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LARYNGOLOGY

Peritonsillar abscess is frequently accompanied by sepsis symptoms

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Abstract

Purpose To evaluate how many patients with peritonsillar abscess (PTA) fulfill sepsis criteria and if there is any difference in risk factors and treatment results between patients with and without sepsis symptoms. We also aimed to evaluate the utility of several clinical and laboratory markers for diagnosing PTA.

Methods Study group consisted of 92 patients with PTA undergoing bilateral emergency tonsillectomy. Blood samples, pus samples and clinical data were collected. Patients were evaluated for sepsis criteria based on 2001 International Sepsis Definitions Conference.

Results Sepsis diagnostic criteria were fulfilled in half of patients (51.1%). Smokers ($p=0.016$) and patients who had not received antibiotic treatment ($p=0.003$) had more sepsis symptoms. Procalcitonin levels were moderate and there was no difference between the groups. In majority of the patients, the pus samples contained undetectable or mild levels of amylase while 12 patients had pus amylase at least twice higher than in blood serum and among them, the levels were remarkably high in 9 patients.

Conclusion Half of the patients with PTA meet the diagnostic criteria for sepsis. The risk factors for the latter include current smoking and not receiving antibiotic treatment before hospitalization. PTA treatment outcome does not differ between the patients with and without sepsis clinical picture in case of surgical treatment. C-reactive protein appears to be better diagnostic marker for PTA than procalcitonin. A portion of the PTA patients have remarkably high amylase level in the pus indicating possible association with Weber's salivary glands infection.

Keywords Peritonsillar abscess · Sepsis · Amylase · Smoking · Antibiotic · Procalcitonin · C-reactive protein

Introduction

Peritonsillar abscess (PTA) is a collection of pus between the fibrous capsule of the palatine tonsil and the superior pharyngeal constrictor muscle [1]. PTA is usually a complication of acute tonsillitis but it can also originate from Weber's salivary glands' infection [2]. PTA is a common disease seen in ear, nose and throat (ENT) department and one of the most common diseases needing an emergency hospitalization in ENT. The incidence of PTA has been shown to be 30 cases per 100,000 people per year in United States and 19 cases per year 100,000 in Germany. The disease is most frequently occurring among adolescents and young adults [3, 4].

PTA is usually diagnosed during clinical examination where asymmetric peritonsillar swelling with tonsil and uvula deviation is present [5]. In rare cases, bilateral PTA might occur where asymmetric swelling is not present. In these cases, the PTA diagnosis based only on clinical examination is difficult, and computed tomography (CT) or ultrasound may be useful.

Severe complications of PTA are rare, abscess extension into deeper neck spaces and airway obstruction being the most frequent [6]. However, PTA patients are commonly found to be obviously ill, uncomfortable, in pain and dehydrated, especially children and older adults. Many of those pronounced symptoms are characteristic for severe systemic inflammatory reaction, but may appear also due to lack of fluid intake, because of pain and swelling. We, therefore,

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aimed to evaluate how many patients with PTA fulfill sepsis criteria and if there is any difference in risk factors and treatment results between patients with and without sepsis symptoms. We also aimed to evaluate the utility of clinical and laboratory markers for diagnosing PTA.

Materials and methods

Study group

The prospective study was performed from April 2016 until August 2017 at the Ear Clinic, Tartu University Hospital, Estonia. The study group consisted of 92 patients (54 male and 38 female, age range 13–67) with PTA undergoing bilateral emergency tonsillectomy. Exclusion criteria included age under 12 years, current administration of immunosuppressive medications, immunosuppressive disease, current chemotherapy or radiotherapy, and diabetes (both type I and type II).

Clinical examination

The diagnosis of PTA was based on the clinical evaluation. In seven patients, the computed tomography (CT) scan was previously made in county hospital where 24 h ENT specialist supervision is not available.

