Review

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Non-pharmacological Methods in the Management of Postoperative Sore Throat in Patients Undergoing Endotracheal Intubation: A Systematic Review

Endotrakeal Entübasyon Uygulanan Hastalarda Ameliyat Sonrası Boğaz Ağrısının Yönetiminde Non-farmakolojik Yöntemler: Sistematik Derleme

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ABSTRACT

The aim of this study was to determine and compare non-pharmacologic methods for the management of postoperative sore throat in adult patients undergoing endotracheal intubation. This study used a systematic review of clinical trials. Articles published between 2010 and 2022 in PubMed, Scopus, Web of Science, MEDLINE, EBSCOHost databases were included. The review was organized according to Cochrane Collaboration guidelines and reported using Preferred Reporting Items for Systematic Reviewsand Meta-Analyses. A total of 857 articles were retrieved in the initial search. After reviewing the articles according to the inclusion and exclusion criteria, a final set of seven articles was evaluated. It was observed that ASA I-II patients in whom elective surgery was planned were mostly included in the studies. It was determined that cold vapor, ice cube, licorice gargle, luo han guo (Monk fruit) herbal tea and tube warming were used as non-pharmacological methods. Interventions were performed preoperatively in five of the studies and postoperatively in two. Numeric pain scale was frequently used to assess sore throat. Patients' sore throat was most commonly evaluated in the second, fourth and 24th hours after extubation. Cold vapor, licorice gargle, luo han guo herbal tea and tube warming were found to be effective in reducing sore throat. Several reliable non-pharmacological methods are available for managing a sore throat in patients undergoing endotracheal

ÖZ

Bu çalışmanın amacı, endotrakeal entübasyon uygulanan yetişkin hastalarda ameliyat sonrası boğaz ağrısının yönetiminde non-farmakolojik yöntemleri belirlemek ve karşılaştırmaktır. Bu çalışmada klinik çalışmaların sistematik bir incelemesi kullanılmıştır. PubMed, Scopus, Web of Science, MEDLINE, EBSCOHost veri tabanlarında 2010 ve 2022 yılları arasında yayınlanan araştırmalar dahil edilmiştir. İnceleme Cochrane Collaboration kılavuzlarına göre düzenlenmiş ve Preferred Reporting Items for Systematic Reviewsand Meta-Analyses kullanılarak raporlanmıştır. İlk aramada 857 makaleye ulaşıldı. Bulunan makaleler dahil etme ve hariç tutma kriterlerine göre gözden geçirildikten sonra, yedi makaleden oluşan son bir set değerlendirildi. Araştırmalara çoğunlukla ASA I-II ve elektif cerrahi planlanan hastaların dahil edildiği görüldü. Hastalara non-farmakolojik yöntem olarak soğuk buhar, buz küpü, meyan kökü gargarası, luo han guo (Monk meyvesi) bitki çayı ve tüp ısıtılması kullanıldığı saptandı. Araştırmaların beşinde girişimler ameliyat öncesi, ikisinde ameliyat sonrası uygulandı. Boğaz ağrısını değerlendirmek için sıklıkla numerik ağrı skalası kullanıldı. Hastaların boğaz ağrısı en fazla ekstübasyon sonrası ikinci, dördüncü ve 24. saatlerde değerlendirildi. Soğuk buhar, meyan kökü gargarası, luo han guo bitki çayı ve tüp ısıtılmasının boğaz ağrısını azaltmada etkili olduğu bulundu. Endotrakeal entübasyon

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ABSTRACT

intubation. However, more research is needed to determine the most effective non-pharmacological approach.

Keywords: Intubation, surgical patient, sore throat, non-pharmacologic methods

ÖZ

uygulanan hastalarda boğaz ağrısının yönetiminde birçok güvenilir non-farmakolojik yöntem kullanılmıştır. Bununla birlikte, en etkin non-farmakolojik yöntemi belirlemek için daha fazla araştırmaya ihtiyaç vardır.

Anahtar Sözcükler: Entübasyon, cerrahi hasta, boğaz ağrısı, non-farmakolik yöntemler

Introduction

Postoperative sore throat (POST) is a common complication. The incidence of POST varies between 18% and 65% and lasts for 12-24 hours after surgery (1,2). It is caused by local tissue trauma and pharyngeal mucosal inflammation (2). The risk factors of POST include head and neck surgery, female gender, nausea and vomiting, cuff pressure and difficult intubation (3). POST affects the healing process by negatively affecting the nutrition and fluid intake of the patients. On the other hand, reducing postoperative complications reduces the length of hospital stay and increases patient satisfaction (4,5).

