

Tonsillectomy under the age of 3 years: is it recommended or not?

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Received 03 February 2014

Accepted 01 August 2014

The Egyptian Journal of Otolaryngology
2014, 30:337–342

Background and objectives

Tonsillectomy is the most common surgical procedure in specialty of otorhinolaryngology. Therefore, there are frequent premises regarding this procedure to be improved from different aspects, indications, time of surgery, techniques, safety measures, and postoperative care. One of the major issues regarding this procedure is the most suitable age for the surgery. This point is creating a lot of controversies particularly at extreme age groups — that is, less than 3 years and more than 60 years. Although the extreme old age groups are considered as risky for any surgical procedures specially for tonsillectomy due to lack of proper body tissues tolerance and response to post-tonsillectomy bleeding as well as upper airway edema and obstruction, those age groups are still at lesser incidence of morbidity and mortality as compared to the infantile age groups who take the wider spectrum of ENT surgeons' concentration, discussions, and studies regarding this issue.

Therefore, this study was conducted prospectively to confirm whether tonsillectomy can be performed safely before 3 years of age with nonsignificant difference regarding postoperative morbidity and mortality as compared to the other age group of 3 years or above.

Patients and methods

A total of 648 children aged from 8 months to 8 years presented at ENT department, Al-Thowra central teaching hospital and Altarahom private center, Elbyda city, Libya during the period between September 2005 and October 2012 as cases of chronic adenotonsillitis with variable patterns of indications for tonsillectomy, namely snoring and apnea attacks, persistent otitis media with effusion, recurrent attacks of acute suppurative otitis media, failure to thrive, recurrent attacks of chest infection, and malocclusive dental deformity. In all, 241 patients were under age of 3 years who represented group A, whereas remaining 407 patients at age of 3 years and above constituted group B. As prospective analytic study, both groups were compared with respect to intraoperative time consumption and whether there is any significant difference between the two groups regarding the incidence of serious postoperative complications occurrence, namely post-tonsillectomy bleeding, aspiration, airway obstruction, dehydration, postadenotonsillectomy negative pressure pulmonary edema, and metabolic as well as nutritional deficiencies. In addition, both groups were compared for any significant difference regarding the period of postoperative hospitalization, which can be used as objective indicator to measure the postoperative morbidity rate.

Results

This presenting study confirmed that the tonsillectomy procedure is an easy procedure among children younger than 3 years of age as in older children; this can be indicated by the appearance of nonsignificant difference between both groups regarding the intraoperative time consumption. In contrast, this procedure appeared to be a safe procedure among children with age below 3 years as in older children; this was illustrated by the presence of nonsignificant difference between group A and group B regarding the serious suspected post-tonsillectomy complications, namely post-tonsillectomy hemorrhage, aspiration, airway obstruction, negative pressure pulmonary edema, dehydration, and metabolic as well as nutritional deficiencies.

Conclusion

In general, tonsillectomy is a safe procedure that can be performed successfully among children at different age groups with low incidence of post-tonsillectomy complications as compared with adults.

Keywords:

post-tonsillectomy complications, post-tonsillectomy hemorrhage, post-tonsillectomy morbidity and mortality, tonsillectomy

Egypt J Otolaryngol 30:337–342

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1012-5574

Introduction

Tonsillectomy constitutes the most common surgical procedure in otorhinolaryngology. Apart from chronic tonsillitis, this procedure can be performed

for wide spectrum of indications, which can be local pathological disorders that are related to the palatine tonsils themselves or regional pathological problems that are related to anatomical structures having close

relationships with the tonsils when the tonsillectomy is performed as surgical approach to reach these regions, and finally this procedure can be performed to cure certain systemic diseases, which from pathogenesis point of view are activated as sequel of β -hemolytic streptococcal septicemia where tonsils are representing one of most common sources of it [1–4].

As in adults, these conditions that are considered as indications for tonsillectomy can appear among the children at different age groups too. However, certain disorders may be seen with higher incidence among the children as compared with the adult age group [1–6]. In the same manner, children below 3 years of age are prone to some of these problems more than other childhood ages; therefore, it becomes necessary to monitor the possibility of performance of this surgery at these age groups. Several years before, one of the first contraindications of tonsillectomy was the age below 3 years, and this concept is still utilized by many ENT surgeons; thus, this will create a significant controversy, which requires more clarifications.

