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What is This?
Relation between Peritonsillar Infection and Acute Tonsillitis: Myth or Reality?

Sofia Kordeluk, MD, Lena Novack, PhD, Moshe Puterman, MD, Mordechai Kraus, MD, and Ben-Zion Joshua, MD

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Abstract

Objective. To investigate the relationship between tonsillar and peritonsillar infections.

Study Design. Retrospective population-based study and a retrospective case series review.

Settings. Tertiary academic medical facility.

Subjects and Methods. All individuals hospitalized with peritonsillar abscess (PTA) or peritonsillar cellulitis (PTC) during 2004-2008 were reviewed. Patient age, gender, diagnosis of PTA or PTC, recurrence, and date of presentation were recorded. In addition, a database of patients diagnosed in the community with acute tonsillitis (AT) was reviewed for the same time period. The weekly number of patients with AT was recorded, and a comparison between incidence of tonsillar infections and peritonsillar infection was performed.

Results. A total of 685 patients were hospitalized with either PTA (467) or PTC (218). Incidence of both upper respiratory infections and AT peaked in January and February of every year with a nadir in August. In contrast, PTA and PTC showed a consistent rate of infection throughout the year. Likewise, assessment based on weekly intervals showed that peaks of PTA and PTC did not follow those of acute tonsillitis with a 1 to 2 weekly lag as would be expected if peritonsillar infection is a complication of AT. Rather, an association between peritonsillar infection and tonsillitis was found within the same week (P = .04).

Conclusion. Higher rates of occurrence of PTA or PTC following AT outbreaks were not found. These results lend further support to the theory that peritonsillar infection is associated not only with complications of AT but may occur from infection of Weber glands or other unknown causes.

Keywords

peritonsillar abscess, peritonsillar cellulitis, complicated tonsillitis, acute tonsillitis, season

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Peritonsillar abscess (PTA), or quinsy, consists of a collection of pus adjacent to the tonsil or peritonsillar space. Peritonsillar cellulitis (PTC) is defined as cellulitis of the peritonsillar tissues without a collection of pus. In both entities, there is a bulging or edema of the soft palate that is different from acute tonsillitis (AT) where inflammation is confined to the tonsils. In addition, AT is usually unilateral, whereas PTA and PTC are usually unilateral. PTC is differentiated from AT by the symptoms and signs related to peritonsillar inflammation: palate asymmetry and trismus. As it is often difficult to differentiate between PTA and PTC, if an abscess is suspected, drainage by either incision or needle aspiration is commonly performed. Ultrasound and computed tomography (CT) have proven helpful in differentiating PTA from PTC.1,2 Regardless, PTA, a polymicrobial infection in which group A streptococcus is the predominate organism,3,4 remains the most common type of deep neck infection of the head and neck.5 The condition occurs primarily in young adults3,5,6 between the ages of 14 and 39 years. Symptoms generally include fever, malaise, sore throat, dysphagia, and otalgia. Physical findings may include trismus and “hot potato,” or muffled voice. Drainage of the abscess, antibiotics, and supportive therapy are the foundations of treatment of PTA.5

The pathogenesis of PTA is commonly described in otolaryngology textbooks7,8 as being the direct communication and progression of acute exudative tonsillitis. If indeed PTA and PTC result from a complication of AT, it would be expected that, following outbreaks of AT, there would likewise be a proportional increase in the incidence of PTA or PTC. Indeed, some research has shown that spring and fall are characterized by an increased incidence of AT as well as of PTA.5,9,10 An alternative theory regarding PTA is tied to the inflammation of

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minor salivary glands (Weber glands) located adjacent to the tonsils. These minor salivary glands are located in the upper, middle, and lower portions of the peritonsillar space. Those located in the upper portion of the peritonsillar space have been implicated in the pathogenesis of PTA. Subsequent evidence has been presented to support the premise that the true cause of PTA is not necessarily an extension of an AT but rather an abscess formation of the Weber glands located in the supratonsillar fossa. Indeed, in our experience, in most cases rather than an abscess formation of the Weber glands located in the supratonsillar fossa, a true cause of PTA is not necessarily an extension of an AT but rather a complication of tonsillitis. Statistical results showing that peaks in AT incidence in the general population are followed by peaks in the incidence of peritonsillar infections would provide support for a possible association between the 2 diseases. We assumed that the time lag between peaks of AT and peaks of PTA or PTC would be 1 to 2 weeks if indeed PTA or PTC is a complication of AT. The comparison of peritonsillar infections with upper respiratory infections (URIs) was performed as a “negative” control because URI is a viral disease and would not be expected to cause peritonsillar infections. The comparison of peritonsillar infections with positive throat cultures was also included in the study because peritonsillar infection may be associated only with bacterial tonsillitis.

