ORIGINAL ARTICLE

Relationship Between Brodsky Grading Scale of Palatine Tonsils and Vitamin D of Recurrent Tonsillitis and Tonsillar Hyperplasia in Children

Sahar A. H. AL-Sharqi[1], Halah Amer[2] ,Zaid Sharba[3]

[1] Department of Biology, College of Science, Mustansiriyah University, 14022 Baghdad. Iraq
[2] Department of Biology, College of Science, Mustansiriyah University, 14022 Baghdad. Iraq
[3] MSc School of environment and life sciences, University of Salford, Manchester, United Kingdom

ABSTRACT

Introduction: Tonsils are the first line defense agonist the microbe that enters the body through the respiratory tract. Tonsillectomy is most commonly used to treat tonsillitis and tonsillar hypertrophy. **Methods:** The current study investigates the relationship between the Brodsky grading scale of palatine tonsils and Vitamin D of recurrent tonsillitis patients(T patients)and tonsillar hypertrophy patients(H patients)in addition to some serological test.The samples were taken from 20 children with tonsillitis and 20 children with tonsillar hypertrophy and 20 as a control group.The physical examination of tonsil grading was done during the operation of tonsillectomy the period from November 2019 to January 2020 in the Central Pediatrics Teaching hospital. **Results:** The most dominant grade in the T patient group was +1 and in the H group was +3 and +2 respectively.The result showed significant differences in the Anti-streptomycin O test(ASOT)between patients and the control group,as well as there was a significant elevation in ASOT in T group as compared to H group.The concentration of vitamin D was decreased in T group(17.5±5.3ng/ml)and H group(18.4±7.2ng/ml)than in control group(28.9±6.1ng/ml)which showed a statistically significant difference.Also,Vitamin D levels in the T and H groups did not significantly differ.The IgE level was higher in the T group(191.3±56IU/ml)and H group(215.2±61IU/ml)when compared with the control group(25.4±11.7 IU/ml)which reported a highly significant difference.Also,the IgE level showed a significant difference between the T group and H group. **Conclusion:** From the present study can conclude the relationship between deficiency of vitamin D, and elevation of IgE with a grade of tonsils in T and H groups.

Keywords: Recurrent tonsillitis,Tonsillar hypertrophy, ASOT,IgE,Vitamin D.

Corresponding Author:
Sahar A. H. AL-Sharqi, PhD
Email: saharalsharqi@uomustansiriyah.edu.iq
Tel: +7901858204

INTRODUCTION

The tonsils are defined as part of mucosa associated lymphoid tissue of the pharynx, which is a lymph node situated at the top of the throat in the back of the mouth that helps to filter out microorganisms and avoid entering into our body system (1).The tonsils form a ring of lymphoid tissue in the pharynx called the Waldeyer ring, which is composed of palatine, lingual, pharyngeal and tubal tonsils.The tubal tonsils refer to lymphoid tissue around the opening of the Eustachian tube in the lateral wall of the nasopharynx. They form the lateral aspect of the Waldeyer's ring (2).Furthermore, by tradition, the term tonsils are mostly used when simply referring to palatine tonsils, which have been found between palatoglossal and palatopharyngeal folds in the oropharynx lateral walls (3).In children the tonsils are always important; for their association with the child's mental and physical development, for many reside such as size and position, it also interferes with the mechanism of phonation, therefore in early life, it has an important relationship with the processing of words, respiration, nutrition, and if it infected, in turn, will affect physical development (4).

Tonsillectomy is a popular surgical procedure for Ear, Nose, and Throat Surgery (ENT).The two major causes of tonsillectomy are tonsillar hypertrophy which is the mean cause of sleep-disordered apnea and severe recurrent tonsillitis (5). Recurrent infection is described as more than 7 documented episodes of an extreme throat infection in 1 year, more than 5 episodes per year for 2 years in a row, or more than 3 episodes

per year for 3 years in a row (6).Tonsillar hypertrophy sometimes is idiopathic tonsillar hyperplasia that leads to unusual palatal tonsillar enlargement.Pediatric tonsillar hypertrophy is not a consequence of recurrent inflammation, acute tonsillitis, or middle ear infections (7). The Brodsky method is a physician-approved measure of the distance between the tonsils required for the airway that varies depending on the physician's clinical diagnosis. (8).