The team who is against conducting this procedure in patients below 3 years of age claimed multiple reasons by which they consider this procedure more risky at this age [7–10]. These reasons can be summarized as:

- (a) Tonsillectomy is defined as major surgical invasion that cannot be tolerated by these extreme young ages;
- (b) The risk for general anesthesia-associated complications by this upper airway-related procedure is higher among this age group as compared with the older age group;
- (c) The kind of tonsils-related disorder at these ages is usually upper airway obstructive lesion; therefore, the tonsillectomy in this pattern of circumstance creates higher incidence of pediatric post-tonsillectomy negative pressure pulmonary edema;
- (d) Anatomically speaking, the inlet of upper airway tract at this age group is incompletely developed; this insufficient space increases the risk for postoperative upper airway obstruction as the result of local reactive edema; and
- (e) Technically speaking, this type of surgery is considered as bloody procedure, which can be associated with either primary or reactionary or secondary hemorrhage; thus, as compared with older ages, children aged less than 3 years are unable to compensate those risky hemorrhages [2,3,5,7–10].

For further details, the tonsillectomy at the extreme ages constitutes a major surgical intervention; this

is because of the well-established tonsillectomy-associated complications, which are usually difficult to be compensated by those extreme young or old patients particularly the post-tonsillectomy hemorrhage, upper airway obstruction, dehydration, aspiration, negative pressure pulmonary edema, as well as nutritional and metabolic disturbances, which will increase the morbidity and mortality among those ages. Regarding the post-tonsillectomy bleeding, physiological speaking, the total amount of the body content of blood in children aged below 3 years is 70 ml/kg in average. Therefore, any surgical blood loss can be considered as significant loss and it may result in hypovolemic shock specially if the procedure is known to be bloody procedure such as the tonsillectomy [2–5,7–12].

The children at the infantile age group are highly susceptible for aspiration as compared with other children with older ages; this is mainly because of certain anatomical as well as physiological predisposition such as:

- (a) The higher location of the larynx,
- (b) Softened and maldeveloped laryngeal cartilaginous skeleton particularly epiglottis,
- (c) The airway segments are short enough as compared with older ages,
- (d) Immature protective adduction movement of true vocal cords,
- (e) Exaggerated gag reflex,
- (f) Maldevelopment of cough reflex, and
- (g) The muscle tone is weak as compared with other older ages.

The aspiration due to tonsillectomy may occur for blood, clots, tissue fragments, saliva, or squeezed pus from infected tonsils; the fate of this aspiration will be either in form of airway obstruction, lung collapse, or chest infection, and all these are considered as serious conditions with high grade of life threatening specially at the extreme age groups [2–5,7–9,11,12].

From the other aspect, some studies claimed that the upper airway obstruction represents other significant sequel of tonsillectomy; it appears with higher incidence among those patients with age less than 3 years as compared with older children. By checking up on these literatures, it was noted that there are different forms of this obstruction, which can be:

- (a) Obstruction due to blood clots inhalation at time of recovery from anesthesia;
- (b) Obstruction as the result of tissue fragment aspiration; usually, this was found to occur as sequel of nasotracheal intubation by anesthetist when fragment of adenoid tissue will slip into airway;

- (c) Upper airway obstruction due to reactive inflammatory edema at site of surgery; this can be reasoned by the anatomical fact that the inlet of upper airway is insufficient regarding its size at this young age group as compared with older ages; and finally
- (d) The functional obstruction, which is mainly due to nutritional as well as metabolic disturbances such as hyponatremia, hypokalemia, hypocalcemia, and hypomagnesemia [5,10,13].

Regarding postadenotonsillectomy pediatric negative pressure pulmonary edema, this condition was first described by Thomas in 1999 as one of serious complications after adenotonsillectomy. Although it can occur among children at different age categories, the extreme childhood ages showed the highest incidence of this problem. This can be explained by the complete or near complete obstruction of the nasopharynx and oropharynx by large adenoid as well as hypertrophied palatine tonsils; consecutively, this is due to already insufficient limited space at these two parts of upper airway inlet that belong to the infantile age group. The long-standing obstruction will create intra-alveolar negative pressure, which will predispose to the intra-alveolar perfusion under effect of pressure gradient between high pulmonary arterial pressure and low intra-alveolar pressure, particularly at time of anesthesia induction and recovery when arterial pulmonary pressure will be the maximum [10].

