Risk Factors of Post-operative Sore Throat and Hoarseness

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Objective: *To identify the risk factors of post-operative sore throat (POST) with and without hoarseness (PH) after general anesthesia.*

Material and Method: *A retrospective cohort case-controlled study was done at Siriraj Hospital, Mahidol University, Bangkok, Thailand. Two thousand six hundred anesthetic records from between July 2013 and January 2014 were retrieved. Inclusion criteria were complete records of patients older than 18 years and elective surgery under general anesthesia longer than 30 minutes using endotracheal intubation (ETT) or Laryngeal mask airway (LMA). All patients went through complete post-operative evaluation.*

Results: *Two thousand five hundred three cases were analyzed. Incidences of POST and PH were 41 and 19.7% respectively, mostly graded as mild symptoms. When severity of POST was increased, the incidence of PH also increased significantly ($p<0.001$). Both POST and PH were strictly related to insertion of ETT. The use of LMA instead of ETI reduced the incidences of POST and PH effectively. In female patients, reduction of ETT from size 7.5 to 7 reduced incidences of POST significantly.*

Conclusion: *The use of LMA reduced the incidences of both POST and PH. This conclusion is limited to selected cases and not applicable to all. Further studies should focus on possible factors to decrease the incidence of POST and PH after endotracheal intubation, which could increase patient satisfaction.*

Keywords: *Risk factors, Postoperative, Sore throat, Hoarseness*

J Med Assoc Thai 2017; 100 (4): 463-8
Full text. e-Journal: *http://www.jmatonline.com*

Postoperative sore throat (POST) with or without hoarseness (PH) is the second most common minor adverse event after general anesthesia, with an incidence of 10%, whereas 13.9% of patients complained of postoperative nausea and vomiting (PONV)[1].

Postoperative sore throat (POST) seems to happen only when the airway is manipulated during anesthesia. The etiology is not yet clearly understood. Previous studies suggested several risk factors for POST such as female gender, insertion of endotracheal tube (ETT), duration of anesthesia, and others[2].

The present study tried to identify risk factors for POST and understand if the POST is responsible for postoperative hoarseness after general anesthesia with airway manipulation. The rationale of the study was to suggest prophylactic measures to avoid these unpleasant side effects.

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Material and Method

This retrospective cohort case-controlled study was done at Siriraj Hospital, Mahidol University, Bangkok, Thailand between July 2013 and January 2014. After ethics approval of the Institutional Review Board No. 665/2556 (ECI), the following electronic anesthetic records were retrieved, pre-anesthetic evaluation form, intra-operative anesthetic record, and postoperative anesthetic evaluation form. We included patients with complete records, older than 18 years with elective surgery under general anesthesia longer than 30 minutes, using endotracheal intubation (ETT) or Laryngeal mask with unproblematic access (maximal 2 tries). Exclusion criteria were head, neck, oral and cardio-thoracic operations, application of cricoid pressure, patients moved to intensive care unit postoperatively, or patients remaining intubated after operation for any reason.

The following factors were considered relevant for the present study, age, sex, BMI, type of airway, size of ETT (five sizes) or LMA (three sizes), duration of anesthesia, Mallampati classification (three groups), grading of Laryngeal view (three groups).

Considering 10 cases for each factor to be adequate, 150 cases were recruited. The incidence of POST varied from 6% to 40%[3,4]. Using the lowest incidence of 6%, at least 2,500 patients were needed for statistical accuracy (sample size).

Anesthetic data were retrieved monthly starting in January 2014 until 2,600 cases were completed. All information including patient demographic, details of anesthetic management, surgical procedures, and postoperative evaluation of POST and PH, were statistically analyzed (SPSS version 11.5). General data expressed in mean or median, standard deviation (SD), range for continuous data as well as number and percentile for categorical data. Chi-square was used for Univariate analysis to identify the correlation between risk factors and incidence of POST and PH in the mean of *p*-value, odds ratio and 95% CI. Only significant risk factors or *p*-value lower than 0.05 were tested in multiple logistic regression model for POST and PH.

