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Original Research Article

Iron deficiency anaemia as a novel immunological indicator of recurrence in chronic tonsillitis

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ABSTRACT

Background: Trace elements such as iron play essential roles in the metabolic and immune functions of the body. Anaemia is known to suppresses immunity and it was assessed based on iron deficiency. The present study was done to elucidate the correlation of iron deficiency anaemia to chronic and recurrent tonsillitis.
Materials and Methods: A 1 -year observational study was conducted and 100 patients with recurrent tonsillitis were included. Serum iron were estimated by spectrometry. Anemia was assessed based on Hb levels, TIBC and peripheral smears. Spearman's and Pearson's correlation Coefficients were used for the statistical analysis.
Results: 84% of the patients had a iron deficiency anaemia, 56% had low serum iron, There was a significant corelation between anaemia and low serum iron among the study population, the Spearman's correlation coefficient r value was 0.824 and the p value was less than 0.05 between iron deficiency anaemia and recurrent tonsillitis with higher grades of hypertrophy and symptoms as well.
Conclusion: In order to plan the treatment of tonsillitis and predict the prognosis accurately we need to assess the patient's immune status, for which serum iron and markers of anaemia can be used. This will be a novel and economical prognostic biomarker which can be embraced in the modern, evidence-based practice of otorhinolaryngology.

1. Introduction

In the practice of Otolaryngology, we commonly encounter recurrent tonsillitis.[1] Recurrent tonsillitis disables and prevents routine functioning of the patients contributing to 0.1 million DALY among both school children and young adults globally. Anaemia also contributes to immunity by several mechanisms thus is a direct measure of immunocompromised state and makes one susceptible to infections of the respiratory tract and gastrointestinal tract which lay open to the environment.[1]

Low serum ferritin and haemoglobin levels are used to diagnose iron deficiency alongside an elevated TIBC. The World Health Organization estimates that iron deficiency anaemia affects only about 8% of Australian children under the age of five and also about 7% of the pediatric American population while in India it's a towering 47.8% of the population with females and children being a vast majority among this group. There have been several studies done which showed a significant risk of development of recurrent tonsillitis among those with iron deficiency anaemia by virtue of suppression of immunity, which is vastly dependent on iron levels.[2]

Recurrent tonsillitis is defined as presence of more than 7 episodes of tonsillitis in 1 year or more than 5 episodes in a year for 2 consecutive years or more than 3 episodes of tonsillitis a year for 3 consecutive years; and these episodes are disabling and prevent routine normal functioning.[3]The management of such recurrent

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or chronic cases is primarily by surgical excision of the palatine tonsils especially in cases not controlled by medical management at this juncture even the fitness for surgery and the hemodynamic during surgery and post operative healing is all compromised if the anaemia isn't corrected.[3] So, in our study we have considered the levels of haemoglobin, peripheral smears, TIBC levels and most importantly serum iron among patients of chronic tonsillitis to look for a corelation between the two.

2. Aim

To determine corelation of Iron deficiency anaemia to recurrent tonsillitis.

3. Materials and Methods

A cross-sectional Observational study was done for 1 year at a suburban tertiary care centre at the department of otorhinolaryngology, with a sample size of 100 Patients.

3.1. Inclusion criteria

All patients between the ages of 5yrs to 50 yrs. presenting with recurrent tonsillitis. Recurrent tonsillitis was defined as presence of more than 7 episodes of tonsillitis in 1 year or more than 5 episodes in a year for 2 consecutive years or more than 3 episodes of tonsillitis a year for 3 consecutive years.

3.2. Exclusion criteria

Consisted of those who were HIV positive or having diabetes and any other Immune compromised state or using steroid medications. Those on iron supplements were excluded. After taking a written and informed consent to participate in the study from all patients, a detailed history was elicited and clinical examination was done following which venous blood samples were collected from all participants.

Anaemia was assessed based on the levels of haemoglobin and iron deficiency was determined based on serum Iron, TIBC, Ferritin and peripheral smears. The levels of serum Iron were estimated using standardized acetylene flame by, atomic absorption spectrometry performed personally by the investigator. The data was then assimilated and analysed using EXCEL and SPSS software and interpreted as follows.