In the same manner, dehydration, nutritional deficiencies, and metabolic disturbances are representing other important sequels of this procedure, which are seen more among extreme ages as compared with other age groups. This is mainly related to postoperative dysphagia and odynophagia. Sometimes, dehydration and electrolytes as well as minerals deficiencies such as hyponatremia, hypokalemia, hypocalcemia, and hypomagnesemia are considered as significant complications, which may lead to life-threatening situations, and thus they require immediate correction and supplements [8,9,14–20].

In contrast, the previous concepts are countered by the other theory that supports and encourages the performance of this procedure safely at age below 3 years [1,3,5,6,13,14,21]. This is reasoned by:

- (a) In the children as general this procedure is usually associated with less bleeding as compared with adults; this is due to less local fibrosis, and therefore more easy dissection;
- (b) The easy dissection will provide less local traumas, and subsequently there will be minimal local pain as well as rapid local healing; thus, the swallowing

function will be recovered among children earlier as compared with adults;

- (c) Same explanation belong to children because of limited local surgical injuries; thus, this will reduce the risk for possible postoperative local edema; and
- (d) Other serious complications such as aspiration, upper airway obstruction, and pediatric postadenotonsillectomy negative pressure pulmonary edema; all can be overcome by optimum general anesthesia-related precautions, which are confirmed to decrease the suspect incidence of these life-threatening sequels [1,3,5,6,13,14,21].

By the end, we can say that sometimes the tonsillectomy procedure may have strong indication to be performed at age under 3 years, and in certain circumstances the delay of surgical intervention can result in further child's morbidities, which might be difficult to be controlled and cured. Therefore, it becomes necessary to improve the ideas and make a chance for this important procedure to be performed easily at this critical age.

For this reason, this study was planned to achieve these aims:

- (a) To confirm whether there is any technical difficulties in performance of tonsillectomy among children aged below 3 years as compared with older age groups and whether this can be measured objectively by calculation of intraoperative time consumption,
- (b) To elucidate whether there is any significant difference between the two circumstances, the performance of tonsillectomy earlier at age below 3 years and in older children regarding the incidence of postoperative complications, namely aspiration, negative pressure pulmonary edema, airway obstruction, bleeding, dehydration as well as metabolic and nutritional deficiencies, and
- (c) To postulate whether there is any significant difference between the two situations regarding postoperative morbidity and hospitalization time.

Patients and methods

A total of 648 children aged from 8 months to 8 years presented at ENT department, Al-Thawra Central Teaching Hospital and Altarahom private center (Elbyda city, Libya) during the period between September 2005 and October 2012 as cases of chronic adenotonsillitis with variable patterns of indications for tonsillectomy, namely snoring and apnea attacks, persistent otitis media with effusion, recurrent attacks

of acute suppurative otitis media, failure to thrive, recurrent attacks of chest infection, and malocclusive dental deformity. In all, 241 patients were under age of 3 years who represented group A, whereas remaining 407 patients at age of 3 years and above constituted group B. The patients were evaluated locally and systemically. The local examination was performed to rule out any evidences of velopalatopharyngeal malformations and dysfunctions such as cleft palate, submucosal palate, and bifid uvula; in addition, the local examination is important to exclude any manifestations of associated allergic pharyngitis or laryngopharyngeal reflux. The systemic evaluation was performed to confirm the general health status of the child with respect to the respiratory system, cardiovascular system, musculoskeletal system, neurological system, metabolic as well as nutritional situation, and bleeding-coagulation profile. All patients underwent adenotonsillectomy by curettage method and simple dissection method consecutively. As prospective analytic study, both groups were compared with respect to intraoperative time consumption and whether there is any significant difference between two groups regarding the incidence of serious postoperative complications occurrence, namely post-tonsillectomy bleeding, aspiration, airway obstruction, dehydration, postadenotonsillectomy negative pressure pulmonary edema, and metabolic as well as nutritional deficiencies. In addition, both groups were compared for any significant difference regarding the period of postoperative hospitalization, which can be used as objective indicator to measure the postoperative morbidity rate. Informed consent was taken from the parents of all patients involved in the research before their participation.

Data were expressed using descriptive analysis such as mean \pm SEM and percentages; test of significance was carried out using the χ^2 -test and two-way analysis of variance. A *P* value of less than 0.05 was considered as significant; the degree of significance was determined using level of SD test. The Student *t*-test was used for dependent sample; in addition, contingency coefficient was calculated as measurement of association between nominal variable.

Results

The results showed nonsignificant difference between the two groups regarding the intraoperative time consumption ($P > 0.5$). The results illustrated that both groups presented nonsignificant incidence of post-tonsillectomy hemorrhage ($P > 0.5$). The study demonstrated that there was no significant difference between both groups regarding the incidence of post-

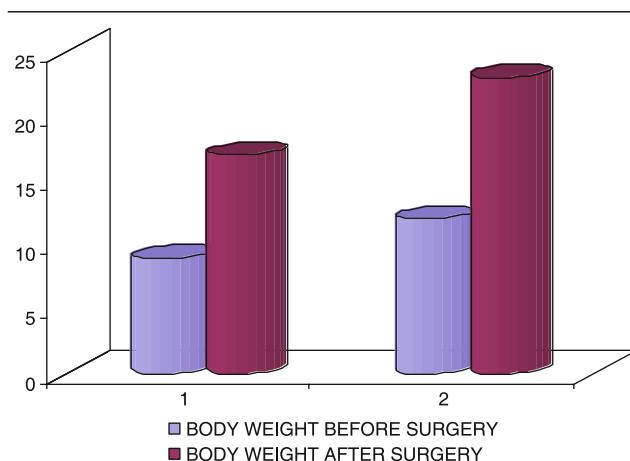
tonsillectomy aspiration, and among both groups there was nonsignificant incidence of registered aspiration cases ($P > 0.5$). Regarding the post-tonsillectomy airway obstruction, it represented the nonsignificant incidence of airway obstruction at both groups ($P > 0.5$). In contrast, the study demonstrated no case of post-tonsillectomy negative pressure pulmonary edema among both groups ($P > 0.5$). In addition, nonsignificant difference was illustrated in the risk for postoperative dehydration and early and late metabolic as well as nutritional deficiencies at both groups ($P > 0.5$). The study presented the effect of tonsillectomy on child's body weight gain; as can be seen in Fig. 1, both groups showed significant gain in body weights of all operated children as compared with preoperative situations ($P < 0.5$). Finally, the results confirmed nonsignificant difference between both groups regarding postoperative period of hospitalization, which was in group A and group B less than 24 h ($P < 0.5$).

Discussion

Although there were many reports claiming that the performance of tonsillectomy in patients below 3 years of age increases the postoperative morbidity and mortality [7–10], it is approved by this presenting study that the tonsillectomy can be conducted safely among extremely young age children [1,3,5,6,13,14,21].

In this presenting study, the intraoperative time required for performance of this procedure showed nonsignificant difference between two groups. This indicates that there are no any technical difficulties regarding tonsillectomy among children of age younger than 3 years as compared with older age groups. This can be explained by well-known fact that the dissection

Figure 1



Effect of tonsillectomy on child's body weight gain (1 = group A, 2 = group B) ($P < 0.5$).

process of the tonsils in children is more easy than that in adults; this is because of less fibrous tissue formation between tonsil and tonsillar bed in children as compared with adult [1,3,5,6,13,14,21]. Pathologically speaking, the amount of fibrosis at inflamed areas is directly proportional to the duration of inflammatory process at same areas — that is, on increasing age, the frequency of remissions and relapses of acute inflammatory reactions is increased resulting in more fibrous tissue formation; thus, younger children show minimal fibrosis as compared with older children [1,3,5,6,13,14,21].

The previous-mentioned concept can be used as basic information to discuss the explanations for nonsignificant risk regarding post-tonsillectomy hemorrhage, dehydration, and metabolic as well as nutritional deficiencies among younger children as compared with the older group. Once the dissection process of tonsils is smooth due to lack of extensive fibrosis, subsequently the chance of bleeding will be less and in the same time there will be minimal local associated tissue injuries, which will produce more tolerated and lower-intensity local nociceptive effects, and by this situation the swallowing function will be recovered postoperatively as soon as possible to help in the maintenance of adequate body hydration status as well as proper nutritional supplement [1,3,5,6,8,9,13–24]. This can explain our nonsignificant registration of cases with these complications among the operated children.

From other aspect, although the extreme young children are prone to higher risk for aspiration as compared with older ages, this is not enough reason to postpone the tonsillectomy procedure at ages younger than 3 years, particularly if there is strong indication that requires immediate interference [1,3,5,6,13,14,21]. This aspiration risk can be overcome by certain technical measurements, which are:

- (a) Avoidance of induction of general anesthesia by nasotracheal intubation by which small adenoid tissue fragment may slip to the airway;
- (b) The endotracheal intubation must be performed with sufficient-sized cuffed tube;
- (c) Intraoperatively, the position of child's head must be at lower level than the trunk; thus, all secretions, blood, or tissue fragments will skip to nasopharyngeal cavity, despite lower airway segments;
- (d) During the performance of tonsillar dissection process, the frequent oropharyngeal suction and clearance is required to keep the field always cleaned and dry; and
- (e) At the end of procedure, there must be nasopharyngeal suction and clearance to avoid any local stagnant fatal clot [1,3,5,6,13,14,21].

In accordance, the same previously mentioned protective measurements will reduce the incidence rate of upper airway obstruction [1–8,11–17,21]. In addition, it was found that the intraoperative as well as postoperative intravenous administration of dexamethasone will help in the maintenance of airway as patent as much as possible due to the potent anti-inflammatory action of this agent. In same manner, the systemic administration of dexamethasone was approved to relieve the post-tonsillectomy throat pain; thus, it helps in the recovery of normal swallowing mechanism as soon as possible, and, due to platelets aggregation-stimulating effect of dexamethasone, its systemic administration was found to reduce the risk for post-tonsillectomy hemorrhage [1–8,11–17,21]. The protocol of dexamethasone administration, which was applied in this presenting study, was 2–4 mg administered intravenously at time of anesthesia induction, followed by 2–4 mg administered intravenously every eighth hour postoperatively for first 24 h, and after that the child will continue with oral administration of dexamethasone as 1 mg/kg/day for 7–14 days accordingly [25–32].

Regarding the postadenotonsillectomy negative pressure pulmonary edema, although this disorder was well established and fully described first by Thomas in 1999, at that time it was considered as one of life-threatening postadenotonsillectomy complications. The pathogenesis of this disorder basically depends on the presence of pressure gradient between the pulmonary circulation and intra-alveolar space — that is, the long-standing upper airway obstruction by large-sized adenoid or hypertrophied tonsils will cause failure of proper ventilation of the lungs alveolar tissue; this will result in compensatory emphysematous changes that lead to decrease in intra-alveolar space pressure toward the negative values. Thus, at time of anesthesia induction and by sudden raising of pulmonary pressure, the blood perfusion will be increased into the alveolar spaces under the effect of wide pressure gradient causing massive pulmonary edema. Recently speaking, many studies including our presenting study confirmed that the incidence of pediatric postadenotonsillectomy negative pressure pulmonary edema is extremely rare. In our presenting study, no any case of postadenotonsillectomy negative pressure pulmonary edema appeared among all operated children; this is in agreement with many recent studies and it can be explained by two reasons:

- (a) From physiological point of view, the pulmonary hypertension has lower incidence in childhood ages as compared with adults and
- (b) The presence of advanced facilities for anesthesia induction gives sufficient prophylaxis against this complication [1,3,5,6,13,14,21].

Our study concluded that tonsillectomy is a safe procedure that can be performed successfully among children at different age groups with low incidence of post-tonsillectomy complications as compared with adults in whom the dissection of tonsils is more difficult due to extensive fibrosis resulting in more risk for post-tonsillectomy bleeding and throat pain, which subsequently lead to dehydration and further metabolic as well as nutritional deficiencies. In addition, the dissection on top of diffuse fibrosis results in more local tissue injuries; therefore, this will predispose for upper airway edema, which may precipitate the obstruction. In contrast, there is no significant fibrosis around the tonsils in children; thus, the dissection is easier and smooth with further postoperative more comfortable situation.

As the tonsillectomy is a commonest procedure in ENT specialty, continuous studies are recommended to resolve all problems that can be associated with it.

Acknowledgements

Conflicts of interest

None declared.

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