Due to the extensive etiologies of POST, several methods are used to prevent and reduce it. These methods usually include pharmacological (1,3) and clinical applications. Some of the clinical applications include acupuncture, cuff pressure, difficult intubation interventions, soaking the endotracheal tube (ET) with water-soluble gel, and nerve block (6-9). However, the routine use of these applications is limited, and there is no clinical standard (10).

Postoperative pain control includes nursing interventions as well as pharmacological and clinical applications. Hot and cold applications such as cold vapor (4,11), licorice (2) and luo han guo (12) are among the nursing interventions. These limited studies are novel and include easy-to-apply nursing interventions for the prevention and reduction of POST (2,4,11,12). However, a systematic review calculating the effect size of these interventions has not been found in the literature.

Methods

Aim

To determine and compare non-pharmacologic methods in managing POST in adult patients undergoing endotracheal intubation.

Design

The research question is "What is the effect of non-pharmacological methods in managing sore throat as a result of a postoperative endotracheal intubation?" This research complied with the principles of the Cochrane Guideline (13) and Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA). Two independent researchers (HO, TY) reviewed the titles and abstracts of the studies according to the inclusion criteria (Figure 1). The researchers (HO, TY) analyzed the data one by one. At all stages, discrepancies were resolved through consensus and collaboration of the researchers (HO, TY).

Inclusion and Exclusion Criteria

Inclusion Criteria

Experimental studies meeting the PICOS criteria were included in the study:

Patients: Adult patients undergoing intraoperative endotracheal intubation and elective surgery.

Intervention: Non-pharmacological interventions in POST management.

Comparison: Intervention and control group.

Outcome: POST.

Study design: Only full-text English articles that contain experimental research published between 2010 and 2022 were included in this review.

Exclusion Criteria

Congress abstracts without full-text articles,

Editorial letters,

Non-English articles,

Studies with pediatric patients,

Pharmacological studies,

Other clinical studies (acupuncture, cuff pressure measurement, difficult intubation interventions, nerve blocking).

Definition of Outcome Measures

The outcomes of the study were the severity and incidence of postoperative sore throat. These outcomes were evaluated in the postoperative care unit (PACU) between the first 24 hours and the third day after surgery.

Literature Search Strategy

PubMed, Scopus, MEDLINE, Web of Science and EBSCOhost databases were used in this study. The databases were searched between January 1, 2010 and February 1, 2022, with no restrictions on article status (abstract or full text, etc.). Search terms included "sore throat", "endotracheal intubation", "postoperative complication" and "hoarseness". The search was performed by combining indexed (e.g. MESH) and free text (sore throat* OR postoperative sore throat) terms using "AND" as follows: (endotracheal intubation) AND (postoperative

complication* OR hoarseness). The study followed the PRISMA guideline recommendations (14).

Study Selection

A total of 857 articles were found in the initial review. After eliminating duplicates and non-English language studies, the number of studies selected for the final survey was 338. The abstracts of these articles were reviewed for exclusion criteria. After excluding letters to the editor (n=1), pharmacological (n=237) and pediatric studies (n=35), the remaining 65 articles were subjected to an additional full-text evaluation to decide which articles to use. Finally, 58 articles about clinical practice were excluded and seven articles about nursing intervention were included (Figure 1).

Data Extraction and Analysis

Two reviewers (HO, TY) independently extracted data from the included studies using a pre-designed data extraction form. The extracted data included study design, study location(s), sample size, patient characteristics, the measurement tool used to assess the severity of sore throat, and the effect of the non-pharmacologic method on POST (Table 1).

Quality Appraisal

This review used the Cochrane tool for assessing risk of bias (RoB) in randomized trials (15), which consists of five domains: Randomization process, Deviations from intended interventions, Missing outcome data, Measurement of outcome, and Selection of reported outcome. Table 2 summarizes the results of the RoB assessments.

Results

Study Characteristics

Two of these studies were conducted in Turkey (4,11) two in China (10,12) one in Austria (2) and two in Korea (16,17). One of these studies was quasi-experimental (11), one was single-blind, and five were double-blind randomized controlled studies.