Vitamin D is among the most necessary nutrients to improve human health. It is considered a part of the steroid hormone family (9).An inadequate amount of vitamin D in circulation may lead to diabetes mellitus, cardiovascular diseases, and immune deficiencies. Moreover, vitamin D plays an important role which promoting innate immunity through its participation in the production of surface antimicrobial peptides (10). Recurrent tonsillitis is caused by a variety of causes, including a weakened immune system, high resistance to bacteria and their membranes, etc (11). The aim of this study investigates the relationship between vitamin D as well as IgE levels with recurrent tonsillitis and tonsillar hypertrophy.

MATERIALS AND METHODS

The study involved a biochemical examination of the serum of 40 chilled which was divided into two groups 20 patients (13 male, 7 female) with tonsillitis (T group) and 20 patients (14 male, 6 female) with tonsillar hypertrophy (H group), in addition to 20 chilled (8 male, 12 female) as control. Recurrent tonsillitis has been reported (3-7 times per year). The physical examination of tonsil grading was done with the help of a certified otolaryngologist as well as the classification of the palatine tonsils during the operations of tonsillectomy. The approval and ethical clearance from the Central teaching hospital of pediatric / ministry of health were attained upon commencement of the study [Reference No: MJ / 21/ 25, DA/ 99 / 2019]. The Helsinki Declaration of 1964 and its later amendments established ethical standards for human research, and all operations were carried out following them. All of the patients signed a written informed consent form. The biochemical study was conducted at the Educational Laboratories / Medical City and the Allergy Specialist center. The current study is a cohort study of patients with Tonsillitis and Tonsillar Hypertrophy who underwent tonsillectomy from November 2019 to January 2020.

Our study investigates the size of the tonsils in children with T and H patients group who underwent tonsillectomy. The distance between the tonsils was measured in children before they underwent tonsillectomy using the Brodsky scale (12). Anti-streptolysin O was determined with the commercially available kit (BioLab/ France), while Vitamin D and total IgE were determined by an enzymatic method with the commercially available kits (VIDAS/ France).

Statistical analysis

The one-way analysis of variance (ANOVA) tests and X2 test were used in the Statistical Analysis System (SAS) to compare various groups with each other. Results were expressed as mean + standard deviation (SD) and values of $p>0.05$ were considered statically no significant while $p<0.01$ and <0.05 were regarded highly significantly and significantly different respectively. The statistical analysis was carried out by SPSS (V. 24).

RESULT

Brodsky grading scale

Table I showed the grade of tonsil in the T patients, H patients, and control group. According to the result data grade, +1 is the most abended grade (85%) of age (5-13year) in the case of the T patients group followed by grade +2 (10%) of age (4.5-10 years) and +3 only (5%) of cases. In the H patients group, we have two abended grade +3(50%) in (4-12year) of age and +2 (45%) in the age of (5-14 year) respectively while +4 formed only (5%) of cases. On the other hand, the controlled healthy children with grade +0 can see in (Figure 1).

Table I: Distribution of patients according to the grade and age into T patients group, H patients group, and control group.

Tested groups	Grade	No. (%)	Age range (year)
Recurrent Tonsillitis (T)	1	17 (85%)	5-13
	2	2 (10%)	4.5-10
	3	1 (5%)	12
	4	0 (0%)	0
Tonsillar hypertrophy (H)	1	0 (0%)	0
	2	9 (45%)	4-12
	3	10 (50%)	5-14
	4	1(5%)	6
Control	0	20 (100%)	6-14

Each group total number =20

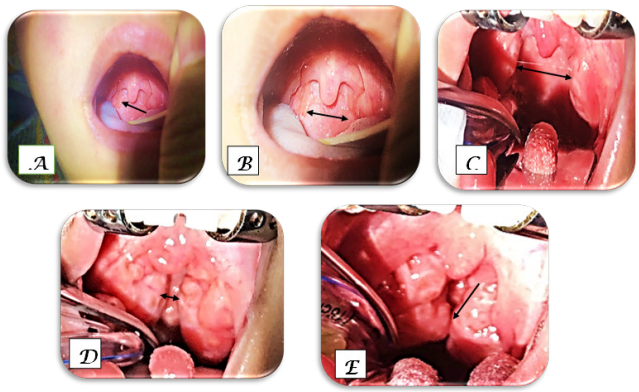

Figure 1: Palatine tonsils grading showed: (A):0 grade no air obstruction, (B): 1+ grade 25% air obstruction, (C): 2+ grade 25-50% air obstruction, (D): 3+ grade 50-75% air obstruction, (E): 4+ grade 75% air obstruction.

Anti-streptolysin O tests (ASOT)

Regarding the information in Table II the (mean± SE) of the ASO level in the serum, the result showed a highly significant difference ($p<0.01$) between the patient and control group (0±0 IU/ml). Furthermore, the result between the T patients group (400±200 IU/ml), and the H patients group (200±200 IU/ml) also showed a significant difference ($p < 0.05$) in the serum ASO level.

