*Acta Anaesthesiol Scand 2007; **51**: 239–243*
Printed in Singapore. All rights reserved

ACTA ANAESTHESIOLOGICA SCANDINAVICA
doi: 10.1111/j.1399-6576.2006.01180.x

Dexpanthenol pastille and benzydamine hydrochloride spray for the prevention of post-operative sore throat

N. Gulhas[1], H. Canpolat[1], M. Cicek[1], S. Yologlu[2], T. Togal[1], M. Durmus[1] and M. Ozcan Ersoy[1]
Departments of [1]Anaesthesiology and [2]Biostatistics, Inonu University School of Medicine, Malatya, Turkey

Background: In this study, we aimed to compare the effectiveness of dexpanthenol pastille and benzydamine hydrochloride spray on the prevention of a sore throat.
Methods: One hundred and eighty patients undergoing general anaesthesia, who were ASA I–II and with their ages ranging between 15 and 70 years, were randomly allocated to three groups, each consisting of 60 patients. For group B, four puffs of benzydamine hydrochloride were sprayed into the mouth initially 30 min before the operation and repeatedly 5 min before anaesthesia induction. For group D, two pastilles of dexpanthenol were administered orally to be sucked 30 min before the operation. For group P, four puffs of distilled water were sprayed into the mouth initially 30 min before the operation. Post-operatively, patients were evaluated for a sore throat for the duration of 24 h.
Results: The incidence of a sore throat was significantly lower for group D when compared with group B and group P. The incidence of a sore throat was similar for group B and group P. According to the sore throat grading system, the number of patients experiencing no complaints was significantly higher for group D when compared with group B and group P. The number of patients achieving moderate scores was significantly higher for group B when compared with group D.
Conclusion: The administration of 200 mg of dexpanthenol prophylactically before endotracheal intubation is effective in the prevention of post-operative sore throat.

Accepted for publication 21 August 2006

Key words: endotracheal intubation; benzydamine hydrocholoride; dexpanthenol; post-operative sore throat.

The incidence of post-operative sore throat (POST) after endotracheal intubation ranges from 21% to 65% (1). POST influences patient satisfaction and might affect the patient's activities after discharge from the hospital (2). A number of events such as pharyngolaryngeal mucosal injury, oedema of the vocal cords and posterior pharyngeal wall (3), mucosal dehydration (4) as well as the effect of cuff pressure on tracheal mucosal capillary perfusion might result in POST (3). To date, either agents with analgesic and anti-inflammatory properties or measures towards the maintenance of capillary perfusion have been used for the prevention and treatment of POST (1, 3, 5). However, those agents that protect the mucosa or that prevent mucosal dehydration have not been investigated.

In addition to its anti-inflamatory effects, dexpanthenol has hydrating and protecting properties over the mucosa (6). Dexpanthenol possesses no serious side-effects and is widely used in Dermatology, Otorhinolaringology and Ofthalmology clinics (6, 7). On the other hand, benzydamine hydrochloride is a topical non-steroidal anti-inflammatory drug (NSAID) with additional analgesic and local anaesthetic properties. It has been demonstrated that benzydamine hydrochloride may prevent POST after endotracheal intubation and laryngeal mask airway insertion (8, 9).

The aim of the present study was to compare the effectiveness of dexpanthenol pastille and benzidamine hydrochloride spray on the prevention of a sore throat after endotracheal intubation.

Methods

After obtaining approval from the Local Ethics Committee and informed consents from the participants, 180 patients scheduled for elective surgery under general anaesthesia (ASA I–II) were enrolled into the study. Patients were excluded if they were undergoing head and neck surgery, pre-operatively complaining of a sore throat, smoking more than

10 cigarettes per day, were to be placed in a lateral or prone position during the operation or the estimated duration the operation below 30 min. Patients who had difficult airways, bloody secretions on oral suctioning or a nasogastric tube in place were also excluded. Pre-operatively, none of the patients received sedative drugs. Considering the study drugs, patients were randomly assigned in a double-blinded fashion into one of the three study groups, each consisting of 60 patients, by means of a number table. The study drugs were administered 30 min prior to arrival in the operating room. For group B, four puffs of benzydamine hydrochloride were sprayed into the mouth initially 30 min before the operation and repeatedly 5 min before induction of anaesthesia. For group D, two pastilles of dexpanthenol were administered orally to be sucked 30 min before the operation. For group P, four puffs of distilled water were sprayed into the mouth initially 30 min before the operation.