Materials and Methods
The study was approved by the Soroka Hospital Helsinki Committee, protocol number 10296. The vast majority of peritonsillar infections in southern Israel, an area comprising approximately 800,000 people, are treated at Soroka Medical Center (SMC). Charts of all patients with peritonsillar infections hospitalized at SMC during 2004-2008 were reviewed, and the following parameters were recorded: patient age, gender, diagnosis of PTA or PTC, recurrence, and date of hospitalization. When a peritonsillar infection is suspected based on severe throat pain, odynophagia, bulging of the soft palate, and usually accompanied by trismus, the patient is hospitalized. All patients with a peritonsillar infection are hospitalized in our institution. Needle aspiration and/or incision and drainage are then performed by an ear, nose, and throat (ENT) resident. If pus is obtained, then a diagnosis of PTA is confirmed; otherwise, the patient is hospitalized with a presumed diagnosis of PTC. A patient who improves with intravenous antibiotics is usually discharged within 1 to 2 days. If there is no improvement, repeat needle aspirations are performed, and if pus indicates as such, the diagnosis is changed to PTA. Imaging, used only in patients who do not improve with the standard protocol, is rarely performed. It should be noted that if the patient presents with a severe tonsillitis involving the anterior pillar (erythema and edema), it is not considered PTC. All patients with a diagnosis of PTC or PTA were included. If the final diagnosis was malignancy or parapharyngeal(retropharyngeal abscess or the correct diagnosis was acute tonsillitis, the patients were excluded from the study.

In addition to reviewing charts, a count of daily visits to primary care physicians due to acute tonsillitis or upper respiratory infection during 2004-2008 was obtained from the local health maintenance organization (HMO) registry (Kupat Holim Clalit Health Services). This HMO treats more than 50% of the population in southern Israel and reflects the general population regarding demographics and diseases. The diagnosis of AT and URI was made by a general practitioner, family physician, or a pediatrician. Finally, all throat cultures sent to SMC for throat infections were obtained from the SMC laboratory, and the number of positive cultures received per day was counted. Throat cultures are usually carried out by either the primary care physician or the clinic nurse, and this is performed by swabbing both tonsils. Positive throat cultures are defined here as group A β-hemolytic streptococcus (GABHS) growth from the tonsils. Throat cultures are sent to SMC by physicians in the community or from within the hospital for suspected bacterial tonsillitis, and the SMC collects most throat cultures in southern Israel to help physicians decide whether to treat patients with antibiotics. We included only GABHS growth because GABHS is the most common pathogen in AT and is reported as positive in throat cultures.

Number of PTA or PTC and number of AT or URI or positive throat cultures were compared by week and by month to determine whether the incidence of PTA or PTC coincides or occurs with a clinically reasonable lag of 1 or 2 weeks with URI, AT, or positive throat cultures.

Statistical Analysis
Continuous variables are described and presented as mean, standard deviation (SD), and range. Categorical variables are shown as a percentage. Patient description is reported on a categorical population regarding demographics and diseases. The statistical results showing that peaks of visits due to tonsillitis (AT) preceded peaks of peritonsillar inflammation (PTC or PTA) by a week or two, which would support the theory of an association between the 2 conditions. Visits due to tonsillitis and hospitalizations due to PTC or PTA were expressed as the number of patients visiting a clinic or admitted to the hospital. The model assumed Poisson distribution in the outcome variable (PTC or PTA counts) and adjusted to possible underlying seasonal fluctuations of PTC/PTA hospitalizations. A sensitivity analysis was performed on smoothing parameters used in the model to validate the findings and avoid overfitting. The method chosen for the analysis is relatively new and statistically more efficient compared to classical time-series techniques. Data analysis was performed with SAS 9.1 (SAS Institute, Cary, North Carolina) and R software.
Results

Between 2004 and 2008, 640 patients were hospitalized with peritonsillar infection, totaling 685 hospitalizations. These demographics are presented in Table 1. PTA was diagnosed in 467 patients. It was a bilateral PTA in 2 patients and unilateral in all the rest. PTC was diagnosed in 218 patients and was always unilateral. The average age was 27.5 years (range, 1-82 years). There was a small difference in age between males and females (Figure 1). Although the peak incidence occurred in the second decade of life in females and in the third decade in males, this difference was not found to be of statistical significance ($P = .276$).

