Role of Laryngopharyngeal Reflux in Complications of Tonsillectomy in Pediatric Patients

Ziya Salturk · Tolgar Lutfi Kumral · Ahmet Arslanoglu ·
Imran Aydogdu · Guven Yildirim · Guler Berkiten ·
Yavuz Uyar

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Abstract Tonsillectomy and tonsillectomy with adenoidectomy are among the most common surgical procedures in otolaryngology practice. Gastroesophageal reflux was identified as a risk factor for complications in tonsillectomy. This prospective study was designed to assess the role of reflux in the development of complications following tonsillectomy in pediatric patients. Children ($n = 60$) who underwent tonsillectomy with adenoidectomy were divided into two groups, i.e., the laryngopharyngeal reflux (LPR) group and control group. Patients with LPR were identified by reflux symptom index and reflux finding score. Pain, hemorrhage, fever, nausea, vomiting, fever, dehydration, infection, and pulmonary problems were evaluated post operatively. The mean lengths of hospital stay were 2.11 days in the reflux group and 1.05 days in the control group. The difference was statistically significant. Visual analogue scores of both groups were similar on day 1 but it was significantly higher on day 7 and 14 in LPR group. Nausea and vomiting rates were 11.1 and 9.5 % for the patients in the LPR group and the controls, respectively. The difference between the two groups was not significant. The mean fever was 37.6 °C in the reflux group and 37.3 °C in the controls, which were not significantly different. 19 % of the controls and 22 % of the LPR group patients were readmitted. This difference was not statistically significant. There were two cases of bleeding in the reflux group, while no bleeding occurred in the control group. This difference was significant

statistically. LPR is a risk factor for complications following tonsillectomy.

Keywords Tonsillectomy · Complication · Laryngopharyngeal reflux · Hemorrhage · Pain

Introduction

Tonsillectomy and tonsillectomy with adenoidectomy are among the most common surgical procedures in otolaryngology practice [1]. Obstructive sleep apnea (OSA) is the most common indication for pediatric tonsillectomy [2], with a rate of 3 % in children, and is most frequently seen between 2 and 6 years old [3]. OSA may lead to behavioral disorders, neurocognitive deficits, somatic developmental disorders, and cardiovascular and metabolic sequelae [4, 5].

Tonsillectomy causes an avulsion wound, which exposes underlying tissues to the oropharyngeal environment. Secondary wound healing takes place [6], with inflammatory exudate covering the tonsillar fossae, which is then replaced by granulation tissue and mucosal creeping [7]. This healing pattern results in a predisposition to complications, such as pain, infection, and hemorrhage [8]. Tonsillectomy has a complication rate of 1–10 % and mortality rate of 1/16,000 [9, 10].

Several factors, such as younger age, OSA, craniofacial anomalies, prematurity, Down's syndrome, cerebral palsy, cardiovascular disease, obesity, and bleeding disorders, increase the complication rate following tonsillectomy [11–14]. Gastroesophageal reflux has also been identified as a risk factor for complications in tonsillectomy in recent studies [15, 16].

This prospective study assessed the role of reflux in the development of complications following tonsillectomy in pediatric patients.

Z. Salturk (✉) · T. L. Kumral · A. Arslanoglu · I. Aydogdu ·
G. Yildirim · G. Berkiten · Y. Uyar
Okmeydanı Eğitim ve Araştırma Hastanesi KBB Kliniği
Darulaceze cad. Şişli/İstanbul, İstanbul, Turkey
e-mail: ziyasalturk@gmail.com

Methods

Institutional review board approval was obtained from Okmeydani Training and Research Hospital Ethical Committee. Children ($n = 60$) who underwent tonsillectomy with adenoidectomy between December 2013 and May 2014 were included. Indications of tonsillectomy were adenotonsillary hypertrophy and recurrent tonsillitis. Patients were divided into two groups, i.e., the laryngopharyngeal reflux (LPR) group and control group. Patients with LPR were identified by reflux symptom index (RSI) and reflux finding score (RFS), both of which are validated tools that were applied just before the operation. $RSI > 13$ and $RFS > 7$ were accepted as LPR [17, 18]. RSI was validated by Belafsky et al. [17], and consists of nine questions that are scored between 0 (no problem) and 5 (severe problem) (Table 1). This tool aims to assess symptoms caused by LPR. RFS was validated by Belafsky [18] and is used to evaluate endoscopic findings of the larynx. This tool is composed of eight parameters, each of which has a special scoring method (Table 2). Children with cystic fibrosis, congenital anomalies, pulmonary diseases, or bleeding disorders were excluded to avoid complications produced by these disorders and reach reliable conclusions reflecting the effects of LPR on healthy children undergoing tonsillectomy.

In all, 18 of 60 children had LPR and constituted the LPR group, while the control group consisted of the remaining 42 cases without LPR. Two groups were compared in regard to complications and length of stay (LOS). An extended hospital stay was defined as more than 24 h. The complications evaluated were pain, hemorrhage, fever, nausea, vomiting, fever, dehydration, infection, and pulmonary problems. Pain was assessed using a visual analog scale (VAS), which was completed by the patients' parents. Other complications were evaluated clinically.

