original article

Beclomethasone inhaler versus intravenous lidocaine in the prevention of postoperative airway and throat complaints: a randomized, controlled trial

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BACKGROUND AND OBJECTIVE: Previous reports indicate that inhaled corticosteroids attenuate airway inflammation. Beclomethasone inhaler was highly effective in the prevention of postoperative airway symptoms. Intravenous lidocaine prior to endotracheal intubation has also been shown to decrease the incidence of postoperative sore throat and cough. The aim of the present study was to compare the effect of beclomethasone inhaler with various clinically used dosages of intravenous lidocaine prior to endotracheal intubation on the incidence and severity of postoperative sore throat, cough, sputum, hoarseness, and dysphagia.

PATIENTS AND METHODS: One hundred twenty patients undergoing elective operations were assigned to one of four treatments: intravenous lidocaine 1mg/kg (Group L1, n=30), intravenous lidocaine 1.5 mg/kg (Group L2, n=30), beclomethasone inhaler 50 µg (Group B, n=30) or intravenous normal saline (Group C, n=30). The incidence and severity of sore throat, cough, sputum, hoarseness, and dysphagia were compared between the beclomethasone inhaler and intravenous lidocaine groups before they left the operating room, 1 hour later, at time of the first postoperative drink or meal (for assessment of dysphagia), and on the morning after surgery.

RESULTS: In the evaluation of postoperative symptoms, the incidence and severity of sore throat were significantly lower in Group L2 and B than Group C ($P<.05$) at all time intervals. One and 20 hours after emergence from anesthesia, the incidence and severity of cough were significantly lower in Group L2 and B than Group C ($P<.05$). The incidence and severity of sore throat or cough was not significantly different between Groups L2 and B. Throughout the study, the incidence and severity of sputum were significantly lower in Group B than group C ($P<.05$).

CONCLUSION: Beclomethasone inhaler is comparable with intravenous lidocaine prior to intubation in decreasing postoperative sore throat and cough. In addition, beclomethasone inhaler decreases the incidence and severity of postoperative sputum.

Sore throat, cough, and sputum are common postoperative airway complications.[1] In many reports, mechanical stimulation related to endotracheal tube size, the pressure or design of the endotracheal tube cuff, or intubation procedure, were associated with sore throat.[1] Coughing exacerbates pain and increases intracranial or intraocular pressure in patients with brain disease or glaucoma.[2] Postoperative sputum production caused by excessive airway secretion leads to atelectasis and infectious pneumonia. Lidocaine decreases goblet cell secretion by suppressing neural control.[3,4] Takekawa and colleagues[2] showed that intravenous (IV) lidocaine prior to endotracheal intubation decreased the incidence of postoperative sore throat and cough. Routine tracheal intubation for elective surgical procedures can result in pathological changes, trauma and nerve damage, which may also account for postoperative throat symptoms such as hoarseness and dysphagia.[5-8] Airway inflammation may be important in the pathogenesis of these symptoms in intubated patients. The effect of inhaled corticosteroids on the attenuation of airway inflammation has been reported previously.[9]

Levy et al[10] showed that topical methylprednisolone is a useful adjuvant in the prevention of sore throat after intubation. In another study,[11] beclomethasone inhaler was highly effective in the prevention of postoperative sore throat and was therefore recommended before tracheal intubation for general anaesthesia. Based on the above studies, we hypothesized that inhaled beclomethasone may have a significant influence on postoperative airway and throat symptoms that is comparable with intravenous lidocaine. We designed this study to compare the effect of beclomethasone inhaler with various clinically used dosages of intravenous lidocaine prior to endotracheal intubation on the incidence and severity of postoperative sore throat, cough, sputum, hoarseness, and dysphagia.

PATIENTS AND METHODS

This randomized, double-blinded, prospective study was approved by the ethics committee of Isfahan University Hospital and written informed consent was obtained preoperatively from all patients. We enrolled 120 patients, aged 16-85 years, who were American Society of Anesthesiologists (ASA) physical status I-II without airway symptoms. Smokers, patients who underwent head and neck surgery or oral surgery, patients using inhaled or oral steroids, and patients requiring nasogastric tube placement were excluded. Also excluded were patients in whom laryngoscopy was attempted more than once or the duration of laryngoscopy was more than 15 seconds. Operations included gynecological, abdominal, and orthopedic surgery in the supine position with expected extubation immediately after the operation. On the morning of surgery, patients were assigned to one of four treatments in equal numbers with 30 patients in each group: lidocaine 1 mg/kg IV (group L1), lidocaine 1.5 mg/kg IV (group L2), 50 μgrams beclomethasone inhaler (Group B) or normal saline IV (Group C). To ensure proper patient allocation and double-blinding, treatment assignments (an equal number for each of the four treatments) were written on sheets of paper, which were folded up and shuffled in a large envelope. For each patient, a physician took one folded sheet from the envelope, and the patient was assigned to the treatment indicated on the sheet. The patient's name was written on the sheet to record the group assignment. Thereafter, the sheet was sealed in another envelope, which was not opened again until the evaluation was finished. Neither the patient nor the interviewer was notified of the results of the allocation.

Patients were premedicated with intravenous midazolam 0.05 mg/kg 20 minutes before induction of anaesthesia. Standard monitoring techniques including electrocardiography, non-invasive blood pressure measurement and pulse oxymetry were applied. Endotracheal intubation was completed smoothly following induction with fentanyl 2.5-3.0μ (g/kg, thiopental 4 mg/kg, and atracurium 0.5 mg/kg 5 minutes after intravenous lidocaine in group L1 and L2 or normal saline in group C. Immediately before intubation, beclomethasone spray was given in group B. Spraying of beclomethasone or intravenous injection of lidocaine or normal saline was done by the first anesthesiologist (RH) who was unaware of which drug he was administrating. During administration of the drugs, the second anesthesiologist (AY) went out of the operating room. After completion of drug treatment, the second anaesthesiologist (AY) returned to the operating room and performed intubation. Endotracheal tubes of 7.5 mm internal diameter for men and 7.0 mm internal diameter for women were used (PVC cuffed endotracheal tube; SUPA, Tehran, Iran). The cuff was inflated manually until no air leakage could be heard with a peak airway pressure at 20 cm H_2O. It was not touched during the operation. The duration of laryngoscopy (DOL) was measured in seconds. The difficulty of laryngoscopy (DFOL) was graded as follows: grade I, no difficulty; grade II, only the posterior extremity of the glottis was visible; grade III, only the epiglottis was visible; and grade IV, no recognisable structure was observed.[12] The second anaesthesiologist (AY) maintained anaesthesia with isoflurane 1-1.25% in oxygen and air in all patients. Nitrous oxide was not used. A third physician, (NA) who was blinded to patient allocation, asked the patients about sore throat, cough, sputum, hoarseness and dysphagia before they left the operating room, 1 hour later, at the time of the first postoperative drink or meal (for assessment of dysphagia), and on the morning after surgery. At the time of the first evaluation, the degree of sedation was assessed by the modified Ramsey Sedation Score (modified RSS: 1, patient anxious or agitated or both; 2, patient cooperative, orientated and tranquil; 3, patient responds to commands only; 4, patient responds to a glabellar tap; 5, patient does not respond).[13] Patients with a modified RSS of 1, 4 or 5 were regarded as inappropriate candidates for this study and were excluded. Severity of sore throat, cough, and sputum were graded as 0, no symptoms; 1, less severe than with a cold; 2, similar to that noted with a cold; 3, more severe than with a cold. Hoarseness was graded as 0, absent; 1, slight; 2, severe; and 3, preventing speech. Dysphagia was graded as 0, absent; 1, slight; 2, moderate; and 3, cannot swallow because of pain. Additional analgesics were not administered until completion of the first evaluation.

Results are expressed as either mean±SEM, as a percentage, or as a number. Patient age, height, weight, duration of laryngoscopy or intubation were compared between groups and tested statistically by analysis of variance (ANOVA). Between-group differences in patient sex, ASA, difficulty of laryngoscopy and the incidence of symptoms were analysed by the chi-square test and Fisher's exact test. The Kruskal-Wallis and Mann-Whitney U tests were used to analyze differences in the severity of symptoms between groups. All statistical analyses were performed with SPSS 13.0. Probability values of less than 0.05 were considered significant. From a pilot study, we estimated that 30 patients were required to provide 80% power to have a smaller proportion of 0.1, a difference of 0.3, and a type I error of 0.05.

RESULTS

All four groups were comparable with respect to demographic characteristics, and there were also no significant differences between the groups in surgical time and duration or difficulty of laryngoscopy (Table 1). For all time intervals, the incidence and severity of sore throat were significantly lower in group L2 or B than group C ($P<.05$) (Table 2, 3). The incidence and severity of sore throat was not significantly different between groups L2 and B. One and 20 hours after emergence from anesthesia, the incidence and severity of cough were significantly lower in group L2 or B than group C ($P<.05$). The incidence and severity of cough was not significantly different between groups L2 and B. Throughout the study, the incidence and severity of sputum was significantly lower in group B than group C ($P<.05$). The incidence of sputum was not significantly different between groups L1, L2, and C. The incidence and severity of postoperative hoarseness or dysphagia was not significantly different between the groups in all time intervals. There were no complications related to administration of lidocaine or beclomethasone.

DISCUSSION

Our data show that a 50-µgram beclomethasone inhaler is comparable to intravenous lidocaine 1.5 mg/kg and significantly decreased the incidence and severity of postoperative sore throat and cough compared with placebo. Our study also showed that in contrast to intravenous lidocaine, beclomethasone inhaler significantly decreased the incidence and severity of sputum after surgery. The incidence and severity of hoarseness or dysphagia was not significantly different between groups in the present study.

Postoperative sore throat is a common complication following endotracheal intubation, with reported incidences of 6.6% to 90%.[7,14] This minor complication is thought to result from a number of events. Firstly, traumatic laryngoscopy or placement of a nasogastric tube or rough suctioning may injure the pharyngolaryngeal mucosa.[15] Secondly, cuff design and pressure affect tracheal mucosal capillary perfusion.[16,17] Thirdly, contact of the tracheal tube with the vocal cords and posterior pharyngeal wall may result in edema or lesion.[18] To prevent trauma to the pharynx, larynx, and trachea, various measures have been recommended, such as the use of endotracheal tubes with a low intracuff pressure,[19] smaller endotracheal tubes,[18] topical or intravenous use of lidocaine,[20,2] steroid coated endotracheal tubes,[21] and inhalation of steroids.[11]

The precise mechanism of the suppression of cough

Table 1. Patient characteristics by study group.

Variable	Group L2 (n=30)	Group L1 (n=30)	Group B (n=30)	Group C (n=30)
Age (year)	30.7±1.9	35.8±2.9	31.4±2.0	31.2±1.6
Sex (male/female)	19/11	17/13	18/12	20/10
ASA (I/II)	22/8	24/6	21/9	20/10
Weight (kg)	68.0±1.7	65.8±2.4	64.6±2.0	64.5±1.9
Height (cm)	167±1.2	167±1.3	166±1.1	168±1.6
Surgical time (min)	105±3.1	101±3.2	106±2.9	103±2.5
DOL (sec)	9.3±0.3	9.2±0.2	9.3±0.1	9.4±0.2
DFOL (I/II/III/IV)	18/12/0/0	19/11/0/0	16/14/0/0	17/13/0/0

Data are presented as either number of patients or as mean±SEM. L=lidocaine; B=beclomethasone; C=control. DOL=duration of laryngoscopy; DFOL=difficulty of laryngoscopy. Patient age, height, weight, and DOL were tested statistically by ANOVA. Between-group differences in patient sex, ASA, DFOL, and the incidence of symptoms were analysed by the chi-square test and Fisher's exact test.

Table 2. Incidence of postoperative sore throat, cough, sputum, hoarseness and dysphagia.