In the operating room, standard monitoring techniques were applied. General anaesthesia was induced using 2–2.5 mg/kg propofol administered intravenously after pre-oxygenation. Laryngoscopy and tracheal intubation were facilitated using 1 mg/kg vecuronium administered intravenously. Tracheal intubation was then performed by the residents in their second year of training. The residents were blinded to the study drugs. Endotracheal tubes with a low pressure cuff (Sheridan, Kendall Healthcare Products, Mansfield, PA) were used. Male and female patients were intubated using tubes with an inner diameter of 8 and 7 mm, respectively. Immediately after intubation, the tube cuffs were connected to a hand manometer. The tube cuffs were inflated to achieve a cuff pressure of 20–25 mmHg. Cuff pressure was measured every 10 min to limit nitrous oxide-related pressure increases. Anaesthesia was maintained using 1.5–2% sevoflurane in 60% nitrous oxide and 40% oxygen mixture. Opioids were administered when deemed necessary. At the end of the operation, residual muscle relaxation was reversed using neostigmine and atropine. Prior to extubation, in order to confirm that secretion clearance was complete, oropharyngeal suction was performed under direct visualization to avoid trauma to the mucosa. Post-operatively, patients were evaluated for the presence and severity of a sore throat for the duration of 24 h, at 10-min intervals within the 1 h and at 1-h intervals thereafter, by a blinded investigator. In face-to-face interviews, patients were asked whether they had experienced a sore throat from the time of the operation until the time of the interview. Sore throat was graded by the patients as none (no sore throat at any time after the operation), mild (scratchy throat during swallowing, disappearing within 3–6 h after the operation), moderate (sore throat disappearing within 6–12 h after the operation), or severe (sore throat lasting for more than 24 h after the operation). Potential side-effects considering the study drugs such as cough, dry mouth, nausea and vomiting were also recorded.

Statistical analysis

Prior to initiation of the study, power analysis was performed. A minimum of 56 patients were required in each group to detect a decrease from 55% to 29% with a power of 80% and a significance level of 95%. Statistical analysis was performed using the 11.0 version of SPSS for Windows software package (SPSS Inc., Chicago, IL). Within the groups, normality for continued variables was determined using the Shapiro-Wilk test. Between the groups, age, height, weight and duration of the operation were compared using analysis of variance (ANOVA). Between the groups, the incidence and the severity of POST were compared using the χ^2-test. A P-value less than or equal to 0.05 was considered to be statistically significant.

Results

Between the groups, the demographic data, with special emphasis on smoking habit, and the duration of the operations were similar (Table 1). Throughout the evaluation period of 24 h, the incidence of POST ranged from 11.6% to 61.6% for group B, 8.3% to 36.6% for group D and 23.3% to 66.6% for group P. Starting from 10 min, within the first 6 h post-operatively, the incidence of POST was significantly lower for Group D when compared with Group P and Group B ($P < 0.05$). Starting from 12 h, until the end of the evaluation period of 24 h, the incidence of POST was similar for group B and group D ($P > 0.05$) whereas the incidence of POST was significantly higher for group P when compared with group B and group D ($P < 0.05$) (Table 2).

According to the sore throat grading system, the number of patients experiencing no complaints was significantly higher for group D when compared with group B and group P ($P < 0.05$). The number of patients achieving moderate scores was significantly higher for group B when compared with group D. On the other hand, the number of patients achieving severe scores was similar for group B and group D ($P > 0.05$). The number of patients achieving

Table 1

The demographic data and the duration of the operations.

	Group B ($n = 60$)	Group D ($n = 60$)	Group P ($n = 60$)
Age (years)	35.9 ± 11.02	34.9 ± 12.82	37.4 ± 12.49
Gender (female/male)	49/11	41/19	44/16
Height (cm)	162.3 ± 7.92	163.2 ± 9.12	162.5 ± 7.76
Weight (kg)	66.5 ± 13.94	65.1 ± 12.84	67.8 ± 12.79
Surgery (min)	124.2 ± 77.04	108.6 ± 58.50	109.8 ± 74.87
Smoking history (%)	25	23	26

Values are presented as mean ± SD or median (range).

severe scores was significantly higher for group P when compared with group B and group D ($P < 0.05$) (Fig. 1).

As for the potential side-effects considering the study drugs, cough was not observed in any of the patients in group B or group D while the incidence of cough ranged from 1.6% to 5% in group P throughout the evaluation period of 24 h. Dry mouth was observed in all of the patients in group B and group P while dry mouth was observed in eight patients in group D. The incidence of nausea and vomiting was similar for all groups as 10 patients in group B, nine patients in group D and 11 patients in group P experienced nausea and vomiting.

