Decdan; 4 $mg \cdot mL^{-1}$; Merind, Mumbai, India).

On the day of surgery patients were premedicated with alprazolam 0.5 mg, *po* preoperatively. In the operating room routine monitors were applied [electrocardiogram), non-invasive blood pressure monitor and pulse oximeter (SpO_2)]. Patients were randomly allocated to receive an injection of either dexamethasone 8 mg *iv* or an equivalent volume of normal saline. Prior to induction of anesthesia a lumbar epidural catheter was placed and tested. Bupivacaine 0.25% was administered intraoperatively and postoperatively into the epidural catheter by continuous infusion at rates between 6–8 $mL \cdot hr^{-1}$. Anesthesia was induced with propofol 2 $mg \cdot kg^{-1}$ *iv* and morphine 0.1 $mg \cdot kg^{-1}$ *iv*, with orotracheal intubation facilitated by vecuronium 0.1 $mg \cdot kg^{-1}$ *iv*. Endotracheal tubes (ETT) with a low-pressure cuff (Portex; Portex Limited, UK) were used. Laryngoscopy was performed by the same anesthesiologist in both groups using standard 3 or 4 Macintosh metal blades. Male patients received either an 8 or 8.5 mm internal diameter (ID) ETT and female patients received either a 7 or 7.5-mm ID ETT. Application of external laryngeal pressure to aid endotracheal intubation was recorded. The cuff was inflated just to the point of obtaining a seal in the presence of positive airway pressure. Intracuff pressure was adjusted every 30 min as required using a pressure gauge to limit nitrous oxide-related intracuff pressure increase. Oral or nasal airways were not placed in any patient, coughing or bucking on the ETT, if any, were recorded. The lungs were mechanically ventilated with N_2O:O_2 (1:1) and isoflurane (0.7–1% end-tidal concentration) to maintain normocarbia. Intraoperatively the following parameters were monitored: mean arterial pressure, heart rate, arterial oxygen saturation (SpO_2), end-tidal CO_2 ($EtCO_2$) pre- and post-induction, and every 15 min thereafter until the end of surgery. Muscle relaxation was maintained by appropriate doses of vecuronium until skin closure. At the end of surgery, ondansetron 6 mg *iv* was administered and residual

neuromuscular block was antagonized with neostigmine and atropine. Oropharyngeal suction before extubation was done under direct vision to avoid trauma to the tissues as well as to confirm that secretion clearance was complete. Patients requiring more than two attempts at passage of an endotracheal tube were eliminated from the study. Presence of blood in the oropharyngeal suction or on the endotracheal tube after extubation also resulted in exclusion.

In the postanesthesia care unit, intensity of sore throat was assessed by a second trained observer who, along with the patient, was blinded to study group assignment. Visual analogue scale scores for sore throat (linear 10 cm, starting from 0 = no pain to 10 = worst pain imaginable) were recorded at rest and with effort (swallowing movement) at one hour postoperatively, and then at three-hour, six-hour, 12-hr and 24-hr intervals. Postoperative analgesia was obtained by continuous epidural infusion of bupivacaine 0.25%, no other analgesics or sedative medications were allowed during 24 hr after surgery. The rescue analgesia was given with epidural boluses of 0.25% bupivacaine 2 mL with a lock out interval of ten minutes. Metoclopramide 10 mg *im prn* was prescribed for nausea and/or vomiting. Hemodyanamic variables (heart rate, mean arterial pressure, SpO_2) and occurrence of any intra- or postoperative adverse events, including nausea and/or vomiting, coughing, hoarseness, dysphonia, or dysphagia were recorded.

Sample size calculation revealed that 55 patients per group would be required to detect a 50% reduction in the incidence of postoperative sore throat, assuming a 50% baseline incidence of sore throat after endotracheal intubation in the control group ($\alpha = 0.05$ and $\beta = 0.20$). Inter-group comparisons of demographic data were made using a Student's *t* test or Chi-square test for contingency tables as appropriate. Parametric methods were applied to normally distributed data by one-way analysis of variance (ANOVA) followed by Student's *t* test with Bonferroni correction. Non-parametric testing was done using the Mann-Whitney U test. Results are expressed as mean ± SD. A value of $P < 0.05$ was considered statistically significant.