4. Results

Data analysis of all 100 subjects was done, whose age ranged from 5 years to 50 years with mean age 19.47 ± 11.45 years pointing predominantly to pediatric and adolescent age group, showing that the incidence and prevalence of the recurrent tonsillitis is maximum among them. Out of 100 subjects, 63% were males and 37% were females with gender ratio of 1.7:1.

Among the study population 45.3% had peripheral smears suggestive of iron deficiency anaemia with a clear picture of microcytic hypochromic erythrocytes. Further we found that 56% subjects had low serum iron, 42% had normal total iron binding capacity, 84% subjects were anaemic. We also noted that the TIBC was raised in about 56% of the patients with chronic tonsillitis group and was normal in 42% that further pointed towards an increased iron requirement and showing that the patients had iron deficiency anaemia.

Serum ferritin was low in more than 46% of the study population another indicator of iron deficiency. Upon using spearman's corelation coefficient we deduced that there was a strong positive correlation between patients of recurrent tonsillitis and low serum iron and those with recurrent tonsillitis having a peripheral smear suggestive of microcytic hypochromic blood picture (Table 1).

Upon general assessment we saw that 36% of the patients had a history of frequent work and school absenteeism due to the episodes of recurrent tonsillitis leading to a DALY. We also saw that 46% of the patients with anaemia had grade 3 tonsillar hypertrophy and 20% had more than 3 recurrent episodes a year as compared to those who were non anaemic, who seemed to have lesser grades and less frequent episodes of tonsillitis per year accounting to better immunity among those who are not having iron deficiency anaemia (Figure 6).

Table 1: Serum iron and anaemia based on peripheral smear corelation coefficient

Variables	Correlation coefficient	p-value
Serum iron and anaemia	0.2437	$0.0146^{SP}*$

Table 2: Serum Iron distribution among subject

Serum Iron	**Low**	**56 (56%)**
	Normal	44 (44%)
	Mean ± SD Median (Min, Max)	67.57 ± 36.9057.50 (19.50, 152)

Table 3: Distribution of subjects as per TIBC

Total Iron Binding Capacity	Low	2 (2%)
	Normal	42 (42%)
	High	56 (56%)
	Mean ± SD Median (Min, Max)	489.21 ± 146.21 475.5 (200, 874)

