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Original article

Cytobacteriological testing of drainage pus from peritonsillar abscess is not contributive in clinical practice: A STROBE analysis

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INFO ARTICLE

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ABSTRACT

Purpose. – Peritonsillar abscess (PTA) is a frequent pathology. Treatment consists in drainage of the collection, associated to probabilistic antibiotic therapy. The usefulness of cytobacteriological testing (CBT) of the drainage pus is controversial.
Material and methods. – A retrospective study of patients managed for PTA between 2013 and 2020 in our university hospital was performed. The main objective was to assess the usefulness of CBT in the management of PTA. The secondary objectives were to determine the bacteriological profile involved in the onset of PTA and to assess the rate of bacterial resistance to antibiotics prescribed on a probabilistic basis.
Results. – The study included 207 patients: 70 outpatients (33%) and 137 inpatients (67%). Probabilistic antibiotic therapy was implemented in 100% of patients. CBT was performed systematically and was negative in 106 patients, revealing oropharyngeal flora in 40% of cases, polymicrobial flora in 50% and sterile samples in 10%. In the 101 patients with positive CBT, the bacteria isolated were penicillin-sensitive in 99%. All patients were successfully treated. In the light of the bacteriological results, no changes were made to the probabilistic antibiotic therapy introduced on admission.
Conclusion. – CBT on drainage pus had no impact on the management of PTA. CBT is therefore unnecessary in patients with no comorbidities and no signs of severity at admission.

1. Introduction

Peritonsillar abscess (PTA) is a complication of pharyngitis, which is the most frequent deep cervical infection [1,2]. Treatment is based on probabilistic antibiotic therapy associated to drainage [3,4]. The pus (Fig. 1) usually undergoes cytobacteriological testing (CBT) [5] to identify the culprit bacterium and disclose any resistance to the prescribed antibiotics. The contribution of CBT is controversial for several reasons. Culture often reveals polymicrobial flora, with no clearly identified bacteria [2,6–8]. When bacteria are identified, they are almost always penicillin-sensitive [9]. Even if they are resistant to penicillin, drainage associated to the penicillin is effective [10,11]. Results are obtained in about 72 hours, by which time the patient's progress, and notably the success of drainage, is known. Nevertheless, some ENT physicians prescribe CBT, but without inquiring as to the results, as found in a 2008 study of 86 UK ENT departments, in which 67% of respondents systema-

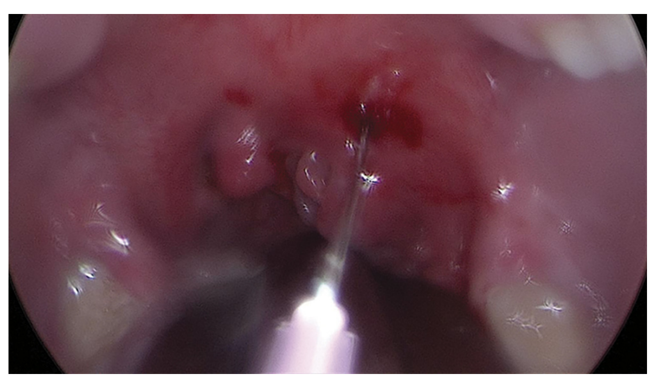

Fig. 1. Peritonsillar abscess drainage.

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Table 1
Bacteria detected in culture and antibiotic resistance[a].

Pathogen	*β-hemolytic Streptococcus*				*Staphylococcus aureus*	*Streptococcus viridans*	*Streptococcus milleri*			*Haemophilus influenzae*
	A	B	C	F			*Constellatus*	*Anginosus*	*Intermedius*	
					Aerobic					
Number	29	2	7	5	6	6	24	9	3	1
Penicillin (%)	100	100	100	100	100	100	100	100	100	100
Macrolide (%)	92	50	70	100	100	85	70	80	30	0
Amox-ca (%)	100	100	100	100	100	100	100	100	100	100
					Anaerobic					
Pathogen	*Fusobacterium necrophorum*		*Prevotella*		*Eikenella corrodens*		*Pasteurella multocida*			
Number	1		5		1		1			
Penicillin (%)	100		100		b		b			
Macrolide (%)	a		60		b		b			
Amox-ca (%)	100		100		100		100			

For each antibiotic, percentage sensitive samples are shown. a: isolates presumed non-susceptible; b: isolates not tested. Amox-ca: amoxicillin-clavulanic acid.

[a] Excluding milleri group (i.e., *Streptococcus constellatus*, *Streptococcus anginosus*, *Streptococcus intermedius*).

tically sent the pus for culture but only 28% looked at the results [12].

