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Original Paper

EVALUATION OF TONSILLECTOMY PATIENTS AND FACTORS RELATED TO IMMEDIATE TONSILLECTOMY

Renāta Vīksne[1,2,#], Karoļina Poļikarpova[3], and Ksenija Jenbajeva[3]

[1] Department of Otorhinolaryngology, Daugavpils Regional Hospital, 20 Vasarnīcu Str., Daugavpils, LV-5401, LATVIA

[2] Department of Doctoral Studies, Rīga Stradiņš University, 16 Dzirciema Str., Rīga, LV-1007, LATVIA

[3] Faculty of Medicine, Rīga Stradiņš University, 16 Dzirciema Str., Rīga, LV-1007, LATVIA

[#] Corresponding author, renata.viksne@gmail.com

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A retrospective cohort study was conducted with the aim to characterise tonsillectomy patients and identify factors related to the development of complicated cases of tonsillitis and consecutive immediate tonsillectomies in the Latvian population. The data of 493 patients were analysed. Patients were hospitalised from 1 January 2019 to 30 November 2020, for elective or immediate tonsillectomy due to recurrent tonsillitis, with or without exacerbation and complications. The patients who underwent elective tonsillectomy were younger than those who underwent immediate tonsillectomy. Peritonsillar abscess was more common in smokers than in non-smokers ($p < 0.001$). Smokers had immediate tonsillectomy more often than non-smokers ($p < 0.001$). Patients who underwent elective tonsillectomy had the shortest period of antibiotic therapy ($p < 0.001$). Patients who had immediate tonsillectomy had a longer hospitalisation time. Immediate tonsillectomies were associated with patients of older age, smokers, longer hospitalisation, and antibacterial treatment periods. Unilateral peritonsillar abscess was the most common complication of tonsillitis, which resulted in immediate tonsillectomy.

Keywords: *complications, peritonsillar abscess, smokers, recurrent tonsillitis.*

INTRODUCTION

Regardless of the widespread use of antibiotics to treat infected tonsils, episodes of tonsillitis tend to recur and cause suppuration around the palatine tonsils, forming peritonsillar or parapharyngeal abscesses (Johnson *et al*., 2003; Page *et al*., 2010; Klug, 2017). The treatment of peritonsillar and parapharyngeal abscesses continues to be of a surgical nature (Windfuhr *et al*., 2016b). Templer *et al.* (1977) highlighted the value of immediate tonsillectomy as the first-line treatment of peritonsillar abscess in 1977. Immediate tonsillectomy promotes complete evacuation of the abscess, the second convalescent period is avoided, and the recovery period is relatively short, in comparison with the abscess incision and drainage process and rehospitalisation period that characterise interval tonsillectomy (Templer *et al*., 1977; Berry *et al*., 2007; Page *et al*., 2010).

Pauls Stradiņš Clinical University Hospital (PSCUH) is an academic tertiary adult hospital in Rīga, Latvia, where both types of tonsillectomies are performed. The purpose of our study was to characterise tonsillectomy patients and identify factors related to the development of complicated cases of tonsillitis and consecutive immediate tonsillectomies in the Latvian population.

METHODS

A retrospective cohort study was conducted among consecutive patients who were diagnosed with recurrent tonsillitis, with or without complications, and who had a tonsillectomy at PSCUH from 1 January 2019 to 30 November 2020. The research included analysis of the clinical data of medical files that were related to diagnosis codes J35.0 (chronic tonsillitis) or J36 (peritonsillar abscess), according

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to the 10th edition of the International Classification of Diseases (*SSK-10 Klasifikācija …*).

The inclusion criteria were set for the study according to the current definitions of recurrent tonsillitis and indications for tonsillectomy: at least seven attack episodes per year in the preceding year, five episodes per year in the preceding two years, or three episodes per year in the preceding three years (Windfuhr *et al.*, 2016b; Buname *et al*., 2021). In-patients with diagnosed recurrent tonsillitis or peritonsillar abscess, who underwent bilateral tonsillectomy, were included. Immediate tonsillectomies had been performed within 24 hours of admission. A total of 493 patients were included.

Four patients were excluded due to their insufficient medical information. They received tonsillectomy in another hospital and were hospitalised in PSCUH due to a postoperative haemorrhage. The inclusion and exclusion criteria are listed in Table 1.

