

Resolving of Tonsillectomy Dilemma Among Children Under Age of Three Years

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Abstract: *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 big 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 i.e. less than three years and more than sixty 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 air way edema and obstruction but those age groups are still at lesser incidence of morbidity and mortality as compared to infantile age groups who take the wider spectrum of ENT surgeons' concentration, discussions, and researches regarding this issue. Therefore this study was conducted prospectively to confirm whether the tonsillectomy can be performed safely before age of three years with non-significant difference regarding post-operative morbidity and mortality as compared to the other age group of three years or more. *Patients and methods:* 648 children aged from 8 months through 8 years presented at ENT department - Althowra central teaching hospital and Altarahom private center – Elbyda city – Libya at period in between September 2005 to October 2012 with different indications for tonsillectomy. 241 patients were under age of three years who represent group-A while remaining 407 at age from three years and above and constitute group-B. As prospective analytic study, both groups compared in relation to intra-operative time consumption and whether there is any significant difference between two groups regarding the incidence of serious postoperative complications occurrence. In addition both groups 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 three years of age as in older children; this can be indicated by the appearance of non-significant difference between both groups regarding the intra-operative time consumption. On the other hand this procedure approved to be a safe procedure among children with age below three years as in older children; this was illustrated by the presence of non-significant difference between group-A and group-B regarding the serious suspected post-tonsillectomy complications namely post-tonsillectomy hemorrhage, aspiration, air way obstruction, negative pressure pulmonary edema, dehydration, and metabolic as well as nutritional deficiencies. *Conclusion:* Generally speaking the tonsillectomy is a safe procedure which can be performed successfully among children at different age groups with low incidence of post-tonsillectomy complications as compared to adults.

Keywords: Tonsillectomy, Post-Tonsillectomy Morbidity and Mortality, Post-Tonsillectomy Complications, Post-Tonsillectomy Hemorrhage

1. Introduction

Tonsillectomy constitutes the most common surgical procedure in otorhinolaryngeology. Apart of chronic tonsillitis, this procedure can be performed for wide spectrum of indications which can be as local pathological disorders that related to the palatine tonsils themselves or regional

pathological problems which are related to anatomical structures have close relations with the tonsils when the tonsillectomy is done as surgical approach to reach these regions, and finally this procedure can be done to cure certain systemic diseases which from pathogenesis point of view are activated as sequel of beta-hemolytic streptococcal septicemia where tonsils are representing one of most

common source of it [1, 3, 4, 6].

As in adult these conditions which are considered as indications for tonsillectomy can appear among the children at different age groups too. Although there are certain disorders may be seen with higher incidence among the children as compared to adult age group [1, 3, 4, 6, 9, 11]. In same manner the children at age below three years are prone for some of these problems more than other childhood ages therefore it becomes necessary to check up on the possibility of performance of this surgery at these age groups. Before several years it was one of first contraindications of tonsillectomy is the age below three years and recently 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 the conduction of this procedure at age under three years claimed multiple reasons via which they consider this procedure more risky at this age [5, 14, 19 and 31]. These reasons can be summarized as: A) tonsillectomy is defined as major surgical invasion which cannot be tolerated by these extreme young ages. B) the risk of general anesthesia associated complications by this upper air way related procedure is higher among this age group as compared to the older. C) the kind of tonsils related disorder at these ages is usually upper air way obstructive lesion therefore the tonsillectomy in this pattern of circumstance create higher incidence of pediatric post-tonsillectomy negative pressure pulmonary edema. D) anatomically speaking the inlet of upper air way tract at this age group is incompletely developed this insufficient space increases the risk of post-operative upper air way obstruction as the result of local reactive edema. 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 to older ages the children who have age less than three years are unable to compensate those risky hemorrhages [3, 4, 5, 9, 14, 19 and 31].

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 usually difficult to be compensated by those extreme young or old patients particularly the post-tonsillectomy hemorrhage, upper air way 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 child aged below three years is 70ml/kg in average. Therefore any surgical blood loss can be considered as significant loss and it may resulting in hypo-volumic shock specially if the procedure is known to be bloody procedure as the tonsillectomy [3, 4, 5, 6, 7, 8, 9, 14, 19 31].