Among the 174 (25%) patients of Bedouin origin, PTA was diagnosed in 75% of the cases, whereas among non-Bedouins (mostly of Jewish origin), PTA was diagnosed in 66% ($P = .03$).

When looking at seasons, no difference in the rate of PTC to PTA was found (Figure 2), nor was there any significant difference in the peritonsillar infection rate according to season. There were 171 cases in autumn, 172 in winter, 168 in spring, and 174 in summer. There was, however, obvious seasonal variation in AT. Between September and March of every year, the AT incidence increased and then declined again during the spring and summer, from 8500 in December 2004 to 4300 in July 2008 ($P < .001$; Figure 3). The same pattern also held true for URI, from 65,000 visits for URI during January 2007 to 14,000 visits for URI during July 2004 ($P < .001$, Figure 4). To check if only bacterial tonsillitis is related to peritonsillar infections, positive throat cultures were next tested for seasonality (Figure 5). Figure 5 shows a biannual rise in bacterial tonsillitis with a peak during winter and a second smaller peak just before summer, from 1900 during December 2008 to 500 during August 2004 ($P < .001$).

In contrast to the clear seasonality observed for throat cultures that tested positive for AT and URI, peritonsillar infections did not show a similar pattern (Figure 6). No association was found between the cycles of each of the above diseases with peritonsillar infection. A separate analysis was performed comparing PTC or PTA to AT or URI, and there was no difference from combining PTC and PTA (data not shown).

### Table 1. Study Population Characteristics

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Study Population (n = 640 Patients; n = 685 Hospitalizations)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, y</td>
<td>Mean ± SD 27.5 ± 14.0</td>
</tr>
<tr>
<td></td>
<td>Range 1-82</td>
</tr>
<tr>
<td>Male gender, No. (%)</td>
<td>352/640 (51.4)</td>
</tr>
<tr>
<td>Diagnosis at hospitalization, No. (%)</td>
<td>Peritonsillar abscess 467/685 (68.2)</td>
</tr>
<tr>
<td></td>
<td>Peritonsillar cellulitis 218/685 (31.8)</td>
</tr>
<tr>
<td>Ethnic group, No. (%)</td>
<td>Jewish 511/640 (74.6)</td>
</tr>
<tr>
<td></td>
<td>Bedouin 174/640 (25.4)</td>
</tr>
<tr>
<td>Recurrent disease, No. (%)</td>
<td>104/640 (16.3)</td>
</tr>
</tbody>
</table>

![Figure 1](image1.png)  
**Figure 1.** The age at presentation grouped in decades according to gender.

![Figure 2](image2.png)  
**Figure 2.** Time of presentation of peritonsillar abscess (PTA) and peritonsillar cellulitis (PTC) grouped into seasons.

![Figure 3](image3.png)  
**Figure 3.** Incidence of acute tonsillitis (AT) per month in southern Israel between 2004 and 2008.
A generalized additive model was performed to test whether peritonsillar inflammation may follow tonsillitis peaks by a lag of a few weeks (Figure 7). The robustness of the final model was verified by sensitivity analysis on smoothing parameters and showed similar results. Lags of 1, 2, and 3 weeks between AT and PTC/PTA counts were tested. None of the lags were found to be statistically significant, and specifically, visits due to tonsillitis a week or two before PTC/PTA peaks had no effect on PTC/PTA incidence ($P = .134$ and $.541$, respectively). An association was found between peritonsillar infection and acute tonsillitis for the same week at a significance level of $.041$ (ie, peaks of admissions due to PTC/PTA tended to coincide in the same week).

### Discussion

Peritonsillar infection was most commonly found between ages 10 and 40 years, comprising 76% of the cases. These statistics are in agreement with previous reports. In women, the disease presents at an earlier age and peaks between the ages of 16 and 20 years, whereas in men, the disease peaks between 21 and 25 years. These findings are similar to those reported by Risberg et al. The rate of peritonsillar infections in males was similar to that in females. This is consistent with 1 study, but others indicate a male predominance by a ratio of 3:1. The difference may be explained by ethnic differences, as do studies showing a male predominance that were carried out in Japan and Singapore.

In this study, 25% of patients with peritonsillar infections were Bedouin, which is proportional to the population, approximately 30% Bedouins in southern Israel. Bedouins, at a rate of 75% versus 66% ($P = .03$), were more commonly afflicted by PTA than non-Bedouins. This may be explained by the fact that they often seek medical attention at a later stage of the disease after cellulitis has already abscessed.