Characteristics of the Patients

The total number of patients in all studies was 1.092. However, 1.067 patients were included in the study sample since 14 patients from the study of Tan et al. (12) and 11 patients from the study of Yu et al. (18) dropped out after the initial selection.

Regarding the sociodemographic characteristics of the participants, the mean age of the patients was 51.37±13.84 years and the mean body mass index was 25.59±5.12 kg/m^2. Most of the patients in the studies were female. Inclusion criteria were similar among the included studies: The patients were over the age of 18, planned for elective surgery under general anesthesia, without preoperative sore throat and hoarseness, had ASA scores I-II (2,4,10,17), had Mallampati Score I-II (4), had Body Mass Index <30 kg/m^2 (16), had Cormack-Lehane Grade I-II (12). The included patients underwent general surgery, lumbar disc herniation, hysterectomy, thoracic surgery and nasal surgery.

Exclusion criteria included difficult intubation or multiple intubation history (2,11,12), steroid drug therapy (10-12), difficulty in co-operation, chronic respiratory system disease (2,11,12,17), psychiatric diagnosis, ASA score ≥III, Mallampati score ≥II-III, presence of nasogastric catheter (4,12), head and neck surgery history, operation time <30 min (4,10,17), a surgery

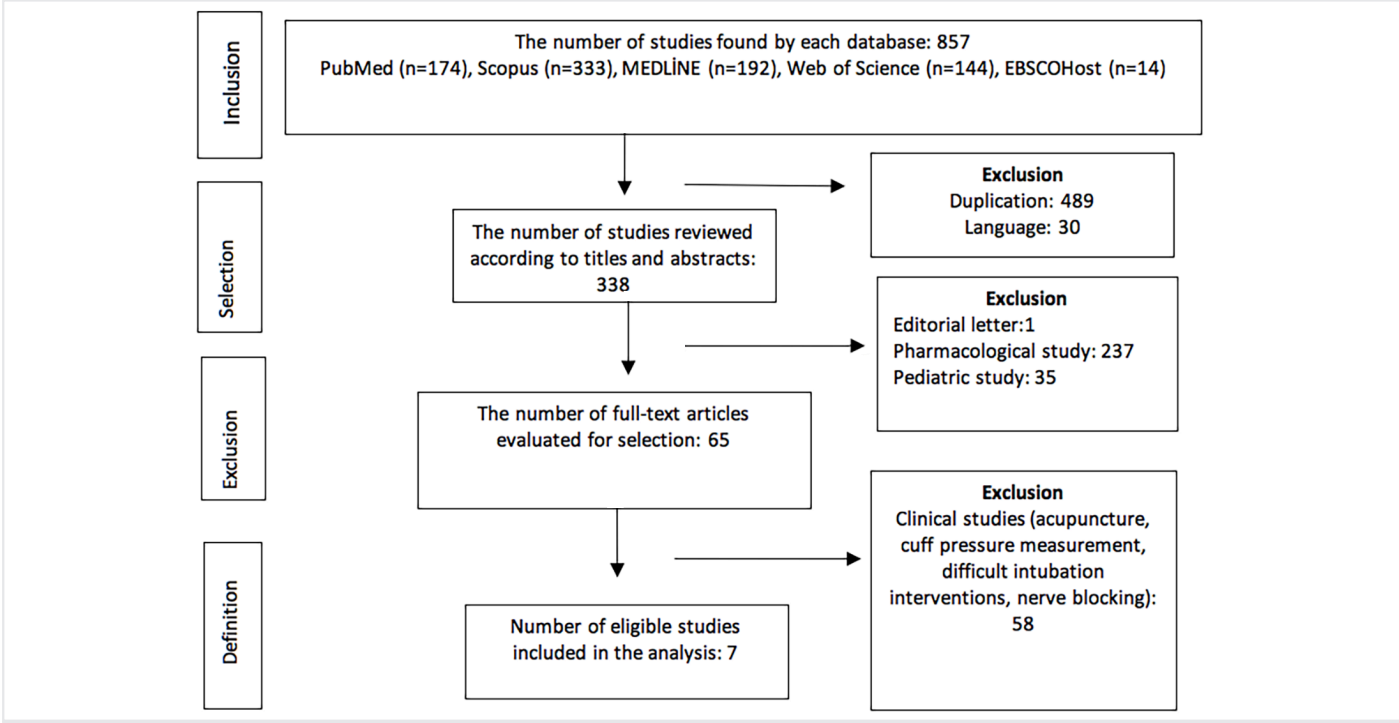

Figure 1. PRISMA flow chart

Table 1. Study summary

Sample size/ group	Sample size/ group	Type of surgery	Intervention		Instrument		Study findings
			Type of non-pharmalogical intervention	Duration and frequency	Name	Reliability	
Sahbaz and Khorshid (4) RCT	120 EG1: 30 EG2: 30 EG3: 30 CG: 30	General surgery	EG1: Cold vapor EG2: 25 g of ice cube EG3: Cold vapor and 25 g of ice cube CG: No intervention	At 0, 2, 6, 24 hours postoperative	VAS	NI	Significant reduction at 6th (p<0.000) and 24 h (p<0.000) postoperatively.