Table II: Comparison of ASOT in serum between the study groups.

Tested groups	ASOT(IU/ml)
Recurrent Tonsillitis (T)	400±200
Tonsillar hypertrophy (H)	200±200
P-value between test groups	0.05
Control	0±0
P-value between test groups and control	0.01
	Results are expressed as mean ±Standard Error, NS: No significant
	P value: P> 0.05, each group total number=20, ASOT: Anti-Streptolysin O test

Vitamin D level

The information presented in Table III shows (mean±SE) of vitamin D level in control group serum was (28.9±6.1 ng/ml) that showed a highly significant ($P< 0.01$) difference when compared with the patient groups. In contrast, the vitamin D level in the T patients group was (17.5±5.3 ng/ml), and in the H patients group was (18.4±7.2ng/ml), and according to the result, there was a non-significant ($P>0.05$) difference between the two groups.

Table III: Comparison of Vitamin D and IgE in serum between the study groups.

Tested groups	Vitamin D (ng/ml)	IgE (IU/ml)
Recurrent Tonsillitis (T)	17.5±5.3	191.3±56
Tonsillar hypertrophy (H)	18.4±7.2	215.2±61
P- value between test groups	NS	0.05
Control	28.9±6.1	25.4±11.7
P-value between test and control groups	0.01	0.001
		Results are expressed as mean ±Standard Error, NS: No significant
		P- value: P> 0.05 and 0.01, each group total number=20

Measurement of Total IgE

The data in table III described the (mean± SE) of total IgE level in the control group as it was (25.4±11.7 IU/ml) that showed a highly significant difference ($p<0.01$) when compared with the patient group. Thus, based on the result the T patient group was (191.3±56 IU/ml) and the H patient group was (215.2±61 IU/ml) which revealed a significant difference ($p<0.05$) in the total IgE level in the patient groups.

DISCUSSION

According to our results, the most prevalent ages were (5-13 year) which disagree with (13), study that showed that most of the patient was under 5 years. Also, the most abended grade in T patients group was +1 (85%), and that agrees with the study of (14) in which his result showed hyperplasia plus one of the other chronic pathological features and confirmed a strong correlation between the clinical diagnosis and histological examination of patients. Also, the predominant grade in the H patients group was +3 (50%) and +2 (45%) respectively and this is similar to the result of (15, 16).

The explanation for hypertrophy may due to inflammation as a site of being the proliferation of lymphoid follicles or as a part of generalized lymphoid hypertrophy as well as cervical vascular congestion (17). According to (18), result grade, +3, and grade +2 was the most appended grade and that agrees with our result. Because the results of the clinical pathology tests were predominantly lymphoid hypertrophies, and hypertrophy of the palatine tonsils may be related to

recurrent tonsillitis, it suggests that the classification of hypertrophic tonsils was determined to be useful in grading.We can consider tonsillar enlargement as a guide for prognostic evaluation.

The study (19), investigates the factor that affects the success of tonsillectomy and he supposed that tonsillar size is one of the most affecting factors, as a result, the study has been showing that a higher tonsil grade was related to the higher success rate. In this study, the grading was investigated between the two groups to determine if there is a certain difference between the two groups. According to the result, there was a difference between T and H patient groups as well as result showed that the most dominant grade in the T patient group was +1 and in the H patients group was grade +3 and +2 respectively.

The increase in the ASO titer in our result agrees with (20) study which assumed the increase in the ASO level was due to tonsillitis caused by streptococcal infections or its complication (glomerulonephritis, reactive arthritis, or rheumatic fever). The result disagrees with the study (21), a result which doesn't show a significant correlation between the ASO level so it suggests that the determination of the ASO titer does not have any value in acute and recurrent tonsillitis and thus should not be performed. In the current study, the result showed a high increase in the ASO titer in patients that corresponding with the result of (22), which reported an elevate in ASO titer in patients and in contrast with (23) study which reported a decrease in the ASO titer in (86%) of the patient involving in the study.

Our result agreed with the results of another previous study (11) presented a significant change which according to his result the group of patients showed a lower vitamin D level is compared with the control group. On the other hand, study results of (24-26) showed patients with tonsil hypertrophy significantly have a low level of vitamin D and its deficiency. In contrast to our results, the study of (7,27) showed no significant change. The study (28-29) indicated significant connotations between low levels of vitamin D and tonsillar diseases, this independent of the vitamin D deficiency may suggest the importance of hypovitaminosis in the initial stages or the complementary role of inflammation.