Discussion

In our study, we determined that dexpanthenol was effective in decreasing the incidence and severity of post-operative sore throat as a result of endotracheal intubation. In an attempt to reduce the incidence and severity of POST, anti-inflammatory agents such as transdermal ketoprofen (3) and tenoxicam gauze packs (1), steroids such as beclomethasone inhalers (10) and local anaesthetics such as lidocaine in intravenous (11), aerosolized (12), tube lubricant jelly or ointment (13, 14) forms have been prescribed. Topical application of 1% hydrocortisone has been found not to be beneficial whereas the use of beclomethasone inhalers have been found to be highly efficient (10, 15). Topical administration of lidocaine to the trachea requires a specialized device besides longer or repeated laryngoscopical procedures (4). Lubricants containing lidocaine do not appear to be beneficial and might actually be harmful, having been implicated as a cause of bilateral recurrent laryngeal nerve palsy (16). Based on the controversial results regarding the effectiveness of the above-mentioned agents, there has been ongoing search towards the use of alternative agents.

Among such alternative agents, benzydamine hydrochloride is a topical NSAID with additional analgesic and local anaesthetic properties (17, 18). Mazzarella et al. (8) have evaluated the use of benzydamine hydrochloride at a total dose of 5.1 mg (in 0.3% concentration) at 3-h intervals for 3 consecutive days and have reported that benzydamine hydrochloride was highly effective in the treatment of lesions as a result of tracheal intubation, providing a significant improvement for the entire symptomatology. The reason for the lower effectiveness of benzydamine hydrochloride in our study in comparison to Mazzarella et al. might be explained by the use of a lower total dose at 2.16 mg and a lower number of applications. As for laryngeal mask airway insertion, Kati et al. (9) have shown that benzydamine hydrochloride decreases the incidence of post-operative sore throat whereas benzydamine hydrochloride that was used at the same dose and at similar intervals did not affect the incidence of post-operative sore throat in our study. Once again, the reason for the lower effectiveness of benzydamine hydrochloride in our study in comparison to Kati et al. might be the lower incidence of post-operative sore throat after laryngeal mask airway insertion as compared with that of endotracheal intubation.

Table 2

The incidence of post-operative sore throat for groups.

Evaluation time	Group B (%)	Group D (%)	Group P (%)
10 min	38	25*†	48
20 min	46.6	30*†	56.6
30 min	48.3	30*†	58.3
6 h	61.6	36.6*†	66.6
12 h	11.6‡	8.3*	23.3
24 h	11.6‡	11.6*	26.6

*$P < 0.05$, group B vs. group D, †$P < 0.05$, group B vs. group P, ‡$P < 0.05$, group D vs. group P.

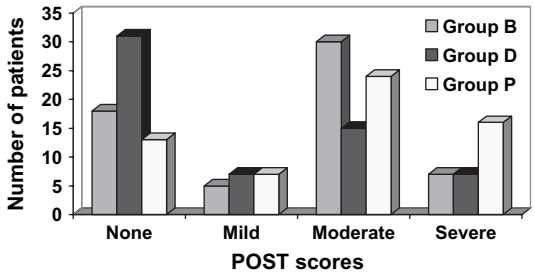

Fig. 1. Number of patients experiencing post-operative sore throat is shown. The number of patients experiencing no complaints was significantly higher for group D when compared with group B and group P ($P < 0.05$) and the number of patients achieving moderate scores and severe scores were significantly higher for group B when compared with group D ($P < 0.05$ and $P < 0.05$, respectively).

Pantotenic acid is essential for normal epithelial function. Topical dexpanthenol acts like a moisturizer to improve the hydration of the stratum corneum and to reduce transepidermal water loss in addition to its anti-inflammatory properties (6, 19). Biro et al. (19) have demonstrated the effectiveness of dexpanthenol in the protection of skin integrity. As mucosal dehydration is among the factors contributing to post-operative sore throat, we believe that dexpanthenol might have had an impact on the lower incidence of post-operative sore throat as a result of its preventive and healing properties. Proliferation of the fibroblasts is a significant factor in the recovery of mucosal damage. Increased proliferation of the human fibroblasts using dexpanthenol has been demonstrated through *in vitro* experiments (6, 20, 21). Besides, the impact of dexpanthenol ointment (in a concentration of 0.5–10%) on human gingival fibroblasts has been defined *in vitro* (6). We believe that the healing properties of dexpanthenol might contribute to the recovery of mucosal damage caused by endotracheal tube contact. In our study, we used dexpanthenol at a lower dose and as a single dose and observed its effectiveness on lowering the incidence of post-operative sore throat. Nevertheless, had we administered dexpanthenol at the recommended maximum daily dose of six pastilles, we could have better observed its effectiveness on the recovery of the mucosal damage. As mucosal damage is among the major reasons for the development of hoarseness and cough in addition to the development of a sore throat in the post-operative period, our study might question the effectiveness of dexpanthenol on these symptoms as well. Although benzydamine hydrochloride has been associated with side-effects including cough, dry mouth, nausea and vomiting (9), no increased incidence of such side-effects were observed in our study when compared with the other study drugs.