The children at infantile age group are highly susceptible for aspiration as compared to other children with older ages, this mainly due to certain anatomical as well as physiological predisposition as: 1) the higher location of the larynx, 2)

softened and mal-developed laryngeal cartilaginous skeleton particularly epiglottis, 3) the air way segments are short enough as compared to older ages, 4) immature protective adduction movement of true vocal cords, 5) exaggerated gag reflex. 6) mal-development of cough reflex, and 7) the muscle tone is weak as compared to 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 air way 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 [3, 4, 5, 6, 7, 8, 9, 14, 19].

From the other aspect some studies claimed that the upper air way obstruction represents other significant sequel of tonsillectomy, it appears with higher incidence among those patients with age less than three years as compared to older children. And by checking up on these literatures it was noted that there are different forms of this obstruction which can be: I) obstruction due to blood clots inhalation at time of recovery from anesthesia. II) obstruction as the result of tissue fragment aspiration, usually this was found to occur as sequel of naso-tracheal intubation by anesthetist when fragment of adenoid tissue will slip into air way. III) upper air way obstruction due to reactive inflammatory edema at site of surgery. This can be reasoned by the anatomical fact that the inlet of upper air way is insufficient regarding its size at this young age group as compared to older ages. Finally, IV) the functional obstruction which is mainly due to nutritional as well as metabolic disturbances as hyponatremia, hypokalemia, hypocalcaemia, and hypomagnesaemia [9, 12, 31].

Regarding post-adenotonsillectomy pediatric negative pressure pulmonary edema, this condition was first described by Thomas on 1999 as one of serious complications after adeno-tonsillectomy. Although it can occur among children at different age categories but the extreme childhood ages showed the highest incidence of this problem. This can be explained by the complete or near complete obstruction of 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 air way inlet belong 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 [31].

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 to other age groups. This is mainly related to post-operative dysphagia and odynophagia. Sometimes dehydration and electrolytes as well as minerals deficiencies as hyponatremia, hypokalemia, hypocalcaemia, and hypomagnesaemia are considered as significant

complications which may lead to life-threatening situations and thus they require immediate correction and supplements [10, 13, 14, 15, 16, 17, 19, 22, 32].

On the other hand the previous concepts are countered by the other theory which supports and encourages the performance of this procedure safely at age before three years [1, 2, 4, 9, 10, 11, and 12]. This is reasoned by: I) in the children as general this procedure is usually associated with less bleeding as compared to adults, this is due to less local fibrosis and therefore more easy dissection. II) 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 to adult. III) by same explanation, belong to children because of limited local surgical injuries thus this will reduce the risk of possible post-operative local edema. IV) other serious complication as aspiration, upper air obstruction and pediatric post-adenotonsillectomy 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, 2, 4, 9, 10, 11, and 12].

By the end we can say that sometimes the tonsillectomy procedure may have strong indication to be done at age under three 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: I) to confirm whether there is any technical difficulties in performance of tonsillectomy among children of age below three years as compared to older age groups, and this can be measured objectively by calculation of intra-operative time consumption. II) To elucidate whether there is any significant difference between the two circumstances, the performance of tonsillectomy earlier at age before three years and at older children regarding the incidence of post-operative complications namely aspiration, negative pressure pulmonary edema, air way obstruction, bleeding, dehydration as well as metabolic and nutritional deficiencies. III) To postulate whether there is any significant difference between the two situations regarding post-operative morbidity and hospitalization time.

2. Patients and Methods

648 children aged from 8 months through 8 years presented at ENT department - Althowra central teaching hospital and Altarahom private center - Elbyda city - Libya at period in between September 2005 to October 2012 as cases of chronic adeno-tonsillitis 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 mal-occlusive dental deformity.

241 patients were under age of three years who represent group-A while remaining 407 at age from three years and above and constitute group-B. The patients evaluated locally and systemically. The local examination was done to rule out any evidences of velo-palato-pharyngeal malformations and dysfunctions as cleft palate, sub-mucosal palate, and bifid uvula, in addition the local examination is important to exclude any manifestations of associated allergic pharyngitis or laryngo-pharyngeal reflux. The systemic evaluation was done to confirm the general health status of the child in relation to respiratory system, cardiovascular system, musculoskeletal system, neurological system, metabolic as well as nutritional situation, and bleeding-coagulation profile. The all patients underwent adeno-tonsillectomy by curettage method and simple dissection method consecutively. As prospective analytic study, both groups compared in relation to intra-operative 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, air way obstruction, dehydration, post-adenotonsillectomy negative pressure pulmonary edema, and metabolic as well as nutritional deficiencies. In addition both groups compared for any significant difference regarding the period of postoperative hospitalization which can be used as objective indicator to measure the postoperative morbidity rate. An informed consent was taken from the parents of all patients involved in the research prior to their participation.