Results

Of the 120 patients studied, ten (five patients in each group) were excluded from the data analysis. Of these patients, six patients required intravenous rescue analgesia apart from the usual epidural rescue analgesia, and four required more than two attempts at intubation. Patient characteristics in the remaining 110 subjects were comparable with respect to age, weight, smoking habits and intubation time (Table I).

TABLE I Demographic data

	Group 1 (control) (n =55)	*Group 2 (D) (n =55)*
Sex (M/F)	26/29	28/27
Age (yr)	43.33 ± 12.24	42.83 ± 11.82
Weight (kg)	64.26 ± 6.27	65.30 ± 5.94
Duration of surgery (min)	135.20 ± 30.25	129.80 ± 32.89
Smokers (%)	13 (23.63%)	15 (27.27%)

Data are presented as mean ± SD or number of patients (%).

TABLE II Factors associated with postoperative sore throat

	Group 1 (control) (n = 55)	*Group 2 (D) (n = 55)*
Second laryngoscopy attempt (%)	6 (10.9%)	5 (9.0%)
External laryngeal pressure (%)	10 (18.2%)	11 (20%)
Bucking or coughing during tracheal intubation (%)	0	1 (1.8%)
Nasogastric tube placement (%)	15 (27.3%)	17 (30.9%)

Data are number of patients (%).

TABLE III VAS scores at rest and during effort at different time intervals and the incidence of sore throat amongst the groups

	Group 1 (control) (n = 55)		*Group 2 (D) (n = 55)*	
Incidence (%)	31 (56.3%)		11*(20.0%)	
Time	*VAS (rest)*	*VAS (effort)*	*VAS (rest)*	*VAS (effort)*
1 hr	3.4 ± 1.2	4.5 ± 1.6	1.3 ± 0.5*	2.3 ± 0.7*
3 hr	3.2 ± 1.0	4.2 ± 1.3	1.2 ± 0.3*	2.2 ± 0.6*
6 hr	3.1 ± 1.0	4.0 ± 1.2	1.2 ± 0.4*	1.8 ± 0.5*
12 hr	2.8 ± 0.6	3.9 ± 1.1	0.9 ± 0.2*	1.7 ± 0.6*
24 hr	2.0 ± 0.7	3.8 ± 1.2	0.8 ± 0.3*	1.6 ± 0.6*

Data represent the mean ± (SD) or numbers of patients (%), *$P <$ 0.05 different from corresponding value of group 1. VAS = visual analogue scale.

The number of patients requiring a second attempt at endotracheal intubation, application of external laryngeal pressure during intubation, and bucking or coughing on the endotracheal tube was similar in both groups (Table II). The incidence of postoperative sore throat during the first 24 hr postoperatively was lower in the dexamethasone group (D) compared to the control group. Eleven (20%) patients in the dexamethasone group had postoperative sore throat compared to 31 (56.3%) patients in the control group ($P < 0.01$, Table III). The VAS scores at one hour, three hours, six hours, 12 hr and 24 hr, during

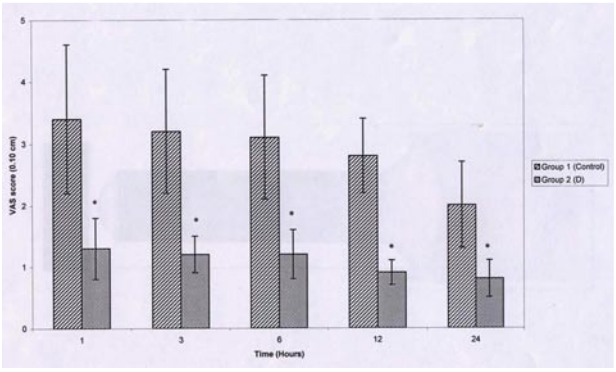

FIGURE 1 Visual analogue scale (VAS) of sore throat at rest. Data are mean ± SD. *P < 0.05 different from corresponding value of Group 1.