Results

From 2,600 cases retrieved, 97 cases were excluded because of incomplete data, therefore, 2,503 cases were included in this study. There were 1,477 females (59%). The oldest case was 95 years and the average age was 53.3±16.5 years. Eighty percent were classified in ASA physical status I or II. LMA were used in 367 cases or 14.7% and ETT in 2,136 cases or 85.3%. Size of LMA and ETT were summarized in Table 1 together with grading of laryngoscopic view in ETT patients.

Incidences of POST and PH were 41% and 19.7%, respectively (Table 3) mostly of which were graded as mild symptom or 90.7% in POST and 86.7% in PH. Though the incidences of postoperative hoarseness (PH) and sore throat (POST) were significantly different, they were closely related to each other (Table 2), particularly with increasing severity of the symptoms ($p<0.001$). There were also 102 out of 493 cases (20%) of PH without POST.

Factors correlated to POST

Comparing cases with and without POST by univariate analysis (Table 3), the incidence was significantly higher in female (OR 1.3, 95% CI 1.1 to 1.5, $p = 0.003$), age lower than 60 years (OR 1.2, 95% CI 1.2 to 1.4, $p = 0.04$), ASA physical status I to II (OR 1.3, 95% CI 1.1 to 1.6, $p = 0.01$), Mallampati class 3 to 4 (OR 1.4, 95% CI 1.1 to 1.9, $p = 0.01$), obesity ($p = 0.001$), and the use of ETT instead of laryngeal mask (OR 1.8, 95% CI 1.4 to 2.3, $p<0.001$). By Multiple logistic regression analysis (Table 4), it was confirmed that the use of ETT was the highest risk factor of POST (Adjusted OR 1.8,

Table 1. Type and size of airway equipment, LMA or ETT and Laryngoscopic view, n (%)

Type	LMA n = 367 (14.7%)		ETT n = 2,136 (85.3%)	
Size	Size 3	113 (30.8)	No. 6.5	28 (1.3)
	Size 4	211 (57.5)	No. 7.0	1,021 (47.8)
	Size 5	43 (11.7)	No. 7.5	640 (30)
			No. 8.0	447 (20.9)
Laryngoscopic view			Grade 1	1,638 (76.7)
			Grade 2	402 (18.8)
			Grade 3	87 (4.1)
			Grade 4	9 (0.4)

Table 2. Association between severe of postoperative sore throat and hoarseness of voice (% by row)

Sore throat	Hoarseness of voice n (%)		*p*-value
	No (n = 2,010)	Yes (n = 493)	
No symptom (n = 1,476)	1,274 (93.1)	102 (6.9)	<0.001
Mild (n = 931)	590 (63.4)	341 (36.6)	
Moderate (n = 71)	35 (49.3)	36 (50.7)	
Severe (n = 25)	11 (44)	14 (56)	