Many studies convened that children with allergy symptoms appeared to be more disposed to tonsillar disease. Conversely, other studies dose not found a direct relationship between tonsil volume and allergies. The argument stays concerning the relationship between tonsil and allergies (30-31) also showed an elevation in the level of serum IgE in his result in the children from H patient group. In our study, the presence of allergy in children from the T patients group and H patients group was investigated, and the result agrees with (32) result which showed an increase in the level of IgE in children with H disease which state that there is a correlation between IgE elevation and allergy. The tonsils contain many immunological tissues which have a humoral immunity by synthesis and secretion of immunoglobulins (IgE, IgA, IgG), and cellular immunity by T-lymphocyte penetrating the epithelial barrier (14). According to (33) in children, systemic atopy may not be caused by tonsillar tissues, thus, anti-allergy medication is still required for children with atrophy following tonsil ectomy.

CONCLUSION

There are significant differences between Recurrent tonsillitis and Tonsillar hypertrophy in children depending on the size of the tonsils and the remaining distance between them, in addition to the significant differences for each of ASOT, Vitamin D, and IgE.

ACKNOWLEDGEMENTS

Thanks and gratitude for the support and advice provided by the Department of Biology, College of Science, Mustansiriyah University (http://uomustansiriyah.edu.iq/).

REFERENCES

1. Pambuk C. A. Acute Tonsillitis in children: Causes and Type. Acta Scientific Microbiology. 2018; 1(10): 25-28.
2. Shah S N, Pine H. Overview of Management of Recurrent Tonsillitis. Ulualp S edithor. Recent Advances in Pediatric Medicine, Bentham Science. 2017; 3(1): 34-50.
3. Neville B W, Damm D D, Allen C M , Chi A C. Bacterial Infections. Color Atlas of Oral and Maxillofacial Diseases, Philadelphia, Elsevier. 2017; :109-123.
4. Kyle R A, Larson D R, Therneau T M, et al. Long-term follow-up of monoclonal gammopathy of undetermined significance. New England Journal of Medicine. 2018; 378(3): 241-249.
5. Anmolsingh R, Ali A, Edmiston R., et al. Tonsillectomy and Adenoidectomy: Indications, Complications and their Management. Journal of Surgery Open Access. 2018; 4(4): 1-7.
6. Bochner R E, Gangar M, Belamarich P F. A clinical approach to tonsillitis, tonsillar hypertrophy, and peritonsillar and retropharyngeal abscesses. Pediatrics in Review. 2017; 38(2): 81-92.
7. Aydin S, Demir M G, Oguztuzun S, Kilic M, Yilmaz C, Dirican O. Glutathione S-transferase enzyme activity and protein expression in patients with recurrent tonsillitis and idiopathic tonsillar hypertrophy. Biomedical Papers of the Medical Faculty of Palacky University in Olomouc. 2019; 163(4): 349-354.
8. Pierce B, Brietzke S. Association of Preoperative,