Bulut et al. (11) quasi-experimental	60 EG1: 20 EG2: 20 CG: 20	Lumbar disc herniation	EG1: Cold vapor EG2: Cold vapor and oxygen group CG: No intervention	Pre-interventional, postoperative 2, 4, 8, 12 hours	Yes-No	NI	There was no statistically significant difference between pre-intervention (p=0.803), 2nd hour (p=0.415), 4th hour (p=0.091), 8th hour (p=0.057) and 12th hour (p=0.235)
Wang et al. (10) double-blind RCT	138 EG: 69 CG: 69	Elective hysteroscopic surgery	EG: Before transferring to the operating room, the intervention group chewed sugar-free herbal gum for two minutes in the pre-operative waiting area CG: They were just asked to swallow twice with no additional treatment	At 2, 6, and 24 hours postoperative	NRS	0.325	Significant reduction in sore throat at 2 hours (p=0.001), 6 hours (p=0.001) and 24 hours (p=0.010) postoperatively
Ruetzler et al. (2) double-blind RCT	235 EG: 118 CG: 117	Elective thoracic surgery	EG: 30 mL of the mouthwash (1 min) prepared with licorice, 5-minutes pre-operatively CG: 30 mL mouthwash with a licorice-like flavor (1 min)	At 30 min, 1.5, and 4 hours Postoperatively	11-point Likert scale	0.46	Significant reduction in sore throat at postoperative 30th min (p=0.005), 1.5 h (p=0.001) and 4th hour (p=0.0001)
Seo et al. (17) double-blind parallel group RCT	140 EG: 70 CG:70	Elective thoracic surgery	EG: The distal part of double-lumen tubes between the bronchial tip and the proximal edge of the tracheal cuff was immersed in sterile normal saline in a bottle for 10 minutes pre-tracheal intubation. The saline temperature was manually maintained at 40 °C for the intervention group using an aseptic thermometer (Ewha Biomedics, Seoul, Korea) CG: The temperature was at operating room temperature for the control group	The sore throat was evaluated on the 1st, 2nd, and 3rd days postoperatively	None= no sore throat; Mild= pain with swallowing; Moderate= persistent pain increasing with swallowing; Severe= pain that prevents eating and requires analgesic medication	0.95	On the first postoperative day, the incidence of sore throat was 20% in the intervention group and 38% in the control group. There was no difference on the 2nd and 3rd days