Previous studies have pointed out that PTA tends to occur during spring and fall, and at the same time there is a rise in the incidence of AT and URIs. Another study noted the biannual

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**Figure 4.** Incidence of upper respiratory tract infections (URTIs) per month in southern Israel between 2004 and 2008.

**Figure 5.** Incidence of positive throat culture per month in southern Israel between 2004 and 2008.

**Figure 6.** Incidence of peritonsillar infections in southern Israel between 2004 and 2008. PTA, peritonsillar abscess; PTC, peritonsillar cellulitis.

**Figure 7.** Comparison between peritonsillar infections (continuous line) and visits to a primary care physician for tonsillitis (dashed line) during 2005 by week. PTA, peritonsillar abscess; PTC, peritonsillar cellulitis.
trend in peritonsillar infections but did not find a correlation with URIs. The current study did not find evidence for the seasonality of peritonsillar infection, and specifically, no significant seasonality for PTA or PTC was found when both were separately assessed (Figure 6). This finding was in contrast to the clear seasonality of AT, URI, and bacterial tonsillitis as indicated by positive throat cultures. A time lag of 1 to 2 weeks between the occurrence of tonsillitis and that of peritonsillar infection was not found to be significant. However, there was a statistically significant association between the occurrence of tonsillitis and that of peritonsillar infection in the same week, which suggests that they may occur simultaneously, but it does not imply a causal relationship. It is possible that a pathogen or certain environmental factors can cause either bilateral AT or unilateral PTA/PTC during the same time period.

These findings suggest that peritonsillar infections are, in most cases, not caused by tonsillar infection and support the alternative theory that PTA is tied to the inflammation of minor salivary glands located close to the tonsils (Weber glands). Alternatively, both explanations could be correct and that in some patients, peritonsillar infections are a consequence of tonsillitis, whereas in others, it is caused by an infection of Weber glands. This thinking is in line with the fact that occasionally a patient with peritonsillar infection has concurrent tonsillitis; however, such cases are rare. Of note, our findings that peritonsillar infections are usually not caused by acute tonsillitis do not prove the alternative theory of Weber gland infection, but there may be a third explanation.

Peritonsillar abscesses rarely develop after tonsillectomy. If Weber glands are involved in the pathogenesis of PTA, how would a tonsillectomy solve the problem of recurrent PTA, and why do we not see more cases of PTA after tonsillectomy? Anatomically, Weber glands are located in the soft palate in the peritonsillar space. Because Weber glands are in the peritonsillar space, they may be excised with the tonsil. Alternatively, even if the glands are left intact, it is possible that after tonsillectomy, there is no tissue obstructing the salivary glands.

It is important to understand the pathogenesis of peritonsillar infection because it may affect treatment of AT. One reason supporting the administration of antibiotics for AT is to prevent peritonsillar infections. If AT is not the cause of PTA or PTC, then the guidelines for treatment may change. Obviously, if streptococcal tonsillitis is diagnosed, then antibiotics should be administered, but often the clinician does not know whether the tonsillar infection is bacterial, and it is debatable whether treating all tonsillar infections with antibiotics could prevent peritonsillar infections.

To better test the connection between AT and peritonsillar infections, a longitudinal study based on individual observations of patients with tonsillitis and later stage development of PTA or PTC is needed. This kind of study would be methodologically difficult to undertake because of the rarity of peritonsillar infections and the uncertainty in verification of the initial diagnosis at an earlier stage of the disease (ie, whether the disease began as tonsillitis or already at presentation was a peritonsillar infection misdiagnosed as acute tonsillitis). Regardless, research that continues to explore this issue would no doubt lead to further insights.

Conclusion
Increased rates of PTA or PTC following acute tonsillitis outbreaks were not found. This finding lends further support to the theory that peritonsillar infection is not a complication of acute tonsillitis. On the other hand, peritonsillar infections do have a tendency to occur in the same week as acute tonsillitis, indicating that, although not a causal factor, they may be linked.

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Author Contributions
Sofia Kordeluk, conception, design, acquisition of data, drafting the article, revising article, final approval; Lena Novak, analysis and interpretation of data, drafting the article and critical revisions, final approval; Moshe Puterman, conception and design, interpretation of data, revision and final approval; Mordechai Kraus, conception and design, acquisition of data, critical revisions and final approval; Ben-Zion Joshua, conception and design, acquisition of data, analysis and interpretation of data; drafting the article revising it critically, final approval.

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