Variable	Group L2 (n=30)	Group L1 (n=30)	Group B (n=30)	Group C (n=30)
Sore throat				
EMA	40.0	26.7*	26.7*	39.3
1 hr after EMA	30.0	16.7**	20.0*	50.0
24 hr after surgery	20.0*	6.7**	10.0**	46.7
Cough				
EMA	30.0	20.0*	23.3	43.3
1 h after EMA	26.7	13.3*	16.7*	43.3
24 hr after surgery	16.7*	3.3**	6.7 **	40.0
Sputum				
EMA	40.0	30.0	20.0*	50.0
1 h after EMA	40.0	26.7	16.7	46.7
24 h after surgery	33.4	23.3	13.3**	46.7
Hoarseness				
EMA	33.4	26.7	20.0	30.0
1 h after EMA	33.4	30.0	23.3	33.4
24 h after surgery	20.0	16.7	10.0	26.7
Dysphagia				
EMA	10.0	10.0	13.3	13.3
1 h after EMA	10.0	6.7	10.0	13.3
24 h after surgery	10.0	10.0	6.7	10.0
First post-op drink	10.0	6.7	6.7	13.3
First post-op meal	13.3	10.0	6.7	13.3

Values are percentages of patients with symptoms in each group. L=lidocaine; B=beclomethasone; C=control; EMA=at emergence of anesthesia; postop=postoperative.*P<0.05 vs Group C, **P<0.01 vs. Group C. The incidence of symptoms were analysed by the chi-square test and Fisher's exact test.

and sore throat by intravenous lidocaine is not clearly known. Suppression of the excitation of airway sensory C fibers, which reduces the amount of neuropeptide released followed by neuroplasticity in the airway and brainstem is a possible mechanism of the effect of lidocaine. Sputum did not show a significant decrease, although lidocaine is expected to have the same effect on sore throat and cough through sensory C fibers.[22] Water transportation might not be directly changed by less lidocaine in the blood after an operation.

Pathological changes in the laryngotracheal area, such as epithelial loss, glottic hematoma, glottic edema, submucosal tears and contact ulcer granuloma, can occur after even uneventful intubation for routine surgery as a contributing factor to the postoperative hoarseness.[23] Another possible cause of hoarseness includes neuropraxia of the recurrent laryngeal nerve where it lies between the cricoid and arytenoid cartilages due to high intracuff pressure and nerve demyelination due to gas sterilization of the tubes.[24] Further risk factors include clamping of the cords onto the tube during intubation when the depth of anaesthesia was lightened, and hooking of the arytenoid by the open end of the tube. The results of our study showed that administration of lidocaine or beclomethasone in usual dosages did not prevent hoarseness or dysphagia after surgery. It seems that using a higher dosage of these two agents may have a significant effect. The timing of the first evaluation of postoperative hoarseness and dysphagia may also be criticized.

Recent bronchoalveolar lavage (BAL)[25] and bronchial biopsy studies[26] in adults have demonstrated

Table 3 Severity of postoperative sore throat, cough, sputum, hoarseness and dysphagia.

Variable	Group L2 (n=30)	Group L1 (n=30)	Group B (n=30)	Group C (n=30)
Sore throat				
EMA	60.0/20.0/10.0/10.0	73.3/20.0/6.7/0.0*	73.3/16.7/6.7/3.3*	46.7/23.3/20.0/10.0
1 hr after EMA	70.0/16.7/6.7/6.7	83.3/13.3/3.3/0.0**	80.0/10.0/6.7/3.3*	50.0/23.3/20.0/6.7
24 hr after surgery	80.0/13.3/3.3/3.3*	93.3/6.7/0.0/0.0**	90.0/6.7/3.3/0.0**	53.3/23.3/16.7/6.7
Cough				
EMA	70.0/23.3/6.7/0.0	80.0/16.7/3.3/0.0*	76.7/16.7/6.7/0.0	56.7/23.3/13.3/6.7
1 h after EMA	73.3/20.0/6.7/0.0	86.7/10.0/3.3/0.0**	83.3/10.0/6.7/0.0*	56.7/20.0/16.7/6.7
24 hr after surgery	83.3/13.3/3.3/0.0*	96.7/3.3/0.0/0.0**	93.3/6.7/0.0/0.0**	60.7/23.3/16.7/6.7
Sputum				
EMA	60.0/33.3/6.7/0.0	70.0/30.0/0.0/0.0	80.0/20.0/0.0/0.0*	50.0/40.0/10.0/0.0
1 h after EMA	60.0/33.3/6.7/0.0	73.3/26.7/0.0/0.0	83.3/16.7/0.0/0.0*	53.3/40.0/6.7/0.0
24 h after surgery	66.7/26.7/6.7/0.0	76.7/23.3/0.0/0.0	86.7/13.3/0.0/0.0**	53.3/36.7/10.0/0.0
Hoarseness				
EMA	66.7/33.3/0.0/0.0	73.3/26.7/0.0/0.0	80.0/20.0/0.0/0.0	70.0/26.7/3.3/0.0
1 h after EMA	66.7/33.3/0.0/0.0	70.0/30.0/0.0/0.0	76.7/23.3/0.0/0.0	66.7/30.0/3.3/0.0
24 h after surgery	80.0/20.0/0.0/0.0	83.3/16.7/0.0/0.0	90.0/10.0/0.0/0.0	73.3/26.7/0.0/0.0
Dysphagia				
EMA	90.0/3.3/6.7/0.0	90.0/10.0/0.0/0.0	86.7/13.3/0.0/0.0	86.7/6.7/6.7/0.0
1 h after EMA	90.0/3.3/6.7/0.0	93.0/6.7/0.0/0.0	90.0/10.0/0.0/0.0	86.7/6.7/6.7/0.0
24 h after surgery	90.0/10.0/0.0/0.0	90.0/10.0/0.0/0.0	93.3/6.7/0.0/0.0	90.0/10.0/0.0/0.0
First post-op drink	90.0/10.0/0.0/0.0	93.0/6.7/0.0/0.0	93.3/6.7/0.0/0.0	86.7/13.3/0.0/0.0
First post-op meal	86.7/10.0/3.3/0.0	90.0/10.0/0.0/0.0	93.3/6.7/0.0/0.0	86.7/10.0/3.3/0.0