Table 1 Reflux symptom index

Symptom	No problem: 0	Severe problem: 5
Hoarseness or voice problems		
Clearing throat		
Excessive post nasal drip or mucus on throat		
Swallowing problems		
Cough after meal or lying down		
Breathing difficulties or choking episodes		
Troublesome or annoying cough		
Sensation of sticking or lump in your throat		
Heartburn, chest pain, indigestion or stomach acid coming to mouth		

Results

Of the 60 patients, 34 were male and the remaining 26 were female; 18 children had LPR (30 %) and the remaining 42 (70 %) did not. The mean age was 7.56 years (SD 3.30) in the LPR group and 6.76 years (SD 2.69) in control group. There were no differences between the groups with regard to age or gender distribution.

The mean RSI and RFS of the reflux group were 15.44 (SD 3.26) and 9.78 (SD 1.06), respectively. Those of the control group were 8.00 (SD 2.74) and 3.62 (SD 3.36), respectively.

The mean lengths of hospital stay were 2.11 days (SD 0.76) in the reflux group and 1.05 days (SD 0.2) in the control group. The difference between the two groups was statistically significant ($p = 0.137$). In all, 12 of 18 (66 %) children from the LPR group had hospital stays of more than 1 day, while 4 of 42 (9.5 %) controls stayed in hospital for more than 24 h. The VAS scores of both groups are shown in Table 3. The scores on day 1 showed no difference but on 7 and 14 were significantly higher in the LPR group than in controls.

Nausea and vomiting occurred in 10.0 % ($n = 6$) of the patients, and the rates were 11.1 % ($n = 2$) and 9.5 % ($n = 4$) for the patients in the LPR group and the controls, respectively. The difference between the two groups was not significant (Table 4). The mean fever was 37.6 °C in the reflux group and 37.3 °C in the controls, which were not significantly different ($p = 0.935$). Measurements were taken during the hospital stay.

Twelve (20 %) patients were readmitted to our clinic postoperatively; 19 % ($n = 8$) of the controls and 22 % ($n = 4$) of the LPR group patients were readmitted. This difference was not statistically significant ($p = 0.778$). As shown in Table 5, there were no significant differences in rate of readmission due to dehydration between the two groups.

There were two cases of bleeding in the reflux group, while no bleeding occurred in the control group. However, this difference was significant statistically ($p = 0.028$). There were no cases of infection or pulmonary complications in either group.

Discussion

Laryngopharyngeal reflux, which was first introduced as a clinical entity by Koufman et al. [19], occurs when gastric contents reach beyond the upper esophageal sphincter to the oropharynx and nasopharynx. The clinical spectrum of LPR varies from cough to apnea [20]. LPR has been implicated in the etiology of several common otolaryngological disorders, including adenotonsillar hyperplasia, OSA, chronic rhinitis, sinusitis, laryngeal disorders, and otitis media with effusion in

Table 2 Reflux finding score

Subglottic edema	Absent: 0	Present: 2		
Ventricular obliteration	Partial: 2	Complete: 4		
Erythema/Hyperemia	Arytenoids only: 2	Diffuse: 4		
Vocal fold edema	Mild: 1	Moderate: 2	Severe: 3	Polypoid: 4
Diffuse laryngeal edema	Mild: 1	Moderate: 2	Severe: 3	Obstructing: 4
Posterior commissure hypertrophy	Mild: 1	Moderate: 2	Severe: 3	Obstructing: 4
Granuloma/granulation	Absent: 0	Present: 2		
Thick endolaryngeal mucus	Absent: 0	Present: 2		

Table 3 Visual analog scores of laryngopharyngeal reflux and control groups

	Reflux (+) (n = 18) Mean $\pm$ SD	Reflux (–) (n = 42) Mean $\pm$ SD	<i>p</i>
VAS1	8.67 $\pm$ 1.19	7.48 $\pm$ 1.153	0.873
VAS7	5.67 $\pm$ 1.5	2.67 $\pm$ 0.85	0.000
VAS14	1.67 $\pm$ 0.69	0.29 $\pm$ 0.69	0.000

VAS visual analog score

Independent Samples *t* test * *p* < 0.05

Table 4 Vomiting rates after surgery

LPR	Vomitting		Total (n) (%)
	Negative (%)	Positive (%)	
Reflux (+)	16 (88.9)	2 (11.1)	18 (100)
Reflux (–)	38 (90.5)	4 (9.5)	42 (100)
Total	54 (90.0)	6 (10.0)	60 (100)

LPR laryngopharyngeal reflux

Pearson Chi Square *p* = 0.851

Table 5 Readmission rates of laryngopharyngeal reflux and control group

	Readmission		Total (n)
	No	Yes	
Reflux (+)	14 (77.8 %)	4 (22.2 %)	18 (100 %)
Reflux (–)	34 (81.0 %)	8 (19.0 %)	42 (100 %)
Total	48 (80.0 %)	12 (20.0 %)	60 (100 %)

Pearson Chi Square *p* = 0.778

pediatric patients [21–23]. Mc Cormick et al. [15] reported that gastroesophageal reflux was a risk factor in children aged 1–2 for early complications following adenotonsillectomy. The present prospective study was performed to evaluate complications following adenotonsillectomy in children with and without LPR. We used RSI and RFS to diagnose LPR, because of tolerance problems, and patients were followed up postoperatively.