An observational study was conducted in our department, with the main objective of assessing the contribution of CBT in the management of PTA. No previous studies specifically addressed this question. The secondary objectives were to determine the bacteriological profile of PTA within a French ENT department and to assess resistance to probabilistic antibiotic therapy, in a country notorious for its high level of antibiotic consumption [13].

2. Materials and methods

Data were collected for all CBTs performed in the microbiology laboratory for our department between January 1, 2013 and December 31, 2020. Systematic analysis of computer records identified patients treated for PTA in the hospital.

Inclusion criteria comprised diagnosis of PTA with pus sampling for CBT. Abscesses were restricted to the peritonsillar or prestyloid region. The single-center retrospective study included 207 patients' files.

Exclusion criteria comprised all other abscess locations: retro- or para-pharyngeal on CT, or clinical or CT signs concerning the retrostyloid or retropharyngeal regions.

Samples were taken using 2 techniques: aspiration in the office, or under general anesthesia ahead of tonsillectomy if the office aspiration failed or there was no clinical improvement under medical treatment within 48 hours. Samples were analyzed in the microbiology laboratory within 24 hours of sampling for Gram staining, aerobic and anaerobic culture and antibiotic sensitivity testing. No special sample conservation method was employed. The retrospective data retrieved from records comprised: clinical and pathology patient data; medical treatment for the PTA prior to consultation in our center, classified as pre-hospital antibiotics, steroidal anti-inflammatory drugs (SAIDs), non-steroidal anti-inflammatory drugs (NSAIDs) or other; type of treatment in the department, with or without inpatient admission; type and duration of antibiotic therapy; type of treatment, classified as fine-needle aspiration or drainage by tonsillectomy; results, classified as PTA complications or complete symptom resolution; outpatient or inpatient management, and department (intensive care or ENT) in the latter case; and CBT data, classified as positive or negative culture and type of bacteria identified. Aspiration was considered unfeasible if prevented by poor clinical tolerance or trismus, non-compliance or age. Results were considered negative if oropharyngeal flora was normal or the sample was sterile, and positive when a pathogen was identified and isolated.

Categoric data were reported as number and percentage and quantitative data as mean and standard deviation or median and interquartile range according to distribution normality on Shapiro-Wilk test.

Correlations between bacteriology data and rates of hospital admission, complications and recurrence were assessed on Chi^2 or Fisher exact test as appropriate.

Analyses used Stata software, version 15 (StataCorp, College Station, TX).

The significance threshold was set at $P < 0.005$, in line with the movement toward better science, "significant", "suggestive" and "non-significant" designating P-values respectively < 0.005, 0.05–0.005 and > 0.05 [14,15].

The study adhered to guidelines for research involving human subjects according to the Declaration of Helsinki, and received local review board approval (n° EI23SN0101). The methodology adhered to STROBE guidelines for observational studies [16].

3. Results

The study included 207 patients: 105 female, 102 male; mean age, 36 ± 16 years. Ten presented comorbidities: 4 cases of diabetes and 6 of rheumatoid arthritis. Before hospital presentation, 57% had received antibiotic therapy and 48% anti-inflammatory drugs. The most frequent antibiotics were amoxicillin (43%), amoxicillin-clavulanic acid (30%) and clarithromycin (7%). Forty-four patients (21%) were under SAIDs and 56 (27%) under NSAIDs.

Bacteriology data are shown in Table 1.

Streptococcus pyogenes, an aerobic bacterium, was the most frequently isolated (14%), followed by *Streptococcus constellatus* (11%). *Prevotella* sp. were the most frequent anaerobic bacteria (3%).

In 99% of cases, isolated bacteria were penicillin-sensitive; 80% were macrolide-sensitive. No patient variables correlated with positive or negative CBT. The antibiotics most frequently prescribed in hospital were amoxicillin-clavulanic acid (74%), associated ceftriaxone-metronidazole (19%) and clindamycin (4%). There was only 1 positive sample in patients in intensive care, for a multi-sensitive viridans group *Streptococcus*, treated by amoxicillin-clavulanic acid. After tonsillectomy, the antibiotic used in intensive care was amoxicillin-clavulanic acid (50%) or associated ceftriaxone-metronidazole (50%). Table 2 shows clinical data according to identification of a bacterium. Probabilistic antibiotic therapy was not found to affect CBT results. All patients were seen in ENT after a few days' antibiotic therapy.