The following information was obtained: age, gender, type of antimicrobial therapy before admission, axillary temperature with accuracy of 0.1 °C, pulse and respiratory frequency. Measurement of axillary temperature was used instead of sublingual since it is a common practice in our clinic to avoid excessive inconveniences for patients with oral and pharyngeal abscesses (including PTA) and patients after surgeries in that area. Before surgery, the blood samples were collected. Patients were also evaluated for sepsis criteria based on 2001 International Sepsis Definitions Conference. Criteria for systemic inflammatory response syndrome (SIRS) are considered to be met if at least 2 out of 4 clinical findings are present: temperature higher than 38 °C or lower than 36 °C; heart rate higher than 90 beats per minute; respiratory rate higher than 20 breaths per minute or arterial carbon dioxide tension lower than 32 mmHg; white blood cell (WBC) count higher than 12×10^9/L or lower than 4×10^9/L or with 10% immature forms. Sepsis is defined by the presence of both infection and SIRS [7]. Clinical and laboratory data are presented in Table 1.

Surgical procedures

All operations were performed under general anesthesia. In the beginning of the operation, the abscess was punctured to collect pus samples. Both tonsils were removed by blunt dissection.

Laboratory methods

Blood samples were transported to United Laboratory of Tartu University Hospital where white blood cell count (WBC), C-reactive protein (CRP), procalcitonin (PCT), antistreptolysin O (ASO) and amylase were measured using standard methods. Amylase levels in the fivefold diluted pus were measured by kinetic colorimetric method in United Laboratory of Tartu University Hospital.

Statistical methods

For statistical analyses, SigmaStat (Systat Software, Chicago, IL) and Excel (Microsoft, Redmond, WA) software programs were used. The differences between the groups were calculated with *t* test (in case of normal distribution) and Mann–Whitney rank sum test (in case of nonparametric distribution) as well as Fisher's exact test and Chi squared test. Spearman correlation was used to determine correlations between the parameters. Statistical significance was assumed at $p<0.05$ for all parameters.

Results

Clinical and laboratory data

Ninety-two patients [54 males and 38 females, median age of 31.5 (range 13–67) years] were hospitalized into the Ear Clinic, Tartu University Hospital (Estonia) due to PTA. Clinical and laboratory data are listed in Table 1. Median duration of symptoms was 5 days before hospitalization, but it ranged widely (1–30 days). One-fifth (21.3%) of patients had fever (above 38 °C). Fifty-two patients (56.5%) had right side abscess, 39 had left side PTA, and 1 patient had bilateral disease. Most of the patients were discharged from the hospital 1 day after surgery. One patient was transferred into intensive care unit after surgery due to severe swelling of the upper airways, where the patient was kept for next 6 days. The patient recovered fully. There were no other major complications in any of the patients.

Almost half of the patients (48.9%) had used antibiotics prior to the hospitalization. The most common antibiotics included penicillin V, amoxicillin, amoxicillin with clavulanic acid, azithromycin, clarithromycin, clindamycin, cefadroxil, cefuroxime, cefprozil and ciprofloxacin. These patients had slightly longer duration of symptoms compared to patients who had not taken any antibiotics (median 5 vs 4 days, $p=0.010$). Those patients also had slightly higher WBC counts (14.3 versus 12.4×10^9/L); however, the