Setabutr et al. [16] explored the reasons for extended hospital stay following tonsillectomy. They reported that 101 of 828 (12.2 %) patients had a prolonged stay (>24 h),

and 76 % of these patients remained in the hospital because of poor oral intake. Respiratory distress was the second most common reason for extended hospital stay (15 %). Zhao and Berkowitz [24] reported a rate of extended hospital stay of 6.5 % in otherwise healthy children. They also found that poor oral intake was the leading reason and followed by fever. In the present study, there was a difference between children with and without LPR. Poor oral intake was also the leading cause of extended hospital stay. We postulated that exposure of the submucosal tissue to acidic gastric contents increased pain and dysphagia, and

may also have caused delayed healing of the tissue and increased level of pain.

Pain is the most common complication associated with tonsillectomy. Sarny et al. [25] defined five main types of pain following tonsillectomy and suggested that intense pain is related to higher bleeding risk. Lavy et al. [26] concluded that the course of pain is different between younger and older children. They reported that the mean pain scores on day 1 had been similar in the two groups. However, in the older group, the level of pain recorded daily remained fairly constant until day 9 when it fell to around half of the initial score. In the younger children, the pain scores peaked on day 2, but fell to approximately half of the peak score by day 6. In the present study, pain levels of both groups were similar on day 1. However, children with reflux experienced higher pain scores on day 7 and 14. This was the main reason for extended LOS due to oral intake problems. Although we did not analyze the postoperative second day pain scores, we think that slower healing displayed its effect on pain level starting from the second day.

Hemorrhage is also a common complication following tonsillectomy [25]. Primary and secondary bleeding are defined as bleeding within the first 24 h and after 24 h after surgery, respectively [27]. Perkins et al. [28] reported that children with OSA and sleep disordered breathing had a lower risk of bleeding following tonsillectomy, while patients with chronic tonsillitis had a higher risk. In addition, patients under 6 years of age had a lower risk of bleeding. In the present study, two children with LPR showed bleeding within the first 24 h after tonsillectomy. There was a statistically significant difference between the LPR and control groups. Considering our results and regarding the increased pain and the limited number of patients in the reflux group, we feel that LPR should be considered a risk factor for bleeding.

Vomiting is also a common complication following tonsillectomy, and is one of the main causes of extended hospital stay and dehydration combined with poor oral intake. Although all of the children were administered metoclopramide postoperatively, vomiting occurred in two children in the LPR group and six children in the control group. There were no significant differences in the occurrence rates of nausea and vomiting between the two groups.

The etiology of posttonsillectomy fever is obscure. Bacteremia during surgery, anesthetic agents, and inflammatory responses of tissue to injury have all been suggested as possible causes [29]. Telian et al. [30] proposed the use of prophylactic antibiotics in children after tonsillectomy to reduce complications and fever. On the other hand, Anand et al. [31] reported no associations between positive blood, core, or surface cultures and the incidence or severity of fever nor any association between colony count in core cultures and fever. Patients who participated

this study was not prescribed any antibiotic. None of the patients had fever exceeding 38.3 °C within the first 24 h postoperatively, and there were no differences in fever between the two groups.

Dehydration is a well-known complication of tonsillectomy due to poor oral intake and vomiting [31], and it is also an important reason for readmission to hospital. The readmission rates in the present study were 22 % in the LPR group and 19 % in the control group due to poor oral intake, and the difference was not statistically significant.

Postoperative infection following tonsillectomy is a rare complication [32]. Postoperative infection of tonsillar fossa was suggested to be responsible for bleeding [33]. In addition, a number of studies have reported peritonsillar abscess following tonsillectomy and intracranial infection, such as brain abscess and meningitis due to bacteremia [34, 35]. There were no cases of postoperative infection in the present study.

The incidence of pulmonary complications following tonsillectomy is low, pulmonary edema is relatively common associated with adenotonsillectomy procedure, young age, obesity, or having pulmonary hypertension [36]. Transient bacteremia following tonsillectomy may develop after tonsillectomy. Therefore, required measures during the preoperative period should be taken into consideration, especially in patients that have chronic tonsillitis with cardiovascular disease [37]. The present study population did not include any immunosuppressed patients, and none of our patients had pulmonary problems.

Conclusions

Laryngopharyngeal reflux is a risk factor for complications following tonsillectomy. As the number of patients in the present study was small, further studies in larger populations are required to evaluate rare complications, such as pulmonary problems and infection.

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