Table 1. continued

Sample size/ group	Sample size/ group	Type of surgery	Intervention		Instrument		Study findings
			Type of non-pharmalogical intervention	Duration and frequency	Name	Reliability	
Tan et al. (12) double-blind RCT	203 EG: 102 CG: 101 189 patients were included in the final analysis: 94 in the intervention group and 95 in the control group	Patients with cervical cancer scheduled for tracheal intubation during general anesthesia for laparoscopic radical hysterectomy	EG: 6 hours postoperatively, the intervention group received 30% oral decoction of luo han guo (300 g of dried luo han guo was boiled in 1000 ml of water for 10 minutes) [0.5-1.0 g/kg/day; 30 mL bolus, three times daily (08:00, 12:00, 16:00) for 48 hours] CG: The control group received black tea according to their condition and dry mouth symptoms	The sore throat was evaluated at the 2nd, 12th, 24th, and 48th hours postoperatively	Visual Analogue Scale	NI	Sore throat scores did not differ significantly between the intervention and control groups 2 hours postoperatively (p=0.971) However, the scores of the intervention group were significantly lower than those of the control group at the 12th, 24th, and 48th hours postoperatively
Yu et al. (16) double-blind RCT	n=196 EG: 96 CG: 94 Analyzed: EG: 94 CG: 91	Elective nose surgery	EG: The air in the tube was vacuumed, and the distal part of the tube was immersed in a sterile bottle of normal saline for 10 minutes pre-intubation. The temperature of normal saline was kept at 40 °C for the intervention group CG: The temperature of normal saline was at operating room temperature for the control group	The sore throat was evaluated at 1st and 24th hours postoperatively	The Sore throat was evaluated with NRS (0-10 points: 0: no pain, 10: worst pain imaginable)	At 1st hour postoperatively NA NA At 24th hours postoperatively NA	In conclusion, ETT intubation after thermal softening reduced the incidence and severity of sore throat at 1st hour postoperatively compared to ETTs without thermal softening (p<0.01)

history within last month (2), BMI >40 kg/m^2, nonsteroidal anti-inflammatory drug use within last 24 hours (2,10), and having cervical spine diseases (17).

Control of Sore Throat

Table 1 shows the details of interventions for sore throat due to intubation in the studies. In these studies, the interventions administered to patients in the intervention group for the management of sore throat were cold vapor-ice cube cold vapor, oxygen administration with cold vapor, licorice extract, luo han guo and thermal softening of ET (2,4,11,12,16,17). As for control groups, three studies had no-intervention control groups (4,10,11), one study applied a placebo with licorice-like taste (2), one study applied black tea (12), and two studies kept the ET at operating room temperature (16,17).

The severity of POST was assessed using scales such as Visual Analog Scale, Numerical Rating Scale and subjective questions (none, mild, moderate, severe). Pain levels were assessed at 2, 4, 6, 12, 24 hours and 3 days postoperatively at the postoperative recovery unit. The results showed that "cold vapor" and "cold vapor-oxygen combination" were not statistically significantly effective in reducing sore throat (11). "Cold vapor-ice cubes-cold vapor combination" and "ice cubes" application were not effective in reducing the severity of sore throat at zero and second hours after surgery, but were effective at 6th and 24th hours (4). While licorice reduced the severity of sore throat 30 minutes, 1.5 hours and 4 hours after surgery (2), luo han guo was found to reduce the severity at the 12th, 24th and 48th hours after surgery (12). Furthermore, thermal softening of ET significantly reduced the incidence of POST (16,17).

Table 2. The Cochrane's risk of bias assessment

Study	D1	D2	D3	D4	D5	Over all		
Sahbaz and Khorsid (4)	!	+	+	+	!	+	+	Low risk
Bulut et al. (11)	!	+	+	!	-	!	!	Some concerns
Wang et al. (10)	+	+	+	+	!	+	-	High risk
Ruetzler et al. (2)	+	+	-	+	!	+		
Seo et al. (17)	+	+	+	+	!	+		
Tan et al. (12)	+	+	+	+	!	!		
Yu et al. (16)	+	+	+	+	!	!		
Low risk of bias	5	7	6	6	0	4		
Some concerns	2	0	0	1	6	3		
High risk of bias	0	0	1	0	1	0		

D1: Randomization process, D2: Deviations from the intended interventions, D3: Missing outcome data, D4: Measurement of the outcome, D5: Selection of the reported result

Discussion

Intubation tubes are commonly used to maintain breathing in patients undergoing surgery under general anesthesia. However, difficult intubation can cause airway damage. Moreover, ET cuff pressure is an important factor in mucosal irritation and inflammation. Therefore, different postoperative complications associated with ET are common. POST is one of these complications (2,16,19,20). It has been reported that the frequency of POST peaks between the 2nd and 6th hours after extubation and decreases over time (21,22). Although pain management in postoperative period is among nursing interventions, studies are inadequate. There are different practices in POST management. These practices generally aim to reduce tissue trauma and prevent inflammation during intubation (2,4,16,17).