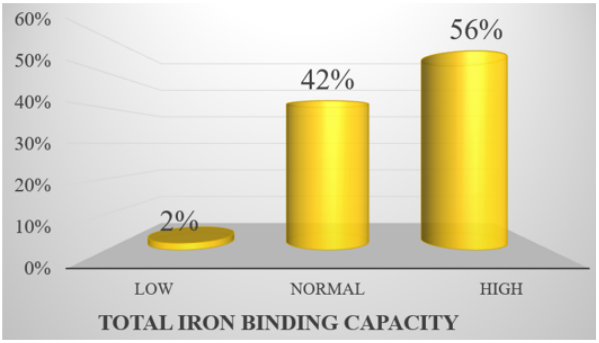

Fig. 1: Subjects distributed according to TIBC

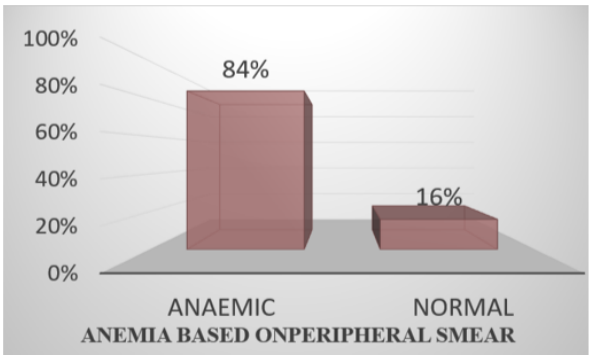

Fig. 2: Subjects distributed according to TIBC

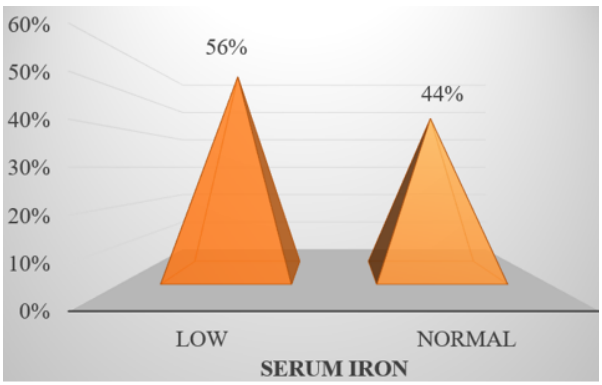

Fig. 3: Subjects distributed according to serum iron

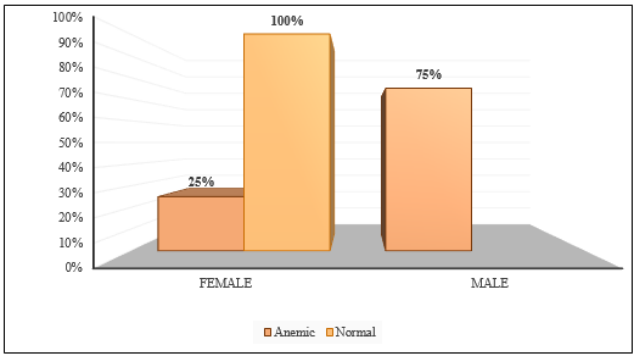

Fig. 4: Distribution of anaemia based on gender

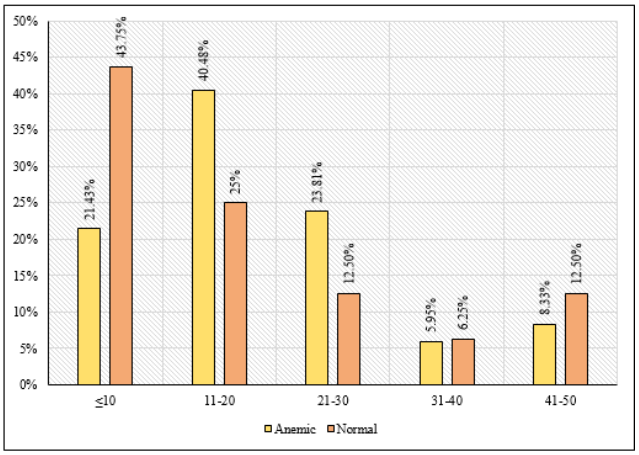

Fig. 5: Distribution of anaemia based on age in years

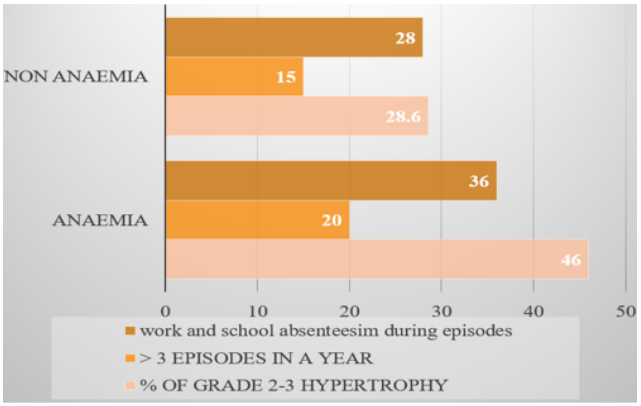

Fig. 6: Overall assessment of Iron deficiency anaemia in recurrent tonsillitis

5. Discussion

Iron deficiency anaemia is common in our Indian subcontinent owing to our diet and racial preponderance. It is postulated that the iron deficiency anaemia can predispose to infections and thus we have attempted to study the corelation between iron deficiency and recurrent tonsillitis.