Table 3. Univariate analysis risk factors for POST and PH

Factors	Sore throat			Hoarseness of voice		
	No	Yes	OR (95% CI) *p*-value	No	Yes	OR (95% CI) *p*-value
Sex						
Male	62.5	37.5	1.3 (1.1, 1.5) 0.003	85.7	14.3	1.8 (1.4,2.3) <0.001
Female	56.5	43.5		78.6	23.4	
Age group						
>60	61.7	38.3	1.2 (1.1,1.4) 0.04	80.6	19.4	1 (0.8,1.2) 0.6
≤60	57.4	42.6		79.8	20.2	
ASA						
ASA 1-2	57.7	42.3	1.3 (1.1,1.6) 0.01	79.2	20.8	1.4 (1.1,1.8) 0.007
ASA 3-4	64	36		84.7	15.3	
Mallampati						
Class 1-2	59.7	40.3	1.4 (1.1,1.9) 0.01	80.5	19.5	1.2 (0.8,1.6) 0.37
Class 3-4	50.8	49.2		77.9	22.1	
BMI						
Underweight	64.3	35.7		82.9	17.1	
Normal	58.6	41.4	1.3 (1,1.5) 0.03	80.5	19.5	1.2 (0.9,1.5) 0.3
Overweight	59.0	41	1.3 (1,1.6) 0.65	79.8	20.2	1.2 (0.9,1.7) 0.2
Obesity	50	50	1.8 (1.3,2.5) <0.001	75.2	24.8	1.6 (1.1,2.3) 0.02
Morbid obese	37.5	62.5	3 (1,8.4) 0.04	75	25	1.6 (0.5,5.1) 0.4
Airway						
LMA	70.3	29.7	1.8 (1.4,2.3) <0.001	91.3	8.7	2.9 (1.9,4.2) <0.001
ET-tube	57	43		78.4	21.6	
Size of ETT						
No. 6.5	57.1	42.9		78.6	21.4	
No. 7	58.5	41.5	0.9 (0.4,2) 0.9	75.9	24.1	1.2 (0.5,2.9) 0.75
No. 7.5	55.5	44.5	1.1 (0.5,2.3) 0.9	78.8	21.3	1 (0.4,2.5) 1
No. 8	55.9	44.1	1.1 (0.5,2.3) 0.9	83.7	16.3	0.7 (0.3,1.8) 0.5
Size of LMA						
No. 3	71.7	28.3		90.3	9.7	
No. 4	72.5	25.7	0.9 (0.6,1.6) 0.9	91.9	8.1	0.8 (0.4,1.8) 0.6
No. 5	55.8	44.2	2 (0.9,4.1) 0.06	90.7	9.3	0.9 (0.3,3.2) 0.9
LV						
Grade 1-2	56.9	43.1	0.8 (0.6,1.3) 0.5	78.5	21.5	
Grade 3-4	60.4	39.6		77.1	22.9	
Operation time						
<3 hrs	60	40	1 (0.97,1.38) 0.09	82.7	17.3	1.6 (1.3,2.0) <0.001
≥3 hrs	56.4	43.1		74.6	25.4	

ASA = physical status; BMI = basal metabolic index; LV = laryngoscopic view

95% CI 1.4 to 2.3, $p<0.001$). Only obesity (Adjusted OR 1.5, 95% CI 1.2-2, $p = 0.003$) and ASA class I to II (Adjusted OR 1.3, 95% CI 1 to 1.6, $p = 0.02$) were confirmed as additional risk factors of POST.

Factors correlated with PH

Comparing cases with and without PH, by univariate analysis (Table 3), the incidence significantly increased in female (OR 1.8, 95% CI 1.4 to 2.3, $p<0.001$), ASA physical status I to II (OR 1.4, 95% CI 1.1 to 1.8, $p = 0.007$), the use of ETT (OR 2.9, 95% CI 1.9 to 4.2, $p<0.001$) and in operation for more than three hours (OR 1.6, 95% CI 1.3 to 2, $p<0.001$). By Multiple logistic regression analysis of PH (Table 4), it was confirmed that the use of ETT was the highest risk factor for PH (Adjusted OR 2.5, 95% CI 1.7 to 3.6, $p<0.001$). Others

significant risk factors were female (Adjusted OR 1.8, 95% CI 1.4 to 2.2, $p<0.001$), ASA class I to II (Adjusted OR 1.4, 95% CI 1.1 to 1.9, $p<0.001$), and operative time more than three hours (Adjusted OR 1.6, 95% CI 1.3 to 1.9, $p<0.001$),

Size of endotracheal tube

Female patients were found to exhibit a correlation between the increased size of endotracheal tube and the incidence of POST and PH (Table 5). In such group, incidence of POST and PH was reduced from 55.4% to 41.4% and from 29.5% to 23.9%, respectively, when the size of ETT decreased from 7.5 to 7.