Subjective Pediatric Tonsil Size With Tonsillectomy Outcomes: A Systematic Review. JAMA Otolaryngology–Head & Neck Surgery. 2019; 145(9): 854-859.
9. Shin J H, Kim B G, Kim B Y, Kim S W, Kim H. Is there an association between vitamin D deficiency and adenotonsillar hypertrophy in children with sleep-disordered breathing?. BMC pediatrics. 2018; 18(1): 1-8.
10. Bodin J, Mihret A, Holm-Hansen C., et al. Vitamin D Deficiency is Associated with Increased Use of Antimicrobials among Preschool Girls in Ethiopia. Nutrients. 2019; 11(3): 575.
11. Elbistanl M S, Güneş S, Yegin Y, Зelik M, Koзak H E, Evren C. Relationship between serum vitamin D levels and childhood recurrent tonsillitis. Otolaryngol Open J. 2017; 3(1): 16-21.
12. Lu X, Zhang J, Xiao S. Correlation between Brodsky Tonsil Scale and Tonsil Volume in Adult Patients. BioMed research international. 2018: 1-6.
13. Adoga A S, Maan, D N, Nuhu S I. Is routine histopathology of tonsil specimen necessary?. African Journal of Pediatric Surgery. 2011; 8(3), 283-285.
14. AL-Ani R M. Facts about chronic tonsillitis: a pathological study. Muthanna Medical Journal. 2016; 3(1): 1-5.
15. Venkatesha B K, Yogeesha B S, Asha M. Clinical grading of tonsils: does it truly represent total tonsil volume in patients with recurrent tonsillitis. International Journal of Otorhinolaryngology and Head and Neck Surgery. 2017; 3(2): 354-358.
16. Hubballi RK, Nayaka GS , Koujalagi SM. Clinical correlation between tonsillar hypertrophy and tonsillitis. International Journal Otorhinolaryngol Head Neck Surg. 2020; 6:132-139.
17. Yasan H, Aynali G, Erdoğan O, Yariktaş M. Does subjective tonsillar grading reflect the real volume of palatine tonsils?. International Journal of Pediatric Otorhinolaryngology. 2011; 75(5): 618-619.
18. Aringa A R, Juares A J, de Melo C, Nardi J C, Kobari K, Perches Filho R M. Histological analysis of tonsillectomy and adenoidectomy specimens-January 2001 to May 2003. Brazilian journal of otorhinolaryngology. 2005; 71(1): 18-22.
19. Chang T S, Chiang R P Y. Total analysis of clinical factors for surgical success of adenotonsillectomy in pediatric OSAS. European Archives of Oto-Rhino-Laryngology. 2017; 274(1): 561-566.
20. Gemeel F A, Hathal W , Shaimaa J S. Isolation and Identification of Bacterial Causes of Acute Tonsillitis. Journal of Global Pharma Technology. 2019; 10(11): 921-924.
21. Windfuhr J P, Toepfner N, Steffe G, Waldfahrer F, Berner R. Clinical practice guideline: tonsillitis I. Diagnostics and nonsurgical management. European Archives of Oto-Rhino-Laryngology. 2016; 273(4), 973-987.
22. Trushin V, Englender M. Clinical value of antistreptolysin O levels in adult patients with tonsillitis: report I. European Archives of Oto-Rhino-Laryngology.2017; 274(4): 2035-2039.
23. AL-Hussaini R M, Naher H S, Alturaihy S H. Bacterial profile associated with chronic tonsiltis and adenoid hypertrophay in children . a bactriological and histopathological. Glob J Biosci Biotech.2016; 5(4): 525-529.
24. Pirzadeh A, Sharghi A, Nikmanesh M. Association between Plasma Level of Vitamin D and Tonsillar Hypertrophy in Children Undergoing Tonsillectomy, Journal of Health Science Research.2019; 4(1): 16-20.
25. Asghari A, Bagheri Z, Jalessi M, et al. Vitamin D levels in children with adenotonsillar hypertrophy and otitis media with effusion. Iranian journal of otorhinolaryngology.2017; 29(90): 29-33.
26. Zicari A M, Occasi F, Di Mauro F, et al. Mean platelet volume, vitamin D and C reactive protein levels in normal weight children with primary snoring and obstructive sleep apnea syndrome. PloS one.2016; 11(4): 1-10.
27. Noohi S, Ghazizadeh M, Maleki L. The relationship between serum vitamin D level and adeno-tonsillar hypertrophy in children. Tehran University Medical Journal TUMS Publications.2019; 77(6): 382-386.
28. Vintilescu B Ş, Niculecu C E, Stepan M D, Ionita E. Involvement of Vitamin D in Chronic Infections of the Waldeyers Ring in the School Aged Child. Current Health Sciences Journal. 2019; 45(3): 291-295.
29. Rondanelli M, Miccono A, Lamburghini S, et al. Self-care for common colds: the pivotal role of vitamin D, vitamin C, zinc, and echinacea in three main immune interactive clusters (physical barriers, innate and adaptive immunity) involved during an episode of common colds—practical advice on dosages and on the time to take these nutrients/botanicals in order to prevent or treat common colds. Evidence-Based Complementary and Alternative Medicine, 2018.2018; 1-37.
30. Ameli F, Brocchetti F, Angela Tosca M, Schiavetti I, Ciprandi G. Tonsil volume and allergic rhinitis in children. Allergy & Rhinology.2014; 5(3): 137-142.
31. Huo Z, Shi J, Shu Y, Xiang M, Lu J, Wu H. (2017). The relationship between allergic status and adenotonsillar regrowth: a retrospective research on children after adenotonsillectomy. Scientific reports.2017 ; 7(1): 1-8.
32. Cho K-S, Kim S H, Hong S-L, et al. Local Atopy in Childhood Adenotonsillar Hypertrophy. American Journal of Rhinology & Allergy.2018; 32(3): 160–166.
33. Song L, Guo J, Liao W, et al. (2017). Long-term effects of adenotonsillectomy on serum-specific immunoglobulin E. Pediatric Research.2017; 82(5): 801-805.