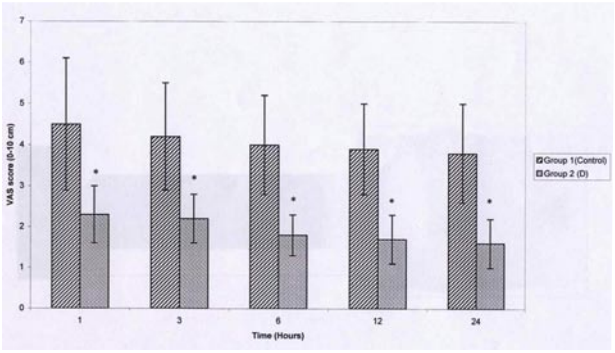

FIGURE 2 Visual analogue scale (VAS) of sore throat during effort. Data are mean ± SD. *P < 0.05 different from corresponding value of Group 1.

both rest and effort, were lower in group D than the control group (P < 0.01, Figures 1, 2, Table III). The percentage reduction in VAS scores at one hour, three hours, six hours, 12 hr and 24 hr in group D was 61.76%, 62.5%, 61.29%, 67.85% and 60% at rest and 48.8%, 47.6%, 55%, 56.4% and 57.8% with effort at corresponding sampling intervals. The frequencies of adverse events during the 24 hr observation period were comparable in both groups. One patient in the control group experienced nausea and vomiting; however no patient in either group experienced coughing, hoarseness, dysphonia, dysphagia or other side effects.

Discussion

The major finding of the present study is that dexamethasone 8 mg *iv* is effective in reducing the incidence and severity of sore throat after general anesthesia with laryngoscopy and orotracheal intubation. A previous study undertaken to evaluate the role of dexamethasone for the prevention of postoperative sore throat after endotracheal intubation did not address the confounding factors responsible for sore throat.[13] The dose and time of administration of dexamethasone in our study was similar to a previous investigation which showed a reduction in postoperative surgical pain in patients undergoing molar dental extractions.[10]

Wang *et al.*[13] studied the effect of dexamethasone on postoperative sore throat in patients undergoing thyroidectomy and concluded that dexamethasone decreases postoperative sore throat. However, confounding factors influencing postoperative sore throat such as type of endotracheal tube,[3,4] type of cuff and intracuff pressure,[14] oral suctioning,[2] coughing or bucking on the endotracheal tube, blood staining on the endotracheal tube after extubation, and history of smoking and lung disease[15] were not controlled, as their study was primarily undertaken to examine the influence of dexamethasone on postoperative nausea and vomiting.

The incidence and intensity of sore throat in the dexamethasone group were lower than in the control group in the current investigation. These findings are consistent with the topical application of corticosteroid on the upper airway prior to endotracheal intubation.[8,9] In contrast, Hamelberg[16] found that there was an insignificant decrease in the incidence of postoperative sore throat when 1% hydrocortisone ointment is applied to endotracheal tube before intubation. Possible explanations for the differences between studies include anesthetic and interview techniques.[17] Later in 1991, Stride[18] used the same method as Hamelberg, together with standardized anesthesia and a direct questioning technique, and concluded that hydrocortisone ointment was ineffective in the prevention of postoperative sore throat, the probable reason being the presence of additive substances which are irritating to the tracheal mucosa.

Corticosteroids are capable of reducing the synthesis of inflammatory mediators, prostaglandins and leucotrienes by inhibiting phospholipase A_2 through production of calcium-dependent phospholipids binding proteins called annexins, taking several hours,[19] and by the inhibition of cyclo-oxygenase-2 during inflammation.[20] Only one patient in the control group in our study experienced nausea and vomiting. The favourably low incidence of nausea and vomiting was probably multi-factorial. Associated factors might include the use of ondansetron within the first six hours,[21] dexametha-

sone-ondansetron combination in the dexamethasone group,[22,23] and better non-opioid analgesia.[24,25]

Although a single dose of dexamethasone is considered safe, long-term administration of corticosteroids is associated with adverse events, such as glucose intolerance, susceptibility to infections, delayed wound healing, adrenal suppression and avascular necrosis of joints.[11] However, the dose of dexamethasone required for the prevention of postoperative sore throat, the time of administration and complete resolution of postoperative sore throat is not known.

In conclusion, a prophylactic single dose of dexamethasone 8 mg *iv* reduces the incidence and severity of sore throat following endotracheal intubation, with no apparent side effects.

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