Discussion

The investigated symptoms appeared generally more often in patients with endotracheal intubation compared to laryngeal mask. We found that the prevalence of postoperative sore throat (POST) was strongly related to obesity and ASA-class (I to II), whereas risk factors for postoperative hoarseness (PH) were among female, ASA physical status I to II, and anesthetic time more than three hours. POST and PH may be minor anesthetic adverse events but they relevantly influence patients' satisfaction. The incidence of POST in the present study was 41% (43% in ETT, 29.7% in LMA) and was comparable to the findings of McHardy and Chung in 1999[4], reported an incidence varying between 14.4% and 50% for ETT and between 5.8% and 34% for LMA. The incidence of POST was significantly higher after ETT compared to LMA, which was in accordance with most studies[4-6].

Though the incidences of POST and PH were different, both were interconnected. Patients experiencing sore throat mainly complained about pain

Table 4. Multivariate analysis of POST and PH

Factors Contribute	Sore throat			Hoarseness of voice		
	Adjusted OR	95% CI	*p*-value	Adjusted OR	95% CI	*p*-value
Sex						
Female	1.18	1.0 to 1.4	0.05	1.8	1.4, 2.2	<0.001
Age (year)						
<60	1.1	0.9 to 1.3	0.04			
BMI						
Overweight	1	0.9 to 1.3	0.01			
Obesity	1.5	1.2 to 2.0	0.003			
ASA						
Grade 1 to 2	1.3	1.0 to 1.6	0.02	1.4	1.1, 1.9	<0.001
Mallampati						
Class 3 to 4	1.34	1.0 to 1.8	0.05			
Endotracheal tube	1.8	1.4 to 2.3	<0.001	2.5	1.7, 3.6	<0.001
Operative time						
>3 hour				1.6	1.3,1.9	<0.001

Table 5. Correlation between female patient with variable ETT number and sore throat (%) and hoarseness

ETT number	Sore throat		Hoarseness	
	No n = 720	Yes n = 580	No n = 975	Yes n = 325
6.5 (n = 27)	59.30%	40.70%	81.50%	18.50%
7.0 (n = 984)	58.60%	41,4%	76.10%	23.90%
7.5 (n = 278)	44.60%	55.40%	70.50%	29.50%
8.0 (n = 11)	27.30%	72.70%	72.70%	27.30%

sensations in the pharynx, above or below the larynx and sometimes in the chest. Jaensson et al[3] reported patient description sore-throat symptoms mostly in pharyngeal and above laryngeal area or above vocal cord area. It can be assumed that tissue irritation with consecutive sore-throat occurrence is caused by airway manipulation leading also to PH. PH is not always the consequence of direct manipulation at vocal cord area and could be found in the use of LMA. Usage of dry anesthetic gases could also lead to PH.

To reduce the incidence of POST and PH, LMA can be used instead of ETT if appropriated. But the choice of airway management depends on several factors such as the duration of surgery (increasing in leakage of LMA), surgical approach (abdominal pressure), position and accessibility of the patient and costs. To ease POST and PH and/or to decrease its incidence in the usage of ETT, the application of locally acting agents such as benzydamine hydrochloride spray[9,10], flurbiprofen (Strepsils®) tablets[11] or inhaled fluticasone[12] should be considered, especially in young healthy female[13,14].

Since 1987, Stout et al[14] proved that the size of ETT tube was correlated with the incidence of POST and PH. Many attempts were introduced by tube design such as 'low-pressure-cuff' to reduce POST and PH but their success was not sustainably proven. McHardy and Chung[4] in their 1999 review concluded that the use of smaller tracheal tubes with a small contact area may reduce the incidence of POST. In recent practice, use of smaller tubes are more common than past[14]. Usually, tube sizes of 7 to 7.5 for female and 7.5 to 8 for male are applied. Collectively, our data could not prove an influence of tube size on POST and PH (Table 5, 7) within a range of 6.5 to 8.0. However, in female patients, ETT size mattered. Tube size 6.5 and 7.0 caused significantly less POST and PH than 7.5 and 8.0 (Table 9). In accordance with other studies[15,16], the only recommendation to be gained from our data is limited initial ETT size of No. 7 for female and probably No. 7.5 for male patients.

The limitation of the present study was retrospective design strongly depended on completeness and reliability of chart data.

Conclusion

Postoperative sore throat (POST) and hoarseness (PH) are minor but unpleasant events after general anesthesia with a still relevant incidence. To avoid them, the use of laryngeal mask seems preferable to endotracheal intubation (ETI), which, however, cannot be applied to the majority of surgical patients. Further studies should focus on strategies to decrease the incidence of POST and PH after endotracheal intubation.

What is already known on this topic?

POST and PH occurred frequently after airway manipulation during general anesthesia. Choosing LMA instead of ET remarkable decreased these side effects significantly.

The etiology is not clearly understood and there is no standard recommendation to reduce these incidences.

What this study adds?

By our reviewed, this study included biggest sample size. Our data support the reduction size of endotracheal tube in female patient generally from No. 7.5 to No. 7.0. We proved that prolong operative time for more than 3 hours is one of the risk factor of PH.

Potential conflicts of interest

None.

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ปัจจัยเสี่ยงต่อการเกิดอาการเจ็บคอและ/หรือเสียงแหบภายหลังการผ่าตัด

ฐิติมา ชินะโชติ, ศิรดา พอใจ, ณิชาภัทร สุขศรี, ชุษณะ รุ่งจินดามัย

วัตถุประสงค์: *เพื่อศึกษาปัจจัยเสี่ยงที่ทำให้เกิดอาการเจ็บคอและ/หรือเสียงแหบภายหลังการให้ยาระงับความรู้สึก*

วัสดุและวิธีการ: *ดำเนินการศึกษาจากบันทึกข้อมูลผู้ป่วยที่ได้รับการให้ยาระงับความรู้สึก ที่ภาควิชาวิสัญญีวิทยา คณะแพทยศาสตร์ ศิริราชพยาบาล จำนวน 2,600 ราย เป็นผู้ป่วยที่อายุมากกว่า 18 ปี มารับการผ่าตัดแบบไม่รีบด่วน ใช้เวลาในการผ่าตัดมากกว่า 30 นาที ผู้ป่วยได้รับการใส่ท่อหายใจหรือ laryngeal mask airway (LMA) โดยผู้ป่วยทุกรายต้องได้รับการตรวจเยี่ยมหลังการผ่าตัดและข้อมูลได้รับการบันทึกไว้อย่างครบถ้วน*

ผลการศึกษา: *ดำเนินการวิเคราะห์ข้อมูลทั้งหมด 2,503 ราย พบอัตราการเกิดอาการเจ็บคอ ร้อยละ 41 และอาการเสียงแหบร้อยละ 19.7 ส่วนมากมีอาการเพียงเล็กน้อย โดยเมื่อความรุนแรงของอาการเจ็บคอเพิ่มขึ้น จะพบอัตราอาการเสียงแหบเพิ่มขึ้น และมีความสัมพันธ์กัน ($p<0.001$) อาการเจ็บคอและ/หรือเสียงแหบพบในการใช้ท่อหายใจมากกว่า LMA ในผู้หญิงการลดขนาดท่อหายใจจาก เบอร์ 7.5 เป็น 7.0 จะสามารถลดการเกิดอาการเจ็บคอได้ อาการเสียงแหบมีความสัมพันธ์กับระยะเวลาการผ่าตัดที่นานมากกว่า 3 ชั่วโมง*

สรุป: *การเลือกใช้ LMA แทนการใส่ท่อหายใจ สามารถลดอาการเจ็บคอ และเสียงแหบหลังการผ่าตัดได้อย่างมีประสิทธิภาพ แต่ในทางปฏิบัติโดยส่วนมากไม่สามารถใช้ LMA ได้ในผู้ป่วยทุกราย ควรมีการศึกษาต่อเนื่องเพื่อลดอุบัติการณ์อาการเจ็บคอและหรือเสียงแหบภายหลังการใส่ท่อหายใจเพื่อเพิ่มความพึงพอใจของผู้ป่วย*