PTA was treated on an outpatient basis in 70 patients (33%) and an inpatient basis in 137 (67%) (Table 1). The two groups were comparable except that the rate of prior amoxicillin treatment was

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Table 2
Clinical data according to positive or negative bacteriological culture.

	Positive (*n* = 101)	Negative (*n* = 106)	*P*-value
Age (years), mean ± SD	37 ± 15	36 ± 16	0.721
Female gender, *n* (%)	52 (52)	53 (50)	0.403
Antibiotic therapy, *n* (%)	54 (53)	64 (60)	0.241
Hospital admission, *n* (%)	63 (62)	74 (70)	0.286
Hospital stay (days), mean ± SD	2.6 ± 1.7	3.1 ± 2.2	0.111
Tonsillectomy, *n* (%)	49 (57)	37 (43)	0.326
Complications, *n* (%)	1 (1)	9 (8)	0.066
Recurrence, *n* (%)	7 (7)	5 (5)	0.383

Data reported as number (percentage) or mean ± standard deviation (SD).

Table 3
Patient data at admission.

	Outpatients (*n* = 70)	Inpatients (*n* = 137)	*P*-value
Age (years), mean ± SD	36 ± 12.0	37 ± 18.0	0.757
Female gender, *n* (%)	38 (54)	68 (50)	0.526
Antibiotic therapy, *n* (%)	44 (63)	74 (54)	0.224
Amoxicillin, *n* (%)	26 (37)	27 (19)	0.006
Amoxicillin-clavulanic acid, *n* (%)	11 (16)	24 (32)	0.743
Clarithromycin, *n* (%)	4 (6)	5 (4)	0.671
Immunosuppression, *n* (%)	0	7 (3)	0.054
SAIDs, *n* (%)	15 (21)	26 (19)	0.675
NSAIDs, *n* (%)	14 (20)	36 (26)	0.318

Data reported as number (percentage) or mean ± standard deviation (SD). Treatments are the pre-hospital treatments. SAIDs: steroidal anti-inflammatory drugs; NSAIDs: non-steroidal anti-inflammatory drugs.

higher in outpatients ($P = 0.006$). Mean hospital stay for inpatients was 3 ± 2.0 days, and < 48 h for 70 (51%). Table 3 shows patient data at in- and outpatient admission.

PTA was successfully treated by aspiration in 58% of cases and by tonsillectomy in 42%. All tonsillectomies were performed under conventional hospital admission. Ten patients (4.8%) were admitted to intensive care: 24 hours' intubation after tonsillectomy in 4 cases of pharyngeal edema, 4 of cervical cellulitis, treated by cervicotomy, and 2 of mediastinitis. Mean intensive care stay was 4 ± 3.0 days. Two of these patients had immunosuppression (1 with diabetes and 1 with rheumatoid arthritis), 4 had not had prior antibiotic therapy, and 6 had received anti-inflammatory drugs (4 NSAID and 1 SAID). Their mean age was 51 ± 24 years: i.e., greater than the overall mean age.

In the 12 cases of recurrence after drainage (5.8%), 7 samples were positive: 6 multi-sensitive *streptococci*, treated by amoxicillin-clavulanic acid, and 1 *Streptococcus agalactiae* resistant to clindamycin in a patient treated with clindamycin due to penicillin allergy.

In the whole series, the initial probabilistic antibiotic therapy was never modified.

4. Discussion

The main reasons for performing CBT in PTA are to adapt probabilistic antibiotic therapy when a bacterium is identified, and to detect bacteria incurring risk of complications. Thus, the test has to be sufficiently contributive to affect treatment. The reasons for not performing CBT are cost, and lack of impact on treatment.