The following data were analysed: age, sex, risk factors (smoking and body mass index (BMI)), complications, comorbidities, used antibiotics, length of antibacterial therapy, surgery type (elective or immediate tonsillectomy), and treatment before hospitalisation. BMI calculations were performed according to the recommendations of the Centre for Chronic Disease Prevention and Health Promotion (Adult BMI Calculator …).

Statistical analysis was performed with IBM SPSS Statistics, version 22 (Chicago, IL, USA). Independent samples Kruskal–Wallis and Mann–Whitney U tests and Pearson's χ^2 and Spearman's tests were used to investigate the associations between the variables. A p-value less than 0.05 was considered statistically significant.

Table 1. Inclusion and exclusion criteria

Inclusion criteria	Exclusion criteria
Aged 16–87 years	Aged < 16 years
In-patient	Out-patient
Diagnosed recurrent tonsillitis or peritonsillar abscess	Other tonsillopathies, tonsillar malignancy, tonsillar hyperplasia
Diagnosis code J35.0 or J36	Other codes for primary diagnosis
Bilateral tonsillectomy	Unilateral tonsillectomy, tonsillotomy, abscess incision and drainage only, external cervical approach
	Failure to perform tonsillectomy
	Insufficient medical information
	Delayed tonsillectomy (tonsillectomy performed later, more than 24 hours after hospitalisation)

Table 2. General characteristics of the study population

Characteristics		Results
Gender	Male, n (%)	216 (43,8)
	Female, n (%)	277 (56.2)
	Male-to-female ratio	1 : 1.28
Age (at the time of hospitalisation)	Age (between, mean ± SD), years	16–87, 35.48 ± 14.24
Tonsillectomy	Elective tonsillectomy, n (%)	213 (43.2)
	Immediate tonsillectomy, n (%).	269 (54.6)
	Incision and drainage	11 (2.2)
Duration of hospitalisation	Duration (between, average), days	1–16, 3

RESULTS

In the study 493 patients were included. General characteristics of the study population are listed in Table 2. The patients who underwent elective tonsillectomy were younger (mean age of 31 years) than those who underwent immediate tonsillectomy (mean age of 33 years) (independent samples Kruskal–Wallis test, $p = 0.004$). The patients who had immediate tonsillectomy had longer hospitalisation times than those who had elective tonsillectomy (mean of 3.36 (IQR 2–4) vs. 2.41 days (IQR = 2–3); independent samples Kruskal–Wallis test, $p < 0.001$). The 11 patients who refused surgery had peritonsillar abscess and were treated with incision and drainage, and were excluded from the study. Older patients (65 years or older) had longer hospitalisation times than younger patients (Spearman's test, $p = 0.014$).

A total of 146 (29.61%) patients had comorbidities, such as cardiologic (n = 57, 11.6%), endocrine system (n = 31, 6.2%), and autoimmune diseases (n = 25 patients (5.1%), an immunosuppressive condition (n = 24 patients, 4.8%), infectious diseases (n = 9, 1.8%), obstructive sleep apnea (n = 9, 1.8%), a dental infection (n = 5, 1%), and neurological (n = 3, 0.6%) or rheumatic (n = 2, 0,4%) diseases (Table 3).

A statistically significant increase in comorbidities were in elderly patients, compared with younger patients (59-years old (±16.8) vs. mean of 31 (±11.6), independent samples Kruskal–Wallis test, $p < 0.001$). Patients who had one or more comorbidities had longer hospitalisation times than patients without comorbidities (average of four (±2.29) vs. three days (±1.41), independent samples Kruskal–Wallis test, $p < 0.001$) (Table 3).

BMI data were collected for 418 (84.8%) patients, but the data of the remaining 75 (15.4%) patients were missing. Adults 20 years and older were pre-obese in 19.9% (n = 98) and obese in 15.4% (n = 76) of cases. Adolescents aged 16 to 19 years old were overweight in 1.4% (n = 7) of cases (Table 4). For adult patients included in obesity class I, immediate tonsillectomy was performed more often (in 64.3% of the cases). No statistically significant association was found between BMI and the number of immediate tonsillectomies performed (Pearson's χ^2 test, $p = 0.276$ for adolescents, $p = 0.948$ for adults) or the duration of hospitalisation (Spearman's test, $p = 0.226$).