In conclusion, we believe that the administration of 200 mg of dexpanthenol prophylactically before endotracheal intubation is effective in the prevention of post-operative sore throat.

References

1. Elhakim M, Siam A, Rashed I, Hamdy MH. Topical tenoxicam from pharyngeal pack reduces postoperative sore throat. *Acta Anaesthesiol Scand* 2000; **44**: 733–6.
2. Higgins PP, Chung F, Mezei G. Postoperative sore throat after ambulatory surgery. *Br J Anaesth* 2002; **88**: 582–4.
3. Ozaki M, Minami K, Sata T, Shigematsu A. Transdermal ketoprofen mitigates the severity of postoperative sore throat. *Can J Anaesth* 2001; **48**: 1080–3.
4. Navarro RM, Baughman VL. Lidocaine in the endotracheal tube cuff reduces postoperative sore throat. *J Clin Anesth* 1997; **9**: 394–7.
5. Karasawa F, Mori T, Okuda T, Satoh T. Profile soft-seal cuff, a new endotracheal tube, effectively inhibits an increase in the cuff pressure through high compliance rather than low diffusion of nitrous oxide. *Anesth Analg* 2001; **92**: 140–4.
6. Ebner F, Heller A, Rippke F, Tausch I. Topical use of dexpanthenol in skin disorders. *Am J Clin Dermatol* 2002; **3**: 427–33.
7. Verse T, Klöcker N, Riedel F, Pirsig W, Scheithauer MO. Dexpanthenol nasal spray in comparison to dexpanthenol nasal ointment. A prospective, randomised, open, cross-over study to compare nasal mucociliary clearance. *HNO* 2004; **52**: 611–5.
8. Mazzarella B, Macarone Palmieri A, Mastronardi P, Spatola R, Lamarca S, De Rosa G et al. Benzydamine for the prevention of pharyngo-laryngeal pathology following tracheal intubation. *Int J Tissue React* 1987; **9**: 121–9.
9. Kati I, Tekin M, Silay E, Huseyinoglu UA, Yildiz H. Does benzidamine hydrochloride applied preemptively reduce sore throat due to laryngeal mask airway? *Anesth Analg* 2004; **99**: 710–2.
10. El-Hakim M. Beclomethasone prevents postoperative sore throat. *Acta Anaesthesiol Scand* 1993; **37**: 250–2.
11. Fuller PB. The relationship between preintubation lidocaine and postanesthesia sore throat. *AANA J* 1992; **60**: 374–8.
12. Herlevsen P, Bredahl C, Hindsholm K, Kruhoffer PK. Prophylactic laryngo-tracheal aerosolized lidocaine against postoperative sore throat. *Acta Anaesthesiol Scand* 1992; **36**: 505–7.
13. Loeser EA, Stanley TH, Jordan W, Machin R. Postoperative sore throat: influence of tracheal cuff lubrication versus cuff design. *Can Anaesth Soc J* 1980; **27**: 156–8.
14. Loeser EA, Kaminsky A, Diaz A, Stanley TH, Pace NL. The influence of endotracheal tube cuff design and cuff lubrication on postoperative sore throat. *Anesthesiology* 1983; **58**: 376–9.
15. Stride PC. Postoperative sore throat: topical hydrocortisone. *Anaesthesia* 1990; **45**: 968–71.
16. McHardy FE, Chung F. Postoperative sore throat: cause, prevention and treatment. *Anaesthesia* 1999; **54**: 444–53.
17. Baldock GA, Brodie RR, Chasseaud LF, Taylor T, Walmsley LM, Catanese B et al. Pharmacokinetics of benzydamine after intravenous, oral, and topical doses to human subjets. *Biopharm Drug Dispos* 1991; **12**: 481–92.

18. Cioli V, Corradino C, Barcellona PS. Review of pharmacological data on benzydamine. *Int J Tissue React* 1985; **7**: 205–13.
19. Biro K, Thaci D, Ochsendorf FR, Kaufmann R, Boehncke WH. Efficacy of dexpanthenol in skin protection against irritation: a double-blind, placebo-controlled study. *Contact Dermatitis* 2003; **49**: 80–4.
20. Grenier JF, Aprahamian M, Genot C, Dentinger A. Pantothenic acid (vitamin B5) efficiency on wound healing. *Acta Vitaminol Enzymol* 1982; **4**: 81–5.
21. Aprahamian M, Dentinger A, Stock-Damge C, Kouassi JC, Grenier JF. Effects of supplemental pantothenic acid on wound healing: experimental study in rabbit. *Am J Clin Nutr* 1985; **41**: 578–89.

Address:
Nurcin Gulhas
Turgut Ozal Tıp Merkezi Anesteziyoloji Bolumu
44315
Malatya
Turkey
e-mail: ngulhas@yahoo.com