No prospective studies assessed the value of CBT in PTA, although a 2015 study concluded that CBT on PTA pus had little impact on management [17]. Due to ignorance of these findings, given the high level of bacterial resistance found in France over the last 20 years and the guidelines of the French Society of Otorhinolaryngology according to which CBT is necessary in the management of PTA [18], in clinical practice CBT is routinely performed for PTA. In the present study, CBT never had any impact on the management of PTA, and thus was non-contributive in clinical practice. The question is whether it should therefore be abandoned in this context or else restricted to at-risk populations or situations. One situation in which CBT might be unhelpful is in case of prior antibiotic therapy leading to negative CBT results. This did not occur in the present series, and likewise in other reports antibiotics did not preclude positive culture [19,20]. Another reason for abandoning CBT is the low level of positivity; in the present series, there was a 49% rate of positive culture among all samples, and this rate is similar to those reported elsewhere [18,19]. One argument in favor of performing CBT would be that detecting certain bacteria could predict complications. In the present study, the complications rate was 6%, and unrelated to any detected bacteria. Complications and rates have been little reported: a 2018 study found that there was were no types of bacteria predictive of complications rates in PTA [21], although there was a specific bacteriological profile in severe deep cervical infection [22]. There is still the question of PTA associated with immunosuppression, where the risk of complications is greater. A profile of Gram-negative bacteria largely resistant to antibiotics was demonstrated in patients with cervical infection and diabetes [22]. Although no formal conclusion could be drawn, in the present study patients in intensive care more frequently showed comorbidities, and CBT seems to us to be necessary in this at-risk population. Finally, the major argument in favor of CBT is to adapt antibiotic therapy in case of poor clinical progression. PTA does not usually require intensive care, but 10 of the present patients did require this, due to complications: 4 pharyngeal edemas after tonsillectomy, requiring 24 hours' intubation, 4 cases of cervical cellulitis, treated by cervicotomy, and 2 cases of mediastinitis. No changes were made to the antibiotic regime, even in these patients who passed through intensive care; the clinical progression of this type of pathology is clear within 48 hours, and was always favorable in the present series. Some studies reported no difference in progression between isolated tonsillectomy and tonsillectomy plus penicillin in PTA [23,24].

The secondary objective of the present study was to analyze bacterial ecology and notably resistance to the antibiotics used in PTA in a French ENT department over the last decade. The strong point of the study in this regard was that it was conducted in a university hospital center with a large sample, and the main limitations were the single-center design and the dynamic nature of bacterial ecology over time. The main aerobic bacteria implicated in upper airway infection and detected on CBT are *Streptococcus pneumoniae*, *Haemophilus influenzae*, and *Moraxella catharrhalis*, with considerably increasing resistance over the last 40 years [25]. However, there are also many anaerobic and aerotolerant anaerobic bacteria significantly involved in PTA. The origin of the bacteria involved in PTA is in the oro- and naso-pharyngeal commensal flora, which is multimicrobial with dominant anaerobic bacteria (3 different species on average) associated with aerotolerant anaerobic bacteria [26], some two-thirds of which secrete β-lactamase [27]. Three bacteria in this commensal flora are mainly implicated in PTA [7,28,29]: *Streptococcus pyogenes*, *Fusobacterium necrophorum*, and the *Streptococcus milleri* group (*S. intermedius*, *S. anginosus*, and *S. constellatus*). This ecosystem was found in the present study, with *Streptococcus pyogenes* in 28% of positive cultures (14% of PTAs) and *S. constellatus* in 12%. The rate of anaerobic bacteria was just 8% in the present study, whereas it was up to 86% in other reports on PTA [7,30]; identification requires particular conditions that were not feasible in our own clinical practice [31].

Given this ecology and the high rate of β-lactamase secreting bacteria, French guidelines advocate probabilistic antibiotic therapy based on amoxicillin and clavulanic acid if there is no allergy [32], macrolides being recommended in case of penicillin allergy; due to the emergence of multi-resistant bacteria, macrolides are little used in first line [33]. In the present study, 74% of patients had received penicillin-based probabilistic antibiotic therapy. The rate of penicillin resistance was just 1% in the identified bacteria, raising doubt as to the interest of adding clavulanic acid to penicillin. However, our technique was not suited to detecting anaerobic bacteria, and we do not in fact doubt the usefulness of clavulanic acid, as many anerobic bacteria secrete β-lactamase [27].

The study demonstrated that CBT is non-contributive in the management of PTA in the absence of comorbidities. Indications for bacteriological study in PTA should be determined on a case-by-case basis. Elderly and immunosuppressed patients such as diabetics or those with autoimmune disease are at high risk of infection and associated complications [34]. One study reported that 6% of admissions and 12% of deaths due to infection were related to diabetes [34].

The main limitations of the present study were its retrospective design and the sample collection and conservation technique, which led to false negatives. Patients were selected according to laboratory findings, raising the question of PTAs without CBT, although this could be ruled out as our department systematically performs CBT on PTA pus. When aspiration fails, tonsillectomy is performed, with intraoperative sampling for CBT.

The main strength of the study was the exhaustiveness of the epidemiological data at all stages of management: before, during and after hospital treatment.

5. Conclusion

For management of peritonsillar abscess, cytobacteriological testing is generally non-contributive and should not be systematic. It is indicated in patients at particular risk of complications: immunosuppressed and/or elderly.

Disclosure of interest

The authors declare that they have no competing interest.

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