A total of 328 patients were non-smokers (66.5%), whereas 165 were smokers (33.5%). Peritonsillar abscess was more common in smokers than in non-smokers (72.1% vs. 27.9%,

Table 3. Characterisation of patients' ages, comorbidities, and durations of hospitalisation

Comorbidities	n	%	Mean age (years ± SD)	Average length of hospitalisation (days ± SD)
Without comorbidities	347	70.39	31 ± 11.6	3 ± 1.41
Cardiologic diseases	57	11.6	43 ± 17.6	2 ± 1.49
Endocrine diseases	31	6.2	34 ± 16.1	2 ± 1.93
T2 DM (insulin-dependent)	4	0.8		
T2 DM (insulin-independent)	8	1.6		
Glucose intolerance	3	0.6		
Other endocrine system diseases	16	3.2		
Autoimmune diseases	25	5.1		
Immunosuppressive condition	24	4.8		
Bronchial asthma with GCc treatment	11	2.2		
Therapy with biological drugs or GCs	9	1.8		
Chemotherapy or radiation therapy	3	0.6		
Neutropenia	1	0.2		
Infectious diseases (HBV, HCV, HIV)	9	1.8		
Obstructive sleep apnea	9	1.8		
Dental infection	5	1.0		
Neurological diseases	3	0.6		
Rheumatic diseases	2	0.4		
Patients who had at least one comorbidity and cardiologic disease	19	3.9	59 ± 16.8	4 ± 2.29

Note: T2 DM – type 2 diabetes mellitus; GCs – glucocorticoids; HBV – hepatitis B virus; HCV – hepatitis C virus; HIV – human immunodeficiency virus.

Table 4. Distribution of patients according to body mass index

BMI classification (kg/m^2)	n (%)	Immediate tonsillectomy	Pearson's χ^2 test, p
Patients 16–19-years old, n = 24 (4.9%)			
Normal weight	17 (3.4)	52.9%	0.276
Overweight + 1SD	7 (1.4)	28.6%	
Patients ≥ 20 years old, n = 394 (79.9%)			
Underweight (< 18.5)	14 (2.8)	50%	0.948
Normal weight (18.5–24.9)	207 (42)	53.1%	
Pre-obesity (25.0–29.9)	97 (19.7)	59.8%	
Obesity class I (30.0–34.9)	42 (8.5)	64.3%	
Obesity class II (35.0–39.9)	22 (4.5)	54.5%	
Obesity class III (> 40)	12 (2.4)	50%	

Note: SD – standard deviation.

Pearson's χ^2 test, $\chi = 34.501$, $p < 0.001$). Smokers had immediate tonsillectomy more often than non-smokers (76.2% vs. 23.2%, Pearson's χ^2 test, $\chi = 46.342$, $p < 0.001$). Moreover, patients who had never smoked had shorter durations of hospitalisation (independent samples Mann–Whitney U test, $p = 0.024$).

A total of 290 (58.8%) patients noted previous episodes of tonsillitis, but 38 (7.7%) had peritonsillar abscess in their medical history. Before hospitalisation, 60 (12.2%) patients received symptomatic treatment, and 108 (21.9%) took antibiotics. The most frequently used antibiotics were amoxicillin/clavulanic acid (n = 55, 11.2%), ampicillin (n = 12, 2.4%), ciprofloxacin (n = 9, 1.8%), clarithromycin (n = 9, 1.8%), and penicillin (n = 7, 1.4%). Of the studied patients, 385 (78.1%) started antibacterial treatment at the beginning of hospitalisation.

A total of 297 (60.24%) patients had a consultation with a healthcare professional beforehand; however, 196 patients (39.76%) immediately presented to the Emergency Department of the PSCUH. In the Emergency Department, patients presented with dysphagia and odynophagia (n = 259, 52.6%), elevated body temperature (n = 192, 38.9%), halitosis (n = 26, 5.3%), and difficulty breathing (n = 18, 3.7). During examination, the following were found: tonsillar hypertrophy (n = 369, 74.8%), tonsillar exudate (n = 57, 11.6%), pharyngeal erythema (n = 255, 51.7%), deviated uvula (n = 174, 35.3%), trismus (n = 170, 34.5%), and cervical lymphadenopathy (n = 60, 12.2%).