Values are percentages of patients with each grade of symptoms in each group. L=lidocaine; B=beclomethasone; C=control; EMA=at emergence of anesthesia; The Kruskal-Wallis and Mann-Whitney U-tests were used to analyze differences in the severity of symptoms between groups. Sore throat was graded as: 0, absent; 1, minimal; 2, moderate; 3, severe. Cough was graded as: 0, absent; 1, minimal; 2, moderate; 3, severe. Severity oof sore throat, cough, and sputum were graded as 0, no symptoms; 1, less severe than with a cold; 2, similar to that noted with a cold; 3, more severe than with a cold. Hoarseness was graded as 0, absent; 1, slight; 2, severe; and 3, preventing speech. Dysphagia was graded as 0, absent; 1, slight; 2, moderate; and 3, cannot swallow because of pain. *P<0.05 vs. Group C, **P<0.01, vs. Group C.

a significant reduction in airway inflammation and bronchial reactivity to inhaled methacholine in adults with asthma following regular inhaled corticosteroids. The finding that topical beclomethasone can deplete the asthmatic airway mucosa of its mast cell content, possibly by inhibiting the production of cytokines from the T-cells,[27-29] may also provide an explanation for the protective effect of this class of drugs against postoperative sore throat, cough, or sputum. The results of these studies confirm that regular inhaled corticosteroids attenuate methacholine and exercise-induced bronchoconstriction in children with recurrent wheeze, supporting the hypothesis that airway inflammation may be important in the pathogenesis of airway symptoms. The effectiveness of beclomethasone inhaler in the prevention of postoperative sore throat has been reported previously by El Hakim and colleagues,[11] who concluded that beclomethasone inhaler attenuated postoperative airway symptoms by a similar mechanism. Of particular interest was the absence of any effect of beclomethasone inhaler on postoperative hoarseness or dysphagia. It seems that the main causative factor in eliciting postoperative hoarseness or dysphagia is trauma to the pharyngolaryngeal area that is so severe that it cannot be controlled with the usual dosage of intravenous lidocaine or beclomethasone inhaler. The effect of the various dosages of lidocaine or beclomethasone on the incidence or severity

of hoarseness or dysphagia warrant more study for a definite conclusion.

In conclusion, beclomethasone inhaler is comparable with intravenous lidocaine prior to intubation and decreases postoperative sore throat and cough. In addition, beclomethasone inhaler decreases the incidence and severity of postoperative sputum. Also, the present study suggests that airway inflammation is an important causative factor in eliciting the airway response in adult patients undergoing laryngoscopy and tracheal intubation under general anesthesia. Further evaluation is needed to arrive at a definite conclusion on the effects of different dosages of beclomethasone inhaler on postoperative hoarseness or dysphagia.

The authors declared no conflict of interest.

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