Table 1 Clinical and laboratory data of PTA patients

	Total ($n=92$)	Without clinical picture of sepsis ($n=45$)	With clinical picture of sepsis ($n=47$)	p values
Antibiotic treatment before hospitalization (n, %)	45 (49%)	29 (64%)	16 (34%)	0.003
	Mean ± SD [median (range)]			
Age (years)	33.5 ± 13.8 [31.5 (13–67)]	35.5 ± 15.7 [33 (13–67)]	31.6 ± 11.6 [31 (15–59)]	NS
Temperature (°C)	37.6 ± 0.6 [37.5 (36.0–39.4)]	37.2 ± 0.5 [37.2 (36.0–39.0)]	37.9 ± 0.6 [38.0 (36.5–39.4)]	<0.001
Duration of symptoms before hospitalization (days)	5.5 ± 4.1 [5 (1–30)]	5.5 ± 2.7 [5 (2–14)]	5.6 ± 5.1 [4 (1–30)]	NS
Smokers (n, %)	20 (22%)	5 (11%)	15 (32%)	0.016
Smoking years	11.0 ± 9.2 [9.5 (0.25–40)]	11.3 ± 16.3 [5 (0.25–40)]	10.9 ± 6.2 [10 (2–20)]	NS
Smokes per day	10.9 ± 6.6 [10 (0.5–20)]	8.4 ± 7.2 [6 (1–20)]	11.7 ± 6.5 [10 (0.5–20)]	NS
Smoking in pack-years	6.3 ± 6.0 [4.3 (0.1–20)]	4.6 ± 5.3 [4 (0.1–13.3)]	6.9 ± 6.3 [4.5 (0.5–20)]	NS
Pulse (×/min)	90.1 ± 16.1 [90 (52–140)]	80.2 ± 12.2 [83.5 (52–102)]	100.1 ± 13.2 [99 (72–140)]	<0.0001
Respiratory rate (×/min)	19.1 ± 5.8 [18 (12–59)]	17.9 ± 3.6 [17 (12–35)]	20.5 ± 7.3 [19 (12–59)]	<0.0001
O_2 saturation (%)	96.6 ± 2.2 [97 ± (88–100)]	96.8 ± 2.2 [98 ± (90–100)]	96.4 ± 2.1 [97 ± (88–99)]	NS
Procalcitonin (ng/mL)	1.2 ± 6.9 [0.07 ± (0.05–49.94)]	1.3 ± 7.7 [0.07 ± (0.05–49.94)]	1.1 ± 6.1 [0.08 ± (0.05–38.05)]	NS
C-reactive protein (mg/L)	100.1 ± 67.4 [86.9 (6.9–334.4)]	88.6 ± 65.9 [74.0 (6.9–274.0)]	111.1 ± 67.7 [106.4 (13.7–334.4)]	0.071
White blood cells ($\times 10^9$/L)	13.6 ± 3.7 [13.8 (6.8–22.7)]	11.6 ± 3.4 [10.7 (6.8–18.9)]	15.4 ± 2.9 [15.4 (10.2–22.7)]	<0.001
Anti-streptolysin O (IU/mL)	259.9 ± 405.3 [147.0 (20.0–3079.0)]	270.2 ± 487.8 [115.5 (20.0–3097.0)]	250.0 ± 311.8 [162.5 (20.0–1541.0)]	NS
Amylase in serum (U/L)	45.3 ± 17.5 [43.0 (20.0–108.0)]	48.0 ± 18.7 [49.0 (20.0–108.0)]	42.6 ± 16.0 [42.0 (20.0–83.0)]	NS
Amylase in pus (U/L)	765.3 ± 2064.5 [< 3 (< 3–10,019)]	589.2 ± 1968.9 [5 (< 3–10,019)]	984 ± 2205.7 [< 3 (< 3–7004)]	NS

NS not significant

difference was not statistically significant. Antibiotic taking was not associated with gender or body temperature.

In majority of the patients, the pus samples contained undetectable or mild levels of amylase. At the same time, 12 patients had pus amylase at least twice higher as in blood serum and among them, in 9 patients the levels were remarkably high, ranging from 860 to 10,019 U/L.

Comparison of patients with and without sepsis symptoms

In nearly half of the patients (51.1%), the sepsis diagnostic criteria were fulfilled. We divided patients accordingly into two groups, patients with and without sepsis symptoms. The patients with sepsis symptoms had statistically significant values of the body temperature, pulse and respiratory rate, CRP and WBC counts (Table 1).

Patients who had not received any kind of antibiotic treatment before hospitalization had more sepsis symptoms ($p=0.003$), and also the patients who were smokers had more sepsis symptoms compared to non-smokers ($p=0.016$).

There were two patients with very high procalcitonin (PCT) levels, 38.05 and 49.94 ng/mL (one with symptoms of sepsis and the other without), but if we excluded these two values from analysis, there was no difference in PCT levels between study groups (corrected median values 0.08 and 0.07, respectively).

Patients with very high pus amylase levels could be found in both groups: four patients without (860–10,019 U/L) and five patients with clinical picture of sepsis (1304–7004 U/L).

Those patients did not have more severe sepsis or other clinical findings.

Discussion

Our study showed that in half of the patients with PTA diagnosis the criteria for sepsis were fulfilled. The risk factors for developing septic symptoms appeared to be smoking and no antibiotic treatment before hospitalization. Nearly a tenth of the patients had remarkably high amylase levels in their PTA pus.

It has been previously shown that smoking can be one of the risk factors for development of PTA [8, 9]. Smoking rate in our study groups (22%) was similar to the overall smoking rate in Estonian population (21%) [10], indicating that we could not consider smoking as a risk factor for PTA in our patients. However, smoking increased significantly the risk for development of sepsis symptoms in our PTA patients. At the same time, there was no association with number of cigarettes per day or duration of smoking in years, indicating that the smoking itself is an important risk factor. We suggest that it can be related to instant effects of smoking on both cell-meditated and humoral immunity, both locally and systemically even after short exposure of smoking. Second, smokers have different microbiota in their upper airways compared with non-smokers, containing more potential pathogens that also could explain more severe symptoms of PTA in these patients [8, 11, 12].

Almost half of the patients had received antibiotics, usually prescribed by family doctors. The prescribed antibiotics were highly variable, belonging to different classes. Similar finding was also found in our previous study [13]. It might be related to understanding that PTA etiology is polymicrobial and there is no consensus in literature what are the true causative microorganisms. For instance, the group A beta hemolytic streptococcus is a well-known pathogen for acute tonsillitis and PTA, but its actual prevalence in the samples from PTA patients is low. In addition, the tonsillar microbiota in PTA patients is highly variable and differs among different geographical areas [14].

Most common biomarkers used to evaluate the inflammation due to infection are WBC and CRP. In addition, procalcitonin (PCT) is used to assess the severity of infection, because noninfectious inflammatory stimuli must be very severe to result in PCT elevation, making it a more specific biomarker for severe infections [15]. Moreover, PCT evaluation is more sustained in patients with neutropenia. In general, CRP values higher than 100 mg/L are associated with severe infection. In our study, we observed elevated WBC and CRP levels, but only slightly elevated or not elevated PCT levels. Therefore, in case of PTA the CRP seems to be a better diagnostic marker than PCT. CRP correlation with WBC count was very good and both can be used as a diagnostic tool.

We also found that a small fraction of patients had very high amylase levels in their pus samples accompanied by normal amylase levels in their serum. It has been shown previously that some PTA patients have very high pus amylase values [16] and it has been associated with subtype of PTA arising from Weber's salivary glands' infection. At the same time, our data showed that those patients did not have more sepsis symptoms or other clinical differences.

To diagnose sepsis, we used the 2001 sepsis criteria [8] that are easy to apply. We did not see that clinical picture of sepsis in admission could provide additional clinical complications since most of the patients were discharged to home a day after tonsillectomy and nobody needed re-hospitalization. This favorable outcome might be related to the used treatment method—tonsillectomy. This is a very effective treatment and there are studies suggesting that patients treated with tonsillectomy for PTA do not need any further antibiotic treatment [17]. At the same time, there are studies indicating that PTA can be treated effectively only with antibiotics and without opening the abscess [18]. The health care providers following this suggestion must carefully take into consideration the result of our study. Evaluating the presence or absence of the signs of more severe systemic response and sepsis might be important in selecting the patients with higher risk and recommending them surgical opening of abscess rather than treating with antibiotics alone.

Conclusions

Half of the patients with PTA meet the diagnostic criteria for sepsis. The risk factors for the latter include current smoking and not receiving antibiotic treatment before hospitalization. PTA treatment outcome does not differ between the patients with and without sepsis clinical picture in case of surgical treatment. C-reactive protein appears to be better diagnostic marker for PTA than procalcitonin. A portion of the PTA patients have remarkably high amylase level in the pus indicating possible association with Weber's salivary glands' infection.

Ethical consideration

Participation in the study was voluntary. All subjects were informed about the study's nature and after the signing of an ethics committee-approved informed consent, they were entered into the study. The study was conducted in compliance with the "Ethical principles for medical research involving human subjects" of Helsinki Declaration and approved by Ethics Review Committee on Human Research of the University of Tartu (protocol no: 255/T-1).

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Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

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