It was found that 307 (62.2%) patients had complications at the time of hospitalisation, including unilateral peritonsillar (n = 254, 51.5%), bilateral peritonsillar (n = 10, 2.0%), parapharyngeal (n = 32, 6.5%) and retropharyngeal abscesses (n = 10, 2.0%), and sepsis (n = 1, 0.2%) (Table 5). Patients with retropharyngeal or parapharyngeal abscesses were older than were those without retropharyngeal (mean of 49 vs. 35 years, $p = 0.011$) or parapharyngeal abscesses (mean of 48 vs. 31 years, $p < 0.001$). Patients with bilateral peritonsillar abscess had higher white blood cell (WBC) counts and C-reactive protein (CRP) levels than patients

Table 5. Most frequent complications of tonsillitis, patient age, and laboratory inflammatory markers

Complications	n	%	Mean age	*p* value	Mean WBC	Test, *p* value	Mean CRP	Test, *p* value
Unilateral peritonsillar abscess	254	51.5		0.096*				
Bilateral peritonsillar abscess	10	2.0		0.442**	↑	< 0.001*	↑	< 0.001*
Parapharyngeal abscess	32	6.5	↑	< 0.001**	↑	< 0.001**		0.097**
Retropharyngeal abscess	10	2.0	↑	0.011**	↑	0.052**		0.113**
Sepsis	1	0.2						

Note: WBCs – white blood cells; CRP – C-reactive protein. Asterisks indicate method of calculation: * independent samples Kruskal–Wallis test; ** independent samples Mann–Whitney U test. In bold – statistically significant increase in the parameter.

with unilateral peritonsillar abscess (mean WBC 16.1×10^9/l vs. 13.2×10^9/l, $p < 0.001$, and mean CRP 232.97 mg/l vs. 104.4 mg/l, $p < 0.001$). Patients with parapharyngeal or retropharyngeal abscesses had higher WBC counts than patients without parapharyngeal (mean WBC count 14.66×10^9/l. vs. 10.02×10^9/l, p 0.001) or retropharyngeal abscess (a mean WBC 14.2×10^9/l vs. 10.3×10^9/l, $p = 0.052$). A statistically significant association between the duration of hospitalisation and the WBC counts and CRP levels was found; patients with high WBC counts and CRP levels had longer hospital stays (Spearman's test, $p < 0.001$).

Three hundred and ninety-eight (80.7%) patients received intravenous antibiotics during hospitalisation. The most frequently used antibiotics were ampicillin (n = 335, 68.2%), ceftriaxone (n = 34, 6.9%), amoxicillin/clavulanic acid (n = 20, 4.1%), metronidazole (n = 14, 2.8%), and amoxicillin (n = 13, 2.6%). Moreover, nearly all patients also received peroral antibiotics after discharge. The most frequently used antibiotics were amoxicillin/clavulanic acid (n = 163, 33.1%), amoxicillin (n = 162, 32.9%), cefuroxime (n = 7, 1.4%), and ampicillin (n = 5, 1.0%).

Patients who underwent elective tonsillectomy had the shortest length of antibacterial therapy (independent samples Kruskal–Wallis test, $p < 0.001$). When patients had elective tonsillectomy, the average length of the intravenous antibacterial therapy was one day, and the average length of the peroral antibiotic therapy was three days. For patients who had immediate tonsillectomy, the average length of the intravenous antibiotic therapy was three days, and the average length of the peroral antibiotic therapy was five days.

Postoperative bleeding occurred in seven patients (1.4%): in six patients after immediate tonsillectomy and in one patient after elective tonsillectomy. Four patients required revision surgery; however, other patients received conservative treatment for post-tonsillectomy bleeding control. No significant association between cardiologic comorbidities and postoperative bleeding (Fisher's exact test, $p = 0.630$) or between other comorbidities and postoperative complications (Fisher's exact test, $p = 0.479$) were found.

DISCUSSION

Tonsillectomy is considered a common operation in otolaryngology. In a 23-month period, 493 tonsillectomies were performed in a single tertiary hospital in Latvia. Immediate tonsillectomies were performed more often than elective tonsillectomies. This might be because PSCUH is a tertiary medical centre where patients receive aid in severe cases, and it is the only hospital in Latvia that provides emergency ENT care for adult patients in the country.