The palatine tonsils along with the other lymphoid follicles of the Waldeyer's ring play a pivotal role in the body's immune system. They provide both local immunity as well as behave as gatekeepers which can detect pathogens and help prepare the system of defence against any further attacks. The tonsillar tissue participates in this manner in the immune system maximally between the age group of 4 to 10 yrs. and they start to involute by the age of puberty this helps to promote the b cell production.[4]

Iron is a vital part of the immune system of the body by contributing several enzymes such as peroxidase, superoxide dismutase peroxidase and other enzymes producing nitrous oxide and even markers of acute phase

such as ferritin.[5]

Diet is the prime source of iron and has two forms Heme and non-Heme iron. Heme iron is more easily absorbed and comes from poultry and red meat whereas green leafy vegetables and pistachio beans and lentils contain the less absorbable non- Heme iron which shows that socio economic strata and diet contribute to development of this condition.

The ideal parameters to measure and define iron deficiency wound be using serum iron, haemoglobin levels, serum TIBC and also ferritin, but it is important to note that ferritin is also a marker of acute infection and inflammation. Hence the use of ferritin as a measure of iron deficiency among those with an infection isn't justifiable as seen in other studies.[6]

Meanwhile a study similar to ours was done to determine the prevalence of iron deficiency anaemia among patients of chronic tonsillitis by Weijie Weng et al,[3] it shows that children undergoing adenotonsillectomy for chronic and recurrent adenotonsillitis have a higher incidence of iron deficiency anaemia when compared to the general population.

They also propose that it could be attributed to the accepted theory that recurrence occurs due to immune deficiency and anaemia in turn compromises the immunity making them more prone to recurrent bacterial infections. Considering that our setting is in suburban India, where the general prevalence of iron deficiency anaemia is higher due to nutritional deficiency as well and worm infestations, the population of the study group was probably thus more prone to infection.[7]

In their study Kerr A.I.G. et al, say that in a group of children with recurrent throat infections admitted for adenotonsillectomy, it was noted that a proportion of venous blood samples showed low haematocrit, indicating a degree of anaemia, and thus in our study we are evaluating haemoglobin, to look for the prevalence of recurrent tonsillitis in anemia.[8]

Somuk Battal Tahsin et al have compared the levels of trace elements such as zinc and iron in the tonsillar tissue in recurrent tonsillitis and in tonsillar hypertrophy, which showed that lower tissue concentrations of these elements could create a predisposition to recurrent tonsillitis.[9] The same study, also stated that Iron and zinc are trace elements which are important and play a vital role in the immune system development, functioning and also that they play a role in the development of infections,[5] but ours was based on values in the serum and hence might not completely comparable.

Kerstein et al. like our study also suggested that younger age group patients, pediatric patients were more anaemic probably predisposing them more to recurrent infections. The treatment of iron deficiency is by the use of dietary supplements of by iron supplements and can thus lower the burden of tonsillitis and help reduce the DALY that it causes.

6. Conclusion

Tonsillitis is probably one of the most commonly encountered conditions in the practice of not only otorhinolaryngology but also general medicine and paediatrics be at the grassroot level, or at highly specialized tertiary care centres. These cases amount to a huge global burden of DALY and lead to work and school absenteeism reducing performance ability of the patients. That is why we have tried to highlight the magnitude of its impact on public health, though at the offset it may seem like a simple ailment;

Over the past decades treatment for tonsillitis in the form of antibiotics and antiseptic gargles and surgery have been vastly explored and several types of surgeries have been developed, not much attention has been given to assess the prognosis or recurrence of infection in such cases. With the modern concepts of evidence-based management in mind we must ensure that prior to suggesting surgery which bears its own complications we must 1^{st} assess the underlying cause and then the chances of recurrence, which can be done by simple investigations as seen in this study.

We suggest that ruling out anaemia especially nutritional iron deficiency anaemia is one of the primary approaches, not only will correcting the anaemia reduce the rate of recurrence, it will also improve general condition of the patient, thereby ensuring better surgical outcome and with standing intraoperative stress if the patient were to undergo surgery.

7. Source of Funding

None.

8. Conflict of Interest

None.

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