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Review

Treatment for parotid abscess: a systematic review

Trattamento degli ascessi parotidei: revisione sistematica della letteratura

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SUMMARY

A parotid abscess is a dangerous complication of parotitis. In this study, we aimed to define current treatment concepts for parotid abscess, focusing on different management options. The authors performed a PRISMA-compliant systematic review across multiple databases including all original studies published until January 2021 focusing on treatment of parotid abscess. Studies specifying treatment modalities and treatment success rates were included based on abstract and full-text selection. The authors assessed study quality, demographics, success rates, management modalities and adverse events. Among 1,318 citations, 18 studies met our inclusion criteria. Twelve studies relied only on incision and drainage with antibiotic therapy; the remaining 6 compared different treatment modalities (incision and drainage versus exclusive medical therapy or ultrasound-guided drainage). Heterogeneity between studies precluded meta-analysis of data. The review showed that antibiotics remain the mainstay of treatment for parotid abscess. Conversely, the role of incision and drainage, and aspiration should be studied further. The higher rate of complications following incision and drainage suggests a more conservative approach is needed. Incision and drainage remain the main salvage option for conservative treatment failures.

KEY WORDS: salivary gland, sialadenitis, antibiotics, drainage, parotitis

RIASSUNTO

Gli ascessi parotidei rappresentano una complicanza della parotite. Questo studio mira a definire i concetti moderni di trattamento di questa patologia e le diverse scelte di gestione. È stata eseguita una revisione sistematica della letteratura secondo il protocollo PRISMA degli studi originali sul trattamento degli ascessi parotidei, pubblicati sino al Gennaio 2021. Gli studi riportanti modalità di trattamento e tasso di successo sono stati inclusi dopo selezione basata su abstract e full-text, valutando qualità degli studi, caratteristiche dei pazienti, tasso di successo, modalità di trattamento ed eventi avversi. Su 1318 citazioni, 18 studi rispettavano i criteri di inclusione, 12 basati su incisione e drenaggio e 6 comparanti diversi trattamenti (incisione e drenaggio versus terapia medica esclusiva o drenaggio eco-guidato). L'eterogeneità degli studi non ha consentito la realizzazione di una meta-analisi. Gli antibiotici si confermano il punto fermo del trattamento degli ascessi parotidei. Il ruolo di drenaggi chirurgici ed eco-guidati dovrebbe essere invece maggiormente esplorato. Il maggiore tasso di complicanze dopo incisione e drenaggio suggerisce un approccio più conservativo. Incisione e drenaggio restano la principale risposta al fallimento della terapia conservativa.

PAROLE CHIAVE: *ghiandole salivari, scialoadenite, antibiotici, drenaggio, parotite*

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Introduction

Treatment of parotid abscesses (PA) represents another iteration of empiric application of the Latin adage "Ubi pus, ibi evacua". They might be regarded just like any other deep neck space abscess, where pus evacuation is required to prevent fasciitis and allow antibiotics to reach the infection site with adequate perfusion [1]. Nevertheless, the well-known anatomical peculiarities of the parotid space (most notably the presence of the facial nerve), make their management definitely more complex [2,3]. Parotitis, which represents the most common inflammatory disease of the parotid gland, only sporadically evolves into PA [4]. PA is more common among elderly or immunocompromised patients [2], but their presentation in immunocompetent healthy children and adults is well documented in clinical practice [5]. PA is frequently due to *S. aureus* infection [6] and are usually managed with a combination of intravenous antibiotics and abscess incision and drainage [7]. Nevertheless, treatment options such as abscess aspiration (with or without radiological guidance) or simple medical management have been reported systematically in the literature [8,9]. Often different treatment options are also employed simply according to the clinicians' preference, even in the context of the same head and neck team [5,7].

This evolution in PA management follows a common de-escalation trend in management of deep neck spaces. Preliminary prospective and meta-analytic data show that aspiration or exclusive medical management of neck abscess may yield results that are non-inferior to incision and drainage, while obviously reducing procedural complications [10,11].

The present literature on PA treatment is characterised by small studies and a general lack of prospective data, and it is therefore unable to provide guidance in the choice of treatment. In this context, we conducted a systematic review to define current concepts in PA management, mainly focusing on the following approaches: incision and drainage, aspiration, and exclusive medical treatment.

Materials and methods

This systematic review was performed respecting PRISMA Statement [12] and PICOTS criteria. Its protocol is registered and publicly available in the International Prospective Register of Systematic Reviews (PROSPERO) (no. CRD42021231347).

PICOTS criteria

The PICOTS criteria for this review were:

- Patients: patients with radiologically or clinically diagnosed PA;
- Intervention: PA incision and drainage, aspiration or exclusive medical therapy;
- Comparator: different PA management options (as described in the intervention criterion);
- Outcome: treatment success (defined as clinical evidence of infection resolution) as the primary outcome, treatment complications as a secondary outcome;
- Time: short term outcomes;
- Setting: specialty care for patients admitted for PA.

Search strategy

The review was performed between January 18 and April 10, 2021. We conducted systematic searches for studies in English, Italian, German, French, or Spanish, published until the search date and reporting original data. On January 18, 2021, we searched the MEDLINE, Embase, Web of Science, Cochrane Library, and ClinicalTrials.gov databases with wide search strategies for all salivary gland abscesses to maximise the results. Full searcs details and results are detailed in Table I.

We included any study dealing, entirely or partly, with the treatment of PA in humans. We excluded meta-analyses, systematic and narrative reviews, grey literature, pre-clinical studies and case reports. References from review articles were hand-checked for additional potentially relevant studies. No minimum study population was required. We included only studies that specified treatment modalities and treatment outcomes and excluded studies focusing systematically on mycobacterial abscesses.

Abstracts and full texts were reviewed in duplicate by different authors. At the abstract stage, we included all studies deemed eligible by at least one rater. At the full-text review stage, disagreements were resolved by consensus.

Data extraction and quality assessment

For each article, we recorded the number of PA patients, male to female ratio, patient age, potential focus on specific subpopulations, abscess diagnostic modalities, PA treatments (which were classified between incision and drainage, i.e. skin or oral open incision with abscess drainage; aspiration, i.e. radiology-guided or unguided needle aspiration without incision; and exclusive medical therapy, i.e. without any local invasive procedure associated), antibiotic treatment(s), therapeutic success, complications and microbial cultures.

Studies were assessed with the National Heart, Lung, and Blood Institute Study Quality Assessment Tools (NHI-SQAT) [13]. Articles were rated in duplicate by two authors and disagreements were resolved by consensus. Articles were rated as good, fair, or poor if they fulfilled, respectively, at least 80% of the items required by the NHI-SQAT, between 50% and 80% of the items, and less than 50% of the items.

Table I. Search keys and results for each database consulted.

Database	Search key	Date of search	No. of items
Medline	((“parotid gland”[MeSH Terms] OR (“parotid”[All Fields] AND “gland”[All Fields]) OR “parotid gland”[All Fields] OR “parotid”[All Fields] OR “parotids”[All Fields] OR “parotid”[All Fields] OR “parotideal”[All Fields]) AND (“abscess”[MeSH Terms] OR “abscess”[All Fields] OR “abscesses”[All Fields] OR “abscessation”[All Fields] OR “abscessed”[All Fields] OR “abscessing”[All Fields])) OR (“salivary”[All Fields] AND (“abscess”[MeSH Terms] OR “abscess”[All Fields] OR “abscesses”[All Fields] OR “abscessation”[All Fields] OR “abscessed”[All Fields] OR “abscessing”[All Fields])) OR ((“sialadenitis”[MeSH Terms] OR “sialadenitis”[All Fields] OR “sialoadenitis”[All Fields]) AND (“abscess”[MeSH Terms] OR “abscess”[All Fields] OR “abscesses”[All Fields] OR “abscessation”[All Fields] OR “abscessed”[All Fields] OR “abscessing”[All Fields]))	January 18th, 2021	581
Clinicaltrials.gov	(parotid AND abscess) OR (salivary AND abscess) OR (sialoadenitis AND abscess)		5
Cochrane Library	(parotid AND abscess) OR (salivary AND abscess) OR (sialoadenitis AND abscess) in All Text - (Word variations have been searched)		16
Web of Science	ALL FIELDS: ((parotid AND abscess) OR (salivary AND abscess) OR (sialoadenitis AND abscess)) Timespan: All years. Indexes: SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, BKCI-S, BKCI-SSH, ESCI, CCR-EXPANDED, IC.		338
Embase	parotid AND (‘abscess’/exp OR abscess) OR (salivary AND (‘abscess’/exp OR abscess)) OR ((‘sialoadenitis’/exp OR sialoadenitis) AND (‘abscess’/exp OR abscess))		987

Levels of evidence were scored according to the Oxford Centre for Evidence-based Medicine (OCEBM) level of evidence guide [14].

Search results collection, selections, and data extraction were performed with the Google Sheets web application (Google LLC, Mountain View, CA, US).

A meta-analysis was not performed as originally planned due to the heterogeneity of collected data, as detailed in the discussion.

Results

Among the 1,318 unique research items initially identified, a total of 92 articles were selected for full-text evaluation, among which 18 relevant studies published between 1999 and 2019 were retained for further analysis (Fig. 1). Except for a single prospective cohort study [9], all articles were retrospective case series [2-5,7,15-26]. Concerning the level of evidence, 17 studies were rated as level 4 according to the OCEBM scale, and one study was rated as level 2. According to the NHI-SQAT, five articles were rated as good-quality, 12 articles were rated as fair-quality and one article was rated to be of poor-quality, respectively. Most lacked ample information to support the comparability of patients and/or lacked detailed study endpoints. All articles were included in the review as no significant methodological bias emerged. As depicted in Figure 2, 7 articles were from southern or eastern Asia, 7 from Europe, 3 from northern America, and 1 from Israel. Eight studies focused only on paediatric patients, while 1 study focused only on melioidosis cases. Table II reports the characteristics and demographics of the studies included.

The 18 studies had 211 participants with parotid gland abscesses. Patient numerosity ranged from a 40-patient series to a neck abscess case report with a single PA patient. Ten articles reported a male to female ratio of included patients, showing a male sex predominance (99 male patients and 68 female patients). Eight studies were restricted to paediatric patients, while there were no age restrictions in the remaining 10. Six studies did not report data on patient age other than inclusion criteria and 3 had a mixed paediatric-adult population. When considering articles not restricted to paediatric cases, patients were on average in their 4th or 5th decade (6 of 10 papers). Computed tomography and ultrasound were the most common diagnostic modalities, although some studies relied partly or completely on clinical examination only. Magnetic resonance imaging was used sporadically in a few selected cases. All patients were treated with one or more antibiotic therapies, often further tailored to results of microbial culture. Most patients (n = 176) also underwent abscess incision and drainage, while others (n = 18) underwent aspiration either with or without radiological guidance. Eleven patients received antibiotic treatment only while the abscess spontaneously ruptured in 5 patients. A single patient refused all treatments (including antibiotic treatment) and died of septic complications. Eight of 18 studies did not specify the antibiotic regimen used. Beta-lactam antibiotics with beta-lactamase inhibitors were used in 6 studies and cephalosporins in 5, thus being the most frequently proposed antibiotic treatments. Five studies reported adjusting antibiotic therapy to antibiogram results where indicated. Details on antibiotic regimens are reported in Table III.

The overall treatment success rate was extremely variable,

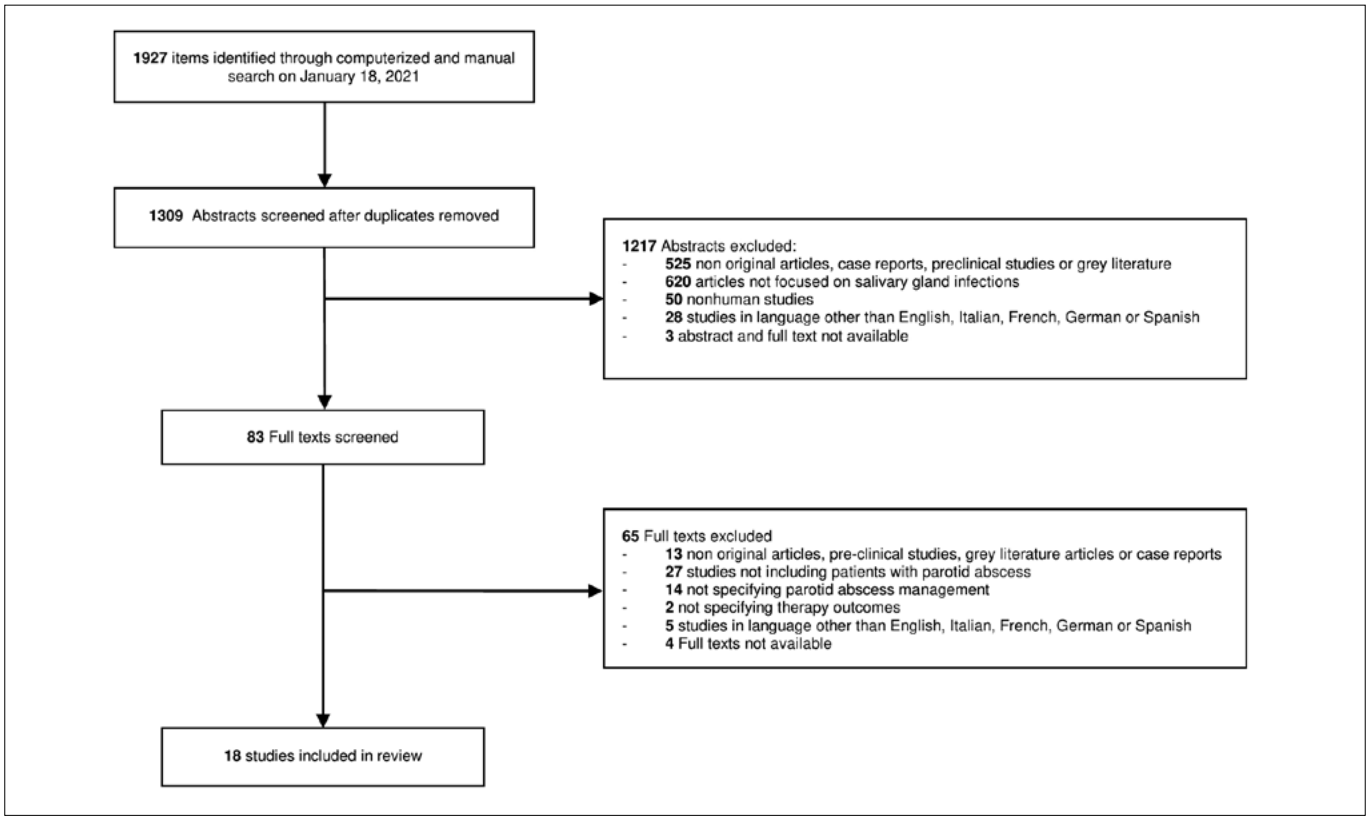

Figure 1. PRISMA flow diagram of study selection through systematic review.

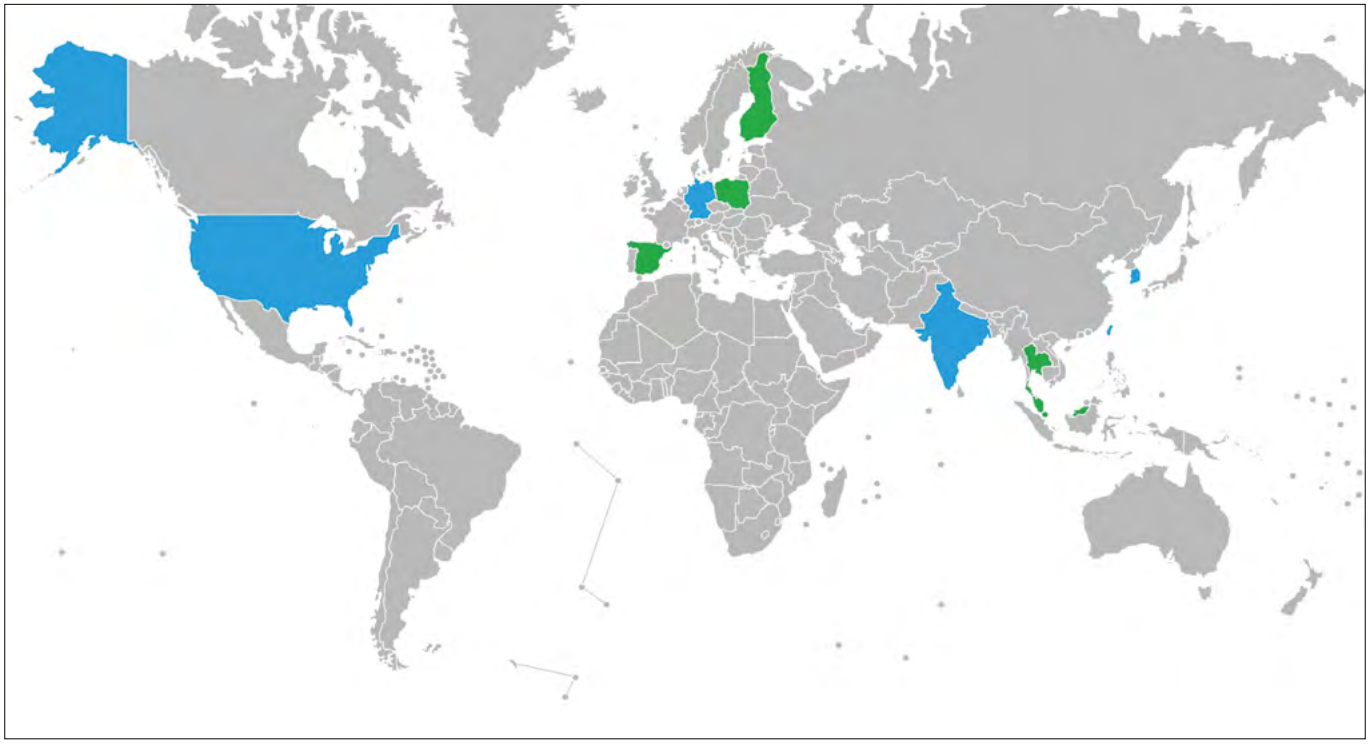

Figure 2. Geographical representation of the countries of origin of the reviewed articles (in green: one article only; in blue: two or more articles).

Table II. Characteristics of the included studies.

	Study type	OCEBM rating	NHI-SQAT score	NHI-SQAT rating	Country	Treated patients (n)	Male to female ratio (n)	Patient age (years)	Specific patient subgroup studied
Cheng et al., 2019 [4]	CS	4	8/9	G	Taiwan	19	12 M : 7 F	Mean 55.5, range 25-88	None
Chi et al., 2014 [15]	CS	4	7/9	F	Taiwan	14	9 M : 5 F	Mean 49.6, SD 14.4, range 22-75	None
Cmejrek et al., 2002 [16]	CS	4	5/9	F	US	1	UNS	UNS	Age < 9 mo
Daramola et al., 2009 [17]	CS	4	6/9	f	US	3	3 F	0.17; 0.33; 7	None
de la Cuesta et al., 2018 [18]	CS	4	5/9	F	Spain	4	UNS	Mean 2.4, SD 2.4	Aged < 15 y
Franklyn et al., 2016 [7]	CS	4	6/9	F	India	40	28 M : 12 F	Mean 46.8, SD 15.8, median 44	None
Ganesh and Leese, 2005 [5]	CS	4	7/9	F	Singapore	10	3 M : 7 F	Median 37, range 20-84	None
Jaboñska-Jesionowska et al., 2017 [19]	CS	4	5/9	F	Poland	2	UNS	UNS	Paediatric patients
Joo et al, 2017 [9]	PCS	2		F	South Korea	4	UNS	UNS	None
Kim et al., 2018 [20]	CS	4	8/9	G	South Korea	13	11 M : 2 F	Mean 51, SD 24.3, range 7-80	None
Lakshmi Narayana et al., 2015 [21]	CS	4	8/9	F	India	7	6 M : 1 F	Range 0.67-15	Paediatric patients
Laskawi et al., 2005 [22]	CS	4	5/9	F	Germany	5	UNS	UNS	Paediatric patients
Mahawerawat and Kasemsiri, 2018 [23]	CS	4	6/9	F	Thailand	22	UNS	UNS	Melioidosis cases
Nusem-Horowitz, 1995 [24]	CS	4	4/9	P	Israel	4	UNS	UNS	Paediatric patients
Saarinen et al., 2007 [25]	CS	4	8/9	G	Finland	10	5 M : 5 F	Median 10, range 2.2-16.8	Age <17 y
Stong et al., 2005 [26]	CS	4	5/9	F	US	2	UNS	Mean 6.5, range 0.5-15	Paediatric patients
Tan and Goh, 2006 [2]	CS	4	8/9	G	Malaysia	15	10 M : 5 F	Median 51, range 0.92-77	None
Thiede et al., 2002 [3]	CS	4	8/9	G	Germany	36	15 M : 21 F	Median 44, range 3 mo-79 y	None

OCEBM: Oxford Centre for Evidence-Based Medicine; NHI-SQAT: National Heart, Lung, and Blood Institute Study Quality Assessment Tools; CS: case series; PCS: prospective cohort study; F: fair; G: good; P: poor; US: United States of America; M: male; F: female; UNS: unspecified; SD: standard deviation; mo: months. y: years.

ranging from 50% to 100%, though higher and less variable in studies with > 10 patients (80-97.2%). The overall mortality rate was 2.37%, with deaths occurring almost exclusively in extremely compromised patients. Detailed surgical, therapeutic and outcomes for each study are reported in Table III.

Nine cases of treatment complications were reported (3 salivary fistulae, 4 facial palsies - one of which was reported, beyond our review temporal scope, as definitive - and 2 wound healing problems). Seven of 9 complications were reported in patients undergoing abscess incision and drainage and 2 in patients with spontaneous abscess rupturing.

Fourteen studies reported microbial culture results, which are detailed in Table IV.

Discussion

Our review shows that at present no univocal management choices are available for PA and the literature lacks specific guidelines or well-designed prospective studies to allow for evidence-based treatment. This is the first systematic review to address the treatment of PA and confirms the overall good treatment success rates, though not free from failure and even deaths, especially in more fragile patients.

Table III. Diagnostic modalities, treatment arms, and outcomes for reviewed studies.

	Abscess diagnostic modalities	Treatment arms	Antibiotic treatment	Outcome	Other complications
Cheng et al., 2019 [4]	CT (n = 19)	ABx + I&D (n = 14)	Amoxicillin/clavulanate (n = 11), or clindamycin (n = 8) first, antibiogram driven next	14/14 cured	None
		ABx + US-guided aspiration (n = 4)		4/4 cured	
		ABx (n = 1)		1/1 died	
Chi et al., 2014 [15]	CT (n = 14)	ABx + I&D (n = 14)	UNS broad-spectrum ABx	14/14 cured	Salivary fistula (n = 1)
Cmejrek et al., 2002 [16]	UNS	ABx + I&D (n = 1)	UNS empirical ABx first, antibiogram-driven next	1/1 cured	None
Daramola et al., 2009 [17]	CT (n = 3)	ABx + I&D (n = 2)	UNS empirical ABx first, antibiogram-driven next	2/2 cured	None reported
		ABx (n = 1)		1/1 cured	
de la Cuesta et al., 2018 [18]	UNS	ABx + I&D (n = 4)	UNS ABx	2/4 cured, 2/4 required another I&D	None
Franklyn et al., 2016 [7]	US (n = 17), CT+MRI (n=14), clinical (n = 9)	ABx + I&D (n = 30)	Cloxacillin and metronidazole first, antibiogram-driven next	26/30 cured, 4/30 required another I&D	None
		ABx + unguided aspiration (n 5)		2/5 cured, 3/5 required I&D	
		ABx in spontaneous rupture (n = 1)		1/1 cured	
		ABx (n = 3)		3/3 cured	
		no therapy (n = 1)		1/1 died	
Ganesh and Leese, 2005 [5]	CT (n = 9), clinical (n = 1)	ABx + I&D (n = 8)	UNS ABx (most frequently ceftriaxone)	7/8 cured, 1 required another I&D	None
		ABx in spontaneous rupture (n = 1)		1/1 cured	
		ABx + CT-guided aspiration (n = 1)		1/1 cured	
Jaboñska-Jesionowska et al., 2017 [19]	UNS	ABx + I&D (n = 2)	Amoxiclavulanate or cephalosporin with clindamycin	2/2 cured	None
Joo et al., 2017 [9]	CT + US (n = 4)	ABx + US-guided aspiration (n = 4)	UNS ABx	4/4 cured	None
Kim et al., 2018 [20]	CT (n = 13)	ABx + I&D (n = 7)	UNS broad-spectrum ABx	6/7 cured, 1/7 required another I&D	None
		ABx (n = 6)		6/6 cured	
Lakshmi Narayana et al., 2015 [21]	US (n = 3), clinical (n = 4)	ABx + I&D (n = 7)	Amoxiclavulanate, changed to clindamycin due to lack of response in 2 patients	7/7 cured	Temporary marginal branch palsies (n = 2)
Laskawi et al., 2005 [22]	UNS	ABx + I&D (n = 5)	Amoxicillin and/or flucloxacillin	5/5 cured	None

▶

Table III. Diagnostic modalities, treatment arms, and outcomes for reviewed studies *(follows)*.

	Abscess diagnostic modalities	Treatment arms	Antibiotic treatment	Outcome	Other complications
Mahawerawat and Kasemsiri, 2018 [23]	UNS	ABx + I&D (n = 22)	Ceftazidime followed by co-trimoxazole (either with or without doxycycline) or amoxi-clavulanate	21/22 cured, 1/22 died	None
Nusem-Horowitz, 1995 [24]	US (n = 2), US after recurrence (n = 1), clinical (n = 1)	ABx + I&D (n = 4)	Penicillin G and cloxacillin	3/4 healed, 1/4 required another I&D	None
Saarinen et al., 2007 [25]	US (n = 9), MRI (n = 1)	ABx+ I&D (n = 3)	UNS broad-spectrum ABx (in most cases metronidazole with penicillin or cefuroxime; clindamycin in one case)	3/3 cured	None
		ABx + US-guided aspiration (n = 4)		2/4 cured, 2/4 required I&D	None
		ABx in spontaneous rupture (n = 3)		2/3 cured, 1/3 required targeted therapy (mycobacteriosis)	Salivary fistula (n = 2)
Stong et al., 2005 [26]	CT (n = 2)	ABx + I&D (n = 2)	UNS ABx	2/2 cured	None
Tan and Goh, 2006 [2]	US (n = 5), CT (n = 8), clinical (n = 2)	ABx+ I&D (n = 15, in one case with underlying tumour resection)	IV cephalosporins (n=7) IV ampicillin/ clavulanate (n=8), concurrent IV metronidazole (n=10). Changed to antibiogram driven when indicated	12/15 cured, 2/15 died, 1/15 required another I&D	1 definitive facial paralysis following re-exploration, 2 wounds with difficult healing
Thiede et al., 2002 [3]	US (n = 34), US+CT (n=2), MRI in selected (n=?)	ABx + I&D (n = 36)	Amoxiclavulanate unless already prescribed prior to I&D	35/36 cured, 1/36 required parotidectomy	Temporary marginal branch palsies (n=1)

CT: computed tomography; UNS: unspecified; US: ultrasound; MRI: magnetic resonance imaging; Abx: antibiotics; I&D: incision and drainage.

The review included a total of 18 studies involving 211 patients diagnosed with PA, allowing for a comprehensive evaluation of the literature. Most of the included studies were of good or fair methodological quality. Data were almost exclusively retrospectively collected and no randomised controlled trials were found.

Treatment success rates overlap between different management choices, while rates of treatment complication were unevenly distributed in the three groups studied. No complications were reported in the 39 patients treated with aspiration or medical therapy, while 7 of 172 patients treated with incision and drainage experienced complications, the most frequent being facial nerve damage. Therefore, given the comparable success rates, a different complication rate makes aspiration or exclusive medical therapy generally preferable to incision and drainage. Even if this observation requires further prospective validation, a more conservative initial approach to PA might seem advisable. A correct choice of antibiotic would allow for adequate drug availability with conservative treatment [27], leaving incision and drainage as a backup option for patients failing first-line treatment.

Antibiotic regimens therefore become a significant matter of debate for PA treatment. Although cephalosporins and beta-lactam with beta-lactamase inhibitors remain the most frequent choice, our systematic review outlined a plethora of regimens selected with little to no homogeneity often providing scarce details on administration, doses and duration. Given that based on the reviewed data *S. aureus* and *S. pneumoniae* represent the most frequent cultured bacteria in PA, amoxicillin-clavulanate should be regarded as the most obvious choice [28], while second-line treatments might be reserved for non-responders. The specific characteristics of each patient (included but not limited to immune status or prolonged hospitalisation) must be taken into account, as well as potential drug resistances that can only be assessed

Table IV. Microbiological results (where available) for the included studies.

	Culture yield
Cheng et al., 2019 [4]	No yield (n = 6), K. pneumoniae (n = 6), S. aureus (n = 2), H. influenzae (n = 1), P. micros (n = 1), M. tuberculosis (n = 1), Candida parapsilosis (n = 1), Salmonella Group D (n = 1)
Chi et al., 2014 [15]	No yield (n = 6), K. pneumoniae (n = 4), F. magna (n = 1), H. influenzae (n = 1), S. aureus (n = 2)
Franklyn et al., 2016 [7]	No yield (n = 3), S. aureus (n = 10), Klebisiella spp. (n = 6), B-haemolytic Streptococcus spp. (n = 4), non-haemolytic Streptococcus spp. (n =), Enterococcus spp (n = 2), Proteus spp. (n = 1), E. coli (n = 1), Enterobacter spp. (n = 1), M. tuberculosis (n = 2)
Ganesh and Leese, 2005 [5]	No yield (n = 5), S. aureus (n = 2), K. pneumoniae (n = 1), E. coli (n = