Original Article

Factors Associated with Moderate to Severe Pain in Post-Anesthesia Care Unit after Tonsillectomy: A Retrospective Study

Nuanprae Kitisin MD[1], Saowapark Chumpathong MD[1], Nattaya Raykateeraroj MD[1], Pichchaporn Praserdvigai MD[1], Matula Tareerath BN[1]

[1] Department of Anesthesiology, Faculty of Medicine Siriraj Hospital, Mahidol University, Bangkok, Thailand

Background: Tonsillectomy can cause high intensity of pain and inadequate pain control might lead to eating problems. However, usage of opioids and non-steroidal anti-inflammatory drugs for postoperative analgesia is limited due to patients' comorbidities such as obstructive sleep apnea and risk of postoperative bleeding.

Objective: To define the incidence of moderate to severe pain after tonsillectomy and associated factors.

Materials and Methods: Electronic medical records of patients age 17 or older undergoing tonsillectomy between March 2014 and December 2018 were retrospectively reviewed. The collected data included patient data, surgical data, pain scores in the post-anesthesia care unit (PACU), and perioperative pain management.

Results: Three hundred twenty-three patients were included. The mean age was 34.9±12.9 years, mean body mass index was 24.8±5.7 kg/m^2, and 65% were female. The incidence of moderate (numeric rating scale [NRS], (0 to 10) of 4 to 6) to severe pain (NRS of 7 or more) in the PACU was 63.8%. Multivariate analysis revealed that not receiving intraoperative dexamethasone was the only factor associated with moderate to severe pain (adjusted OR 2.21, 95% CI 1.34 to 3.65) in the PACU.

Conclusion: Moderate to severe pain after tonsillectomy was found in 63.8% of patients in the PACU and not giving intraoperative dexamethasone was a significant risk factor.

Keywords: Risk factor, Post-anesthesia care unit, Tonsillectomy, Dexamethasone, Postoperative pain

Received 24 August 2020 | Revised 21 October 2020 | Accepted 29 October 2020

J Med Assoc Thai 2021;104(3):438-44

Website: http://www.jmatonline.com

Tonsillectomy causes high intensity of pain in up to 30% of adult patients during the first 24 hours after surgery[1-3]. Sixty percent of the patients may encounter painful experiences for one to two weeks, leading to eating difficulty and weight loss[3,4]. One study reported that 22% of the patients' re-visit to the hospitals was due to inadequate pain control after ambulatory tonsillectomy[5].

Some studies reported a relationship between the degree of pain after tonsillectomy with dissection technique[6], peritonsillar local anesthetic infiltration[7-10], and high dose perioperative systemic corticosteroid[11,12]. Unfortunately, there is no study to define whether any of the patient-related factors are associated with the high intensity post-tonsillectomy pain.

The authors conducted the present study to define the incidence of moderate to severe post-tonsillectomy pain in the post-anesthesia care unit (PACU) and to identify the risk factors to establish the clinical practice guideline for pain control and thus result in better patient satisfaction and outcome.

Correspondence to:

Chumpathong S.

Department of Anesthesiology, Faculty of Medicine Siriraj Hospital, Mahidol University, 2 Wanglang Road, Bangkoknoi, Bangkok 10700, Thailand.

Phone: +66-2-4197978, **Fax**: +66-2-4113256

Email: saowapark.chu@mahidol.ac.th

How to cite this article:

Kitisin N, Chumpathong S, Raykateeraroj N, Praserdvigai P, Tareerath M. Factors Associated with Moderate to Severe Pain in Post-Anesthesia Care Unit after Tonsillectomy: A Retrospective Study. J Med Assoc Thai 2021; 104:438-44.

doi.org/10.35755/jmedassocthai.2021.03.11864

Materials and Methods

The study was approved by Siriraj Institutional Review Board, Faculty of Medicine Siriraj Hospital, Mahidol University, Bangkok, Thailand (COA no.225/2018). The medical records of patients older than 17 years old that underwent tonsillectomy between March 2014 and December 2018 were

reviewed. The records were excluded if there were combined with other operations or incomplete data.

The tonsillectomy procedures included 1) local infiltration with 1% lidocaine with adrenaline (1:200,000) 6 to 8 mL at anterior pillars before the incision, and 2) bilateral tonsillectomy using dissector, and bipolar cautery or ligation technique. The operation was mainly performed by staff, first, or second-year residents trained in Otolaryngology. The subjective tonsillar size was evaluated and only the biggest size of both tonsils recorded using the Brodsky grading scale[13]. The scale was classified in five grades, grade 0=tonsils within the tonsillar fossa, grade 1=tonsils just outside of the tonsillar fossa and that occupy 25% or less of the oropharyngeal width, grade 2=tonsils that occupy 26% to 50% of the oropharyngeal width, grade 3=tonsils that occupy 51% to 75% of the oropharyngeal width, and grade 4=tonsils that occupy more than 75% of the oropharyngeal width. The sum volume of both resected tonsils (width*length*height) in milliliter from pathologist's reports was also collected.

The collected data included gender, age, weight, height, body mass index (BMI), the American Society of Anesthesiologists (ASA) physical status classification, comorbidities, indication for surgery, tonsillar size and volume, operator, surgical details, and postoperative complications. Intraoperative opioids or other medications were given at the discretion of the attending anesthesiologist were also recorded.

The severity of postoperative pain was assessed every 15 minutes for 1 hour by the PACU nurse using numeric rating scale (NRS 0 to 10). A NRS of 1 to 3, 4 to 6, and 7 to 10 were classified as mild, moderate, and severe pain, respectively. Inadequate pain control was defined as at least one occasion of moderate to severe pain and intravenous (IV) opioids were given until the NRS was below 4 before discharging the patient to the ward. In the case of re-operation, only the pain score that occurred during the first operation were recorded.

The perioperative IV opioids were varied such as fentanyl, pethidine, and morphine. The opioid doses were converted into fentanyl using a standard analgesic equivalent dose (IV morphine 10 mg or pethidine 75 mg equals to fentanyl 100 mcg).

Afterward, patients were divided into two groups, no or mild pain (NRS 0 to 3) and moderate to severe pain (NRS 4 to 10), and the data were used to find a correlation with patients' pain severity.

Sample size calculation and statistical analysis

The sample size was calculated by using nQuery 6.0, based on a previous study that reported a 30% incidence of moderate to severe pain in the first 24-hour after tonsillectomy[3]. Using a two-sided test with a 95% confidence interval (CI) and allowable error of 0.05, the calculated sample size was 323.

Statistical analyses were performed using PASW Statistics, version 18.0 (SPSS Inc., Chicago, IL, USA). Descriptive data were presented as mean ± standard deviation (SD), number and percentage, or median (interquartile range) and were analyzed using the chi-squared test, two-sample t-test, and Mann-Whitney U test. The assumptions of probable risk factors including age, gender, BMI, indication for surgery, tonsillar size, IV dexamethasone, duration of operation, and estimated blood loss were proposed. Factors with p-value of less than 0.10 were chosen for multivariate logistic regression analysis, which p-value of less than 0.05 was considered statistically significant.

Results

Between March 2014 and December 2018, there were 419 records of tonsillectomy patients. Fifty-eight cases were tonsillectomy combined with other operations, and 38 cases had incomplete data. The remaining 323 patients were included for the final analysis.

Demographic data and surgical details of the study population are shown in Table 1. Most patients were young female, presented with recurrent tonsillitis, and underwent bilateral tonsillectomy. The other indications for surgery were found in 40 patients (12.4%), such as suspected malignancy, tonsillolith, and foreign body. Intraoperative complications were found in 16 patients (5%), in which seven patients had injury of adjacent tissue. The other nine patients had immediate postoperative bleeding, one of them had minimal bleeding, which could be treated conservatively, and the rest of them needed re-operation to stop the bleeding.

Intraoperative IV opioids were fentanyl (83.9%), morphine (10.2%), and pethidine (5.9%). The number of patients who received intraoperative IV non-steroidal anti- inflammatory drugs (NSAIDs) was 41 (12.7%), including ketorolac (10, 3.1%) and parecoxib (31, 9.6%). Intraoperative IV dexamethasone was administered in 135 (41.8%) patients with a dosage of 5 mg (30, 9.3%) or 10 mg (105, 32.5%).

The incidence of moderate to severe pain in the PACU was 63.8%. The risk factors that had a

Table 1. Demographic data and surgical details of the study population

Parameter	n=323
Sex: female	210 (65.0)
Age (year); mean±SD	34.9±12.9
BMI (kg/m^2); mean±SD	24.8±5.7
ASA physical status	
I	187 (57.9)
II	126 (39.0)
III	10 (3.1)
Co-morbidities	
Hypertension	37 (11.5)
Allergic rhinitis	30 (9.3)
Dyslipidemia	27 (8.4)
Diabetes	11 (3.4)
Indication for surgery	
Recurrent tonsillitis	243 (75.2)
Obstructive symptoms	40 (12.4)
Others	40 (12.4)
Operator	
Staff	105 (32.5)
Resident	218 (67.5)
Tonsillectomy	
Bilateral	314 (97.2)
Unilateral	9 (2.8)
Size of tonsils	
<3+	164 (50.8)
≥3+	159 (49.2)
Volume of resected tonsils (mL^3); median (min, max)	12.9 (7.8, 19.1)
Surgical technique	
Electrocauterization	283 (87.6)
Ligation	40 (12.4)
Operative time (minute); median (min, max)	55 (35, 75)
Estimated blood loss (mL); median (min, max)	20 (10, 40)
Intraoperative complications	16 (5.0)

SD=standard deviation; BMI=body mass index; ASA=American Society of Anesthesiologists

p<0.1 were BMI, indication for surgery, operator, tonsillar size, and intraoperative IV dexamethasone administration (Table 2).

Multivariate analysis revealed that intraoperative IV dexamethasone was the only factor that significantly associated with moderate to severe pain in the PACU (odds ratio [OR] 2.21; 95% CI 1.31 to 3.65) (Table 3).

Discussion

The present study revealed that the incidence of moderate to severe pain in PACU after tonsillectomy was 63.8% and the significant risk factor causing moderate to severe pain was the lack of intraoperative IV dexamethasone.

According to the study of Kokki et al, the incidence of inadequate pain control during the first 24 hours after tonsillectomy is 28%[3]. Tolska et al showed that during the first week of post-tonsillectomy, the pain intensities ranging from 4 to 8 (NRS 0 to 10), and after that the pain score drop to less than 4 in most patients[14]. However, the present study reported a much higher incidence of moderate to severe pain, which was 63.8% in the first one to two hours after surgery in the PACU. As aforementioned, each study assessed the pain score at different times. The present study assessed the pain score in the first few hours after tonsillectomy at PACU, which might be causing the different incidence of inadequate pain control. Additionally, this considerable difference may be caused by a lack of adequate perioperative pain management protocol in the authors' institute, in contrary to the previously mentioned study conducted by Kokki et al[3] where every patient received post-operative continuous ketoprofen infusion.

In other types of surgery, many studies identified the risk factors related to postoperative pain. Ip et al reported that preoperative pain, anxiety, age, and type of operation were the relating factors to postoperative pain in general surgery[15]. Admassu et al found that age, gender, and incision length were associated with the severity of postoperative pain[16]. However, up until now, there are still limited studies that can define the factors related to moderate to severe pain after tonsillectomy in adult patients.

The post-tonsillectomy pain control is quite challenging due to the risk of respiratory depression after opioid administration in patients who had a history of snoring or been diagnosed with obstructive sleep apnea[17,18]. The use of NSAIDs may have benefits because of their opioid-sparing effect[19,20]. However, their antiplatelet property raises the consideration of post-tonsillectomy bleeding, which is one of the most common complications with a reported incidence of post-tonsillectomy bleeding at 2% to 10%[21-23]. While some studies concluded that the use of NSAIDs was not associated with post-tonsillectomy bleeding[20,21], two meta-analyses showed that the use of NSAIDs may be associated with post-tonsillectomy bleeding[23,24]. Moreover, in the present study, the authors found that the lack of intraoperative IV NSAIDs was not associated with inadequate pain control.

Table 2. Demographic data, surgical details, and anesthetic details of the study population at the post-anesthesia care unit

Parameter	No or mild pain (NRS 0 to 3) (n=117); n (%)	Moderate to severe pain (NRS 4 to 10) (n=206); n (%)	p-value
Sex: female	70 (59.8)	140 (68.0)	0.141
Age (year); mean±SD	35.9±12.6	34.3±13.0	0.278
BMI (kg/m^2); mean±SD	25.8±6.1	24.2±5.3	0.017*
ASA physical status			0.907
I	66 (56.4)	121 (58.7)	
II	47 (40.2)	79 (38.3)	
III	4 (3.4)	6 (2.9)	
Indication for surgery			0.053*
Obstructive symptom	20 (17.1)	20 (9.7)	
Non-obstructive symptom	97 (82.9)	186 (90.3)	
Operator			0.085*
Staff	45 (38.5)	60 (29.1)	
Resident	72 (61.5)	146 (70.9)	
Tonsillectomy			1.000
Unilateral	3 (2.6)	6 (2.9)	
Bilateral	114 (97.4)	200 (97.1)	
Size of tonsils			0.016*
<3+	49 (41.9)	115 (55.8)	
≥3+	68 (58.1)	91 (44.2)	
Volume of resected tonsils (mL^3); mean±SD	16.3±13.9	15.0±1.0	0.883
Electrocauterization used	103 (88.0)	180 (87.4)	0.864
Operative time (minute); mean±SD	58.8±28.5	62.5±31.9	0.303
Estimated blood loss (mL); mean±SD	31.5±37.7	36.8±44.0	0.172
Intraoperative complications	5 (4.3)	11 (5.3)	0.671
Intraoperative medications			
Dexamethasone not given	54 (46.2)	134 (65.0)	0.001*
NSAIDs not given	99 (84.6)	183 (88.8)	0.274
Morphine or pethidine not given	94 (80.3)	177 (85.9)	0.190
Intraoperative fentanyl (mcg/kg/hour)†; mean±SD	1.0±0.2	1.0±0.2	0.855

SD=standard deviation; NRS=numeric rating scale; BMI=body mass index; ASA=American Society of Anesthesiologists; NSAIDs=nonsteroidal anti-inflammatory drugs

† Fentanyl equivalent dose, * p<0.05 is considered statistically significant

Table 3. Factors associated with moderate to severe pain at post-anesthesia care unit

Factors	Adjusted OR (95% CI)	p-value
BMI (kg/m^2)	0.97 (0.92 to 1.00)	0.113
Indication for surgery: non-obstructive symptom	1.69 (0.82 to 3.51)	0.158
Operator: resident	1.29 (0.76 to 2.20)	0.341
Size of tonsil: <3+	1.49 (0.90 to 2.47)	0.122
Intraoperative dexamethasone not given	2.21 (1.34 to 3.65)	0.002*

BMI=body mass index; OR=odds ratio; CI=confidence interval

* p<0.05 is considered statistically significant

The study conducted by Hoddeson and Gourin described that the patients who underwent tonsillectomy for obstructive symptoms were associated with postoperative pain[25]. Unfortunately, the authors have yet to find such a correlation.

In the present study, most surgeon were Otolaryngology residents, which had limited experience and skill. This might lead to more tissue damage than the cases operated by staffs. However, there was no previous study that proved this presumption. Furthermore, from the present study results, the operator factor was not significantly

associated with a higher degree of pain.

The authors suspected that the size of tonsil, which were 3+ or greater, might make the cutting plane more difficult to achieve and may associate with a greater degree of tissue injury. Although, García Callejo et al did not find the association of tonsillar size with pain intensity, they reported higher pain intensity in cases that operation intruded peritonsillar area along with the load of heat energy applied[6]. Some studies stated that post-tonsillectomy pain was not different between the surgical techniques[26,27]. So, the authors looked for an association between electrocauterization and post-tonsillectomy pain by comparing it with the suture ligation technique and found a similar proportion of patients who received electrocauterization in both pain groups. The present study reported seven patients who had injury of adjacent tissue such as uvula, posterior pharyngeal wall, and anterior tonsillar pillar. Of these, five out of seven patients reported a maximum NRS 7 to 10, while others reported NRS of 0 at 90 minutes at the PACU.

In the first assumption, the operative time and the estimated blood loss might be a surrogate to represent the degree of tissue injury. On the contrary, the authors found that the estimated blood loss might be inaccurate because individual estimation could be easily erroneous when the blood is mixed with saliva. At the same time, most of the tonsillectomy was performed by the Otolaryngology trainee, which varies in experience and skill. Thus, the operative time and the estimated blood loss were not a good parameter to represent the degree of tissue injury.

Many studies reported the efficacy of peritonsillar local anesthetic infiltration in post-tonsillectomy pain[7-10]. Anyhow, this technique was the standard practice in all cases of tonsillectomy in the authors' institute.

McKean et al showed that a single dose of 10 mg of IV dexamethasone at induction of anesthesia was effective in reducing post-tonsillectomy pain, nausea, and vomiting[12]. Additionally, a systematic review and meta-analysis revealed that IV dexamethasone can significantly reduce pain on the first day after tonsillectomy in adult patients, especially when it was given in both intraoperative and postoperative periods with a total dose of more than 10 mg in the first 24 hours after the operation[11,14]. The present study also showed similar results that the lack of intraoperative IV dexamethasone was the only significant risk factor contributing to moderate to severe post-tonsillectomy pain in the PACU. Meanwhile, 58% of the cases did not receive IV dexamethasone.

Tolska et al reported that opioids, paracetamol, NSAIDs, dexamethasone, gabapentinoids, and dextromethorphan can reduce the pain on the first day after tonsillectomy[14]. Therefore, the authors might consider using other alternative analgesic drugs for post-tonsillectomy pain control, including gabapentinoids and dextromethorphan.

As a result of the prior studies and the present study, perioperative IV dexamethasone has a benefit for improving post-tonsillectomy pain intensities. Thus, the use of multimodal analgesia and perioperative IV dexamethasone is the way to improve post-tonsillectomy pain management.

The limitation of the present study is its retrospective design and manual medical records, so some data might not be accurate or even missing. A wide variety of techniques and medications used made the analyses more difficult. Additionally, the preoperative pain scores were not recorded, so the authors could not prove whether preoperative pain is one of the factors that cause postoperative tonsillectomy pain. However, the results of the present study reminded us to establish an evidence-based perioperative pain control protocol for tonsillectomy in the authors' institute. The future prospective study may be needed to define the patient factors that correlate with moderate to severe post-tonsillectomy pain to be able to provide proper pain management to this group of patients.

Conclusion

The incidence of moderate to severe post-tonsillectomy pain in the PACU was 63.8%. The lack of intraoperative IV dexamethasone was the only significant risk factor for inadequate pain control. Therefore, the authors recommend that IV dexamethasone should be given intraoperatively to decrease immediate post-tonsillectomy pain if the patients did not have any contraindications or complication from dexamethasone.

What is already known on this topic?

The incidence of inadequate pain control in tonsillectomy is high, and perioperative IV dexamethasone has a benefit for improving post-tonsillectomy pain intensities.

What this study adds?

The risk factor for moderate to severe pain in post-tonsillectomy patients is still unclear. This study result showed that the lack of intraoperative IV

dexamethasone was the only significant risk factor for inadequate pain control. Unfortunately, the authors have yet to find the association between the size of tonsils, intraoperative blood loss, the experience of surgeons, and the indication for surgery with the pain intensity.

Acknowledgement

The authors appreciated the support from Assoc. Prof. Vimolluck Sanansilp of the Department of Anesthesiology, Faculty of Medicine Siriraj Hospital, Mahidol University. The authors gratefully acknowledge Asst. Prof. Dr. Chulaluk Komoltri of the Division of Clinical Epidemiology, Department of Research and Development, Faculty of Medicine Siriraj Hospital for assistance with statistical analysis.

Conflicts of interest

The authors have no conflicts of interest to declare.

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