The mean age at the time of hospitalisation was 35 years, which is older than in other studies where patients were 28 years old at the time of tonsillectomy (Witsell *et al*., 2008; Senska *et al*., 2015). The sex distribution in our study at the time of surgery favoured women. This trend was also observed in comparable studies (Witsell *et al.*, 2008; Senska *et al.*, 2015).

In our study, peritonsillar abscess was the most common complication of tonsillitis. Peritonsillar abscess was more common in smokers than in non-smokers. Marom *et al.* (2010) found smoking was a predisposing factor for peritonsillar abscesses. Strong association exists between the incidence of peritonsillar abscesses and certain comorbidities. The incidence of peritonsillar abscess was highest in patients with T2 DM and increased with T2 DM severity, rheumatoid arthritis, and end-stage renal disease (Chang *et al.*, 2021; Ding *et al*., 2021; Wu *et al*., 2021). In our study, only 2.4% of patients had T2 DM and 0.4% had rheumatoid disease. A larger patient sample size is necessary to draw reliable conclusions regarding concomitant diseases and the incidence of peritonsillar abscesses in our study group.

The currently available literature has no data regarding obesity having an impact on peritonsillar abscess formation. In our study, adult patients included in obesity class I had immediate tonsillectomies performed more often; however, the difference was not statistically significant. No statistically significant association between BMI and the duration of hospitalisation was found.

Page *et al.* (2010) considered peritonsillar and parapharyngeal abscesses as anatomically similar because most parapharyngeal abscesses are peritonsillar (representing parapharyngeal suppuration located lateral to the palatine tonsils, which was the source of the infection) or associated with peritonsillar abscesses. The close connection between these two abscesses can explain the high rate of parapharyngeal abscesses in the current study: it was the 2nd most common complication after peritonsillar abscess.

When compared with clinical scoring systems and the detection of the bacteria, due to lower sensitivity and specific-

ity, clinical–chemical blood examination methods (counts of leukocytes, neutrophil granulocytes, and CRP) are not recommended for the diagnosis of bacterial tonsillitis (Windfuhr *et al*., 2016a). Nevertheless, CRP levels can be used to assess the severity of bacterial infection (Christensen *et al.*, 2013; 2014). In the current study, patients with more severe infections, such as bilateral peritonsillar and para- and retro-pharyngeal abscesses, showed higher levels of CRP and a higher WBC count in comparison with cases of unilateral peritonsillar abscess.

The most commonly used antibiotics were penicillin and cephalosporin, which met practical guidelines that recommended their use in cases of penicillin failure and frequent recurrence. They are also considered more reliable for the eradication of β-hemolytic streptococci (Windfuhr *et al.*, 2016a). Macrolides (e.g., erythromycin estolate) are also considered valuable alternatives in cases of penicillin allergy (Windfuhr *et al*., 2016a). However, in the current study, none of the patients received erythromycin. Clindamycin and amoxicillin/clavulanic acid have considerable clinical activity in pharyngotonsillitis (Mahakit *et al*., 2006; Munck *et al*., 2018). This corresponds to the data collected, as amoxicillin/clavulanic acid was the most common antibiotic received before hospitalisation and on discharge from the hospital.

The regular use of antibiotics in post-tonsillectomy patients is not advised (Baugh *et al*., 2011; Dhiwakar *et al*., 2012; Gil-Ascencio *et al*., 2013; Junaid *et al*., 2021). However, patients did receive antibiotics after tonsillectomy. Nevertheless, the duration was much shorter in patients who received elective tonsillectomy.

The average hospitalisation duration of three days coincides with the results in other studies, where the mean length of hospital stay was 2.84–3.4 days (Berry *et al*., 2007; Page *et al*., 2010; Albertz and Nazar, 2012). Longer hospitalisation duration was observed for patients with high inflammatory markers and comorbidities and in cases of immediate tonsillectomy.

Post-tonsillectomy bleeding rates vary widely from 2.61% to 21.8% (Witsell *et al*., 2008; Seshamani *et al*., 2014; Senska *et al*., 2015; Østvoll *et al*., 2018). However, in this study, the post-tonsillectomy bleeding rate was 1.4%, despite a large proportion of study patients being smokers. Factors such as current smoking status, sex, age, and perioperative nonsteroidal anti-inflammatory drug administration are considered clinical risk factors for post-tonsillectomy haemorrhaging in adults (Østvoll *et al*., 2018). Riechelmann *et al*. (2014) concluded that being overweight or obese did not increase the risk of post-tonsillectomy haemorrhaging in adults. However, substantial associations between cardiological diseases (or other comorbidities) and postoperative bleeding were not revealed in this study.

An analysis of surgically treated patients with recurrent tonsillitis or peritonsillar abscess in a 23-month period was provided. Data analysis was discontinued on 30 November 2020, due to the coronavirus disease of 2019 (COVID-19). On 3 December 2020, restrictions were set for scheduled operations; thus, COVID-19 restrictions did not affect the frequency of surgeries in the current study. Limitations include incomplete medical histories and uncertain previous treatments with empiric antibiotic therapies prescribed in outpatient clinics or GP practices, as well as the use of self-prescribed over-the-counter medications. The results of microbiological testing can explain the inconsistencies in the use of antibiotics during hospitalisation. During hospitalisation, antibacterial treatment was adjusted according to the antibacterial susceptibility results of isolated pathogens. The microbiological analysis, as well as the analysis of isolated pathogens and their associations with clinical characteristics, was beyond the scope of our study.

CONCLUSIONS

Immediate tonsillectomies were performed more often than elective tonsillectomies.

Age and smoking status facilitated the development of complicated cases of tonsillitis, which resulted in consecutive immediate tonsillectomies, longer period of hospitalisation and increased the need for antibacterial treatment.

A unilateral peritonsillar abscess was the most common complication of tonsillitis.

ETHICS

The study was approved by the local Ethics Committee of Rīga Stradiņš University (ethical approval number: 6-1/10/99), and all of the data was collected according to the guidelines on data protection and confidentiality.

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TONSILEKTOMIJAS PACIENTU UN AR AKŪTU TONSILEKTOMIJU SAISTĪTO FAKTORU NOVĒRTĒJUMS

Neraugoties uz antibakteriālās terapijas iespējām, tonsilīta recidīvi atkārtojas un tiek novēroti arī tādi sarežģījumi kā paratonsilārs abscess, kad nepieciešama ķirurģiska terapija. Akūtas tonsilektomijas paratonsilārā abscesa drenāža joprojām saglabā savu lomu. Mūsu pētījumā tiek raksturoti tonsilektomijas pacienti un faktori, kas saistīti ar tonsilīta dekompensāciju un komplikācijām, kad veikta akūta tonsilektomija. Pētījums ir retrospektīvs un aprakstošs. Pētījumā iekļauta informācija par 493 pacientiem, kuriem laika posmā no 2019. gada 1. janvāra līdz 2020. gada 30. novembrim Paula Stradiņa Klīniskās universitātes slimnīcas Otorinolaringoloģijas klīnikā veikta tonsilektomija plānveida kārtā vai akūti. No pacientu medicīniskās dokumentācijas tika ievākti demogrāfiskie, klīniskie un laboratoriskie dati, kā arī informācija par veikto operāciju, pēcoperācijas periodu, uzturēšanās ilgumu stacionārā, izvēlēto antibakteriālo terapiju. No pētījumā 493 iekļautiem pacientiem 213 (43,2%) bija veikta plānveida tonsilektomija, bet 269 (54,6%) — akūta tonsilektomija. Pacienti, kuriem veikta plānveida tonsilektomija, bija jaunāki nekā pacienti, kuriem tonsilektomija veikta akūtā kārtā. Paratonsilārs abscess, kura dēļ veikta akūta tonsilektomija, biežāk novērots smēķētājiem nekā nesmēķētājiem (*Pearson's* χ^2 tests, $\chi = 34.501$, $p < 0.001$). Pacienti pēc plānveida tonsilektomijas saņēma īsāku antibakteriālās terapijas kursu nekā pacienti pēc akūtas tonsilektomijas (neatkarīgo izlašu *Kruskal–Wallis* tests, $p < 0.001$). Akūta tonsilektomija tiek asociēta ar ilgāku hospitalizāciju. Secinājumi: akūta tonsilektomija biežāk tiek veikta vecāka gadagājuma pacientiem, smēķētājiem un tai raksturīgs ilgāks hospitalizācijas un antibakteriālās terapijas kurss. Vienpusējs paratonsilārs abscess ir biežākais tonsilīta sarežģījums, kura dēļ tiek veikta tonsilektomija akūtā kārtā.