Thermal softening of the ET allows the ET to form easily and thus reduces physical trauma to the larynx. Seo et al. (17) used saline heated at 40 °C and a softened intubation tube for the patients undergoing elective thoracic surgery. They observed that the incidence of POST was significantly reduced by 20% on the first day. Yu et al. (18) similarly found that thermal softening of ET reduced the incidence and severity of sore throat in the first hour after surgery. These findings show that thermal softening is a simple and easily applied method in POST. Wang et al. (10) used chewing gums to reduce physical trauma for the management of POST and found that sore throat decreased at the 2nd, 6th, and 24th post-operative hours. Chewing gum increases salivation and reduces intubation-related trauma by lubricating the oral cavity (10). The results suggest that thermal softening of ETs and the use of chewing gum may be among the nursing interventions to reduce POST with an interdisciplinary approach.

Hot and cold applications reduce inflammation in patients undergoing endotracheal intubation. Herbal teas are presented as hot applications in the literature. Licorice was used in this systematic review and meta-analysis (23). The researchers used herbal teas prophylactically and reported that herbal teas significantly reduced sore throat within 30 minutes, 1 hour and 4 hours postoperatively. Licorice contains glycyrrhizin and has anti-inflammatory and antiallergic effects. Glycyrrhizin reduces prostaglandin secretion and inhibits inflammation by slowing platelet aggression (24,25). Tan et al. (12) used luo han guo to reduce POST and observed that sore throat was reduced in the 12th, 24th and 48th postoperative hours. Luo han guo is an anti-inflammatory, antibacterial herb widely used in Traditional Chinese Medicine to moisturize the lungs, relieve heat and alleviate cough (26,27). These findings suggest that anti-inflammatory herbal teas can be cost-effective applications in

nursing interventions to reduce POST. However, the correct use of herbs may require further knowledge. Therefore, integrative applications are recommended.

Cold applications affect POST by reducing the capillary permeability, controlling edema, reducing the risk of hematoma formation and bacterial activity, preventing the transfer of pain stimulus to the upper centers, and eliminating painful spasms (28). It is observed that "cold vapor" and "ice cube" applications are used to cope with POST (4,11). In the literature, it has been reported that cold vapor can relieve complications such as hoarseness, cough, dry throat and sore throat due to laryngeal damage (29-33). Sahbaz and Khorshid (4) also suggested that cold vapor application, which was easy to apply, had no side effects and low drying cost, might reduce sore throat in the first hours after surgery. However, some studies showed that the effect of cold applications (such as cold vapor and ice cubes) in managing POST was not statistically significant.

Bulut et al. (11), applied cold vapor to the patients in the intervention group for 15 minutes in the first hour after admission to the PACU, while no intervention was applied to the patients in the control group. No statistically significant difference was found between the incidence of sore throat in the intervention and control group patients at the 2nd, 4th, 8th and 24th hours. Similarly, in the study of Özsoy et al. (34), cold vapor was applied to the patients in the intervention group at 0, 2 and 6 hours after surgery. No intervention was applied to the control group. As a result, no statistical difference was found between the POST levels of the patients in the intervention and control groups. Özsoy et al. (34), attributed the similarity between the two groups to the short operation time, successful intubation placement in the first attempt, appropriate ET use and postoperative analgesic doses (34). The time of starting oral intake, frequency of cold application, duration of application and cuff pressure within the normal range may affect the difference between the groups in cold applications.

Study Limitations

This systematic review had several limitations. It included only English-language experimental studies and addressed only the adult patient group. Furthermore, this review was not recorded and published in a specific protocol due to time constraints and limited resources.

Conclusion

POST is a common complication in adult patients undergoing elective surgery. However, interventions mainly include pharmacological and other clinical interventions (acupuncture, cuff pressure, difficult intubation methods, etc.). Nursing interventions with thermal softening, chewing gum and herbal teas significantly reduce POST. However, cold applications that prevent inflammation (cold vapor, etc.) provide only an insignificant decrease in the severity of POST. There are limited number of studies on nursing interventions and more randomized controlled trials are needed.

Ethics

Peer-review: Externally peer reviewed.

Authorship Contributions

Surgical and Medical Practices: H.Ö., T.Y., Concept: H.Ö., T.Y., Design: H.Ö., T.Y., Data Collection or Processing: H.Ö., T.Y., Analysis or Interpretation: H.Ö., T.Y., Literature Search: H.Ö., T.Y., Writing: H.Ö., T.Y.

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