Data were expressed by using descriptive analysis as means \pm standard error of mean (s. e. m) and percentages, test of significance was carried out, using Chi-squar test and two way analysis of variance. A probability less than 0.05 was considered as significant, the degree of significance was determined by using level of standard deviation test. Student -t- test was used for dependent sample, as well as contingency coefficient was calculated as measurement of association between nominal variable.

3. Results

The results presented in Figure-I showed non-significant difference in between the two groups regarding the intra-operative time consumption ($P > 0.5$). Figure-II illustrated that both groups presented non-significant incidence of post-tonsillectomy hemorrhage ($P > 0.5$). Figure-III demonstrated that there is no significant difference between both groups regarding the incidence of post-tonsillectomy aspiration and among both groups there was non-significant incidence of registered aspiration cases ($P > 0.5$). Regarding the post-tonsillectomy air way obstruction, Figure-IV represented the non-significant incidence of air way obstruction at both groups ($P > 0.5$). On the other hand Figure-V demonstrated no case of post-tonsillectomy negative pressure pulmonary edema among both groups was recorded ($P > 0.5$). In addition Figure-VI, VII, and VIII illustrated non-significant difference in the risk of post-operative dehydration, early and late metabolic as well as nutritional deficiencies at both

groups ($P > 0.5$). Figure-IX presented the effect of tonsillectomy on child's body weight gain, as can be seen at this figure the both groups showed significant gaining in body weights of all operated children as compared to pre-operative situations ($P < 0.5$). Finally Figure-X confirmed non-significant difference between both groups regarding post-operative period of hospitalization which was in group-A and group-B less than 24 hours ($P < 0.5$).

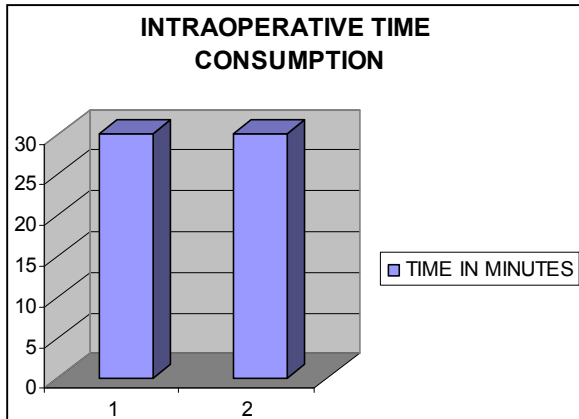


Figure I: relationship between age of child and intra-operative time consumption in minutes which is required for tonsillectomy (1=group-A, 2=group-B) ($P > 0.5$).

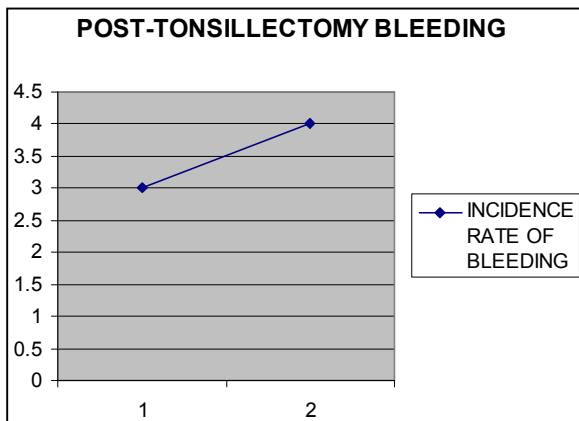


Figure II: relationship between age of child and incidence of post-tonsillectomy bleeding (1=group-A, 2=group-B) ($P > 0.5$).

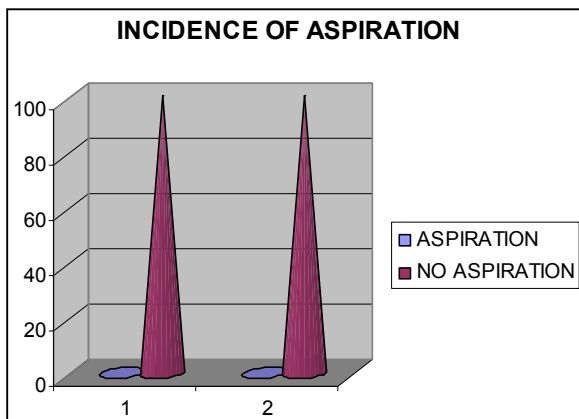


Figure III: relationship between age of child and incidence of aspiration during tonsillectomy procedure (1=group-A, 2=group-B) ($P > 0.5$).

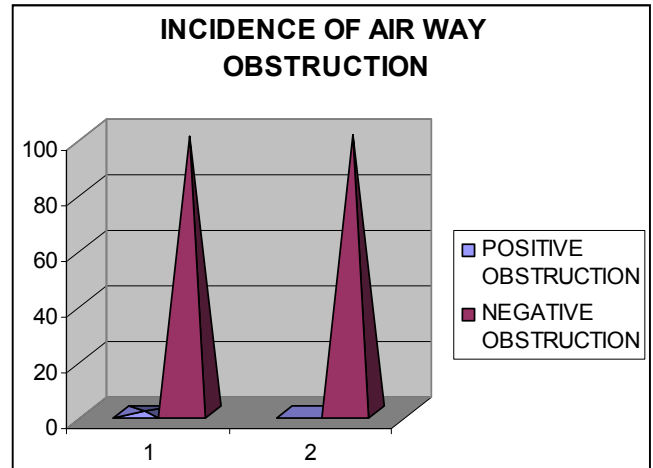


Figure IV: relationship between age of child and incidence of air way obstruction after tonsillectomy (1=group-A, 2=group-B) ($P > 0.5$).

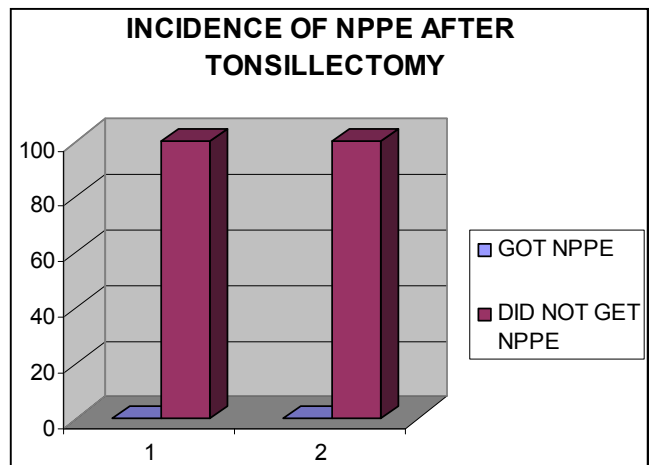


Figure V: relationship between age of child and incidence of negative pressure pulmonary edema (NPPE) after tonsillectomy (1=group-A, 2=group-B) ($P > 0.5$).

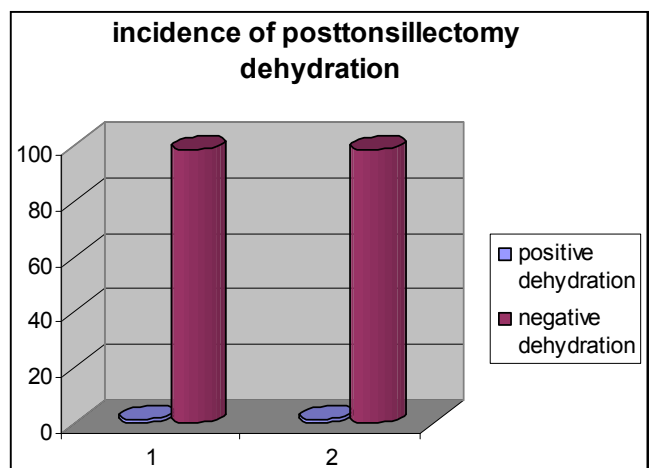


Figure VI: relationship between age of child and incidence of post-tonsillectomy dehydration (1=group-A, 2=group-B) ($P > 0.5$).

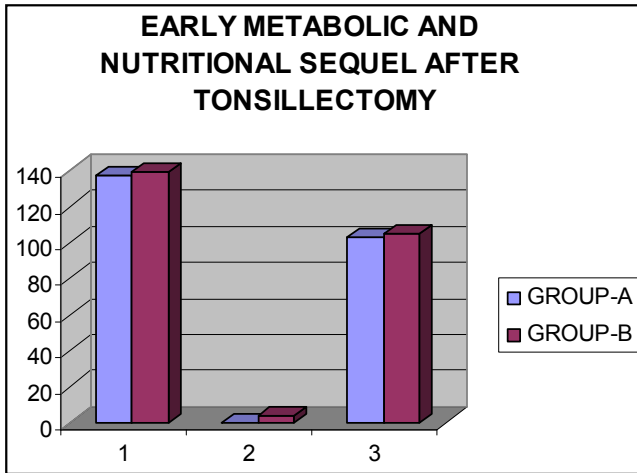


Figure VII: relationship between age of child and incidence of post-tonsillectomy early metabolic and nutritional deficiencies (1=serum sodium level, 2=serum potassium level, and 3= serum chloride level) ($P > 0.5$).

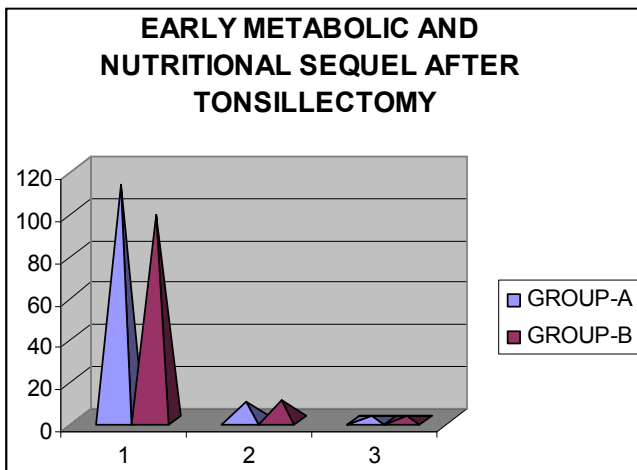


Figure VIII: relationship between age of child and incidence of post-tonsillectomy early metabolic and nutritional deficiencies (1=serum random blood sugar level, 2=serum calcium level, and 3= serum magnesium level) ($P > 0.5$).

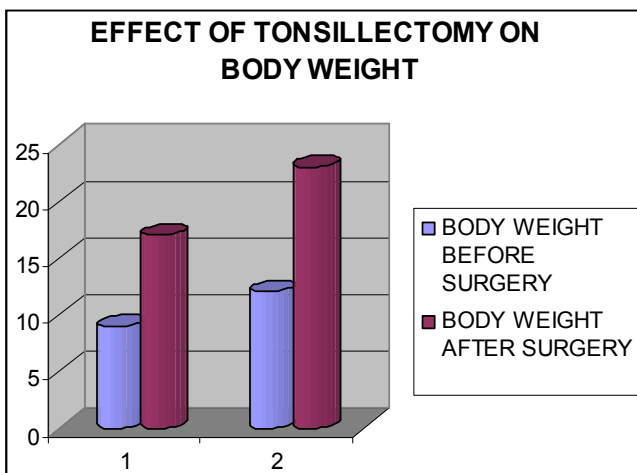


Figure IX: effect of tonsillectomy on child's body weight gain (1=group-A, 2=group-B) ($P < 0.5$).

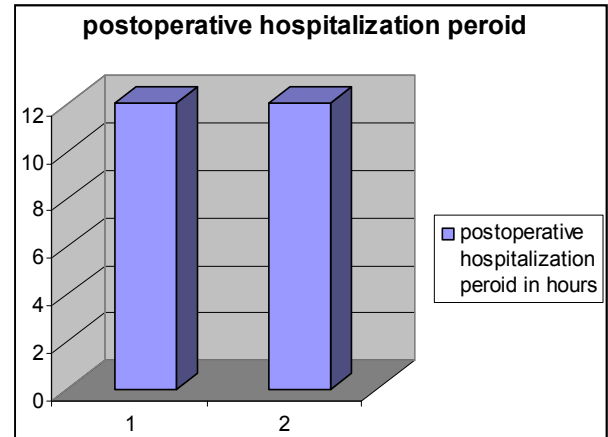


Figure X: relationship between age of child and the time which is required for his/her hospitalization after tonsillectomy (1=group-A, 2=group-B) ($P > 0.5$).

4. Discussion

Although there were many reports which claimed that the performance of tonsillectomy before age of three years increases the post-operative morbidity and mortality [5, 14, 19 and 31]. On the other hand as it is approved by this presenting study, the tonsillectomy can be conducted safely at children with extreme young ages [1, 2, 4, 9, 10, 11, and 12].

As it was found in this presenting study the intra-operative time which is required for performance of this procedure showed non-significant difference in between two groups. This indicates that there are no any technical difficulties regarding tonsillectomy among children of age younger than three years as compared to older age groups. This can be explained by well-known fact that generally speaking the dissection process of the tonsils in the children is more easy than that in the adult, this is because of less fibrous tissue formation between tonsil and tonsillar bed in children as compared to adult [1, 2, 4, 9, 10, 11, 12]. Pathologically speaking the amount of fibrosis at inflamed areas is directly proportional to the duration of inflammatory process at same areas i.e. by going of the age the frequency of remissions and relapses of acute inflammatory reactions is increased resulting in more fibrous tissue formation thus the more young children show minimal fibrosis as compared to older children [1, 2, 4, 9, 10, 11, 12].

The previous mentioned concept can be used as basic information to discuss the explanations for non-significant risk regarding post-tonsillectomy hemorrhage, dehydration, and metabolic as well as nutritional deficiencies among younger children as compared to older group. Once the dissection process of tonsils is smooth due to lack of extensive fibrosis therefore 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 of 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, 2, 4, 9-17, 19, 20-23, 32]. This can

explain our non-significant registration of cases with these complications among the operated children.

From other aspect, although the extreme young children are prone for higher risk of aspiration as compared to older ages but this is not enough reason to postpone the tonsillectomy procedure at ages younger than three years particularly if there is strong indication which require immediate interference [1, 2, 4, 9, 10, 11, and 12]. This aspiration risk can be overcome by certain technical measurements which are: 1) Avoidance of induction of general anesthesia by naso-tracheal intubation via which small adenoid tissue fragment may slip to the air way. 2) The endo-tracheal intubation must be done with sufficient sized cuffed tube. 3) Intra-operatively, 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 in spite of lower air way segments. 4) During the performance of tonsillar dissection process the frequent oropharyngeal suction and clearance is required to keep the field always cleaned and dry. 5) At the end of procedure there must be nasopharyngeal suction and clearance to avoid any local stagnant fatal clot [1, 2, 4, 9, 10, 11, 12].

In accordance the same previously mentioned protective measurements will reduce the incidence rate of upper air way obstruction [1-16]. In addition it was found that the intraoperative as well as postoperative intravenous administration of dexamethasone will help in the maintenance of air way 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 relief 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 of post-tonsillectomy hemorrhage [1-16]. The protocol of dexamethasone administration which applied in this presenting study was 2-4mgs administered intravenously at time of anesthesia induction then followed by 2-4mgs administered intravenously every eight hours postoperatively for first 24 hours and after that the child will continue with oral administration of dexamethasone as 1 mg \ kg \ day for 7-14 days accordingly [24-30].

Regarding the post-adenotonsillectomy negative pressure pulmonary edema, although this disorder was well-established and fully described first by Thomas on 1999, at that time it was considered as one of life-threatening post-adenotonsillectomy complications. The pathogenesis of this disorder is basically depending upon the presence of pressure gradient between the pulmonary circulation and intra-alveolar space i.e. the long standing upper air way 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 which lead to dropping of 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 post-adenotonsillectomy negative pressure pulmonary edema is extremely rare. In our presenting study there was no any case of post-adenotonsillectomy 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: 1) From physiological point of view, the pulmonary hypertension is of lower incidence in childhood ages as compared to adults. 2) The presence of advanced facilities for anesthesia induction gives sufficient prophylaxis against this complication [1, 2, 4, 9, 10, 11, and 12].

Our study concluded to that, the tonsillectomy is a safe procedure which can be performed successfully among children at different age groups with low incidence of post-tonsillectomy complications as compared to adults at who the dissection of tonsils is more difficult due to extensive fibrosis resulting in more risk of post-tonsillectomy bleeding and throat pain which subsequently leads 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 air way edema which may precipitate the obstruction. On the other hand there is no significant fibrosis around the tonsils in children thus the dissection is easier and smooth with further post-operative more comfortable situation.

As the tonsillectomy is a commonest procedure in ENT specialty thus continuous researches are recommended to resolve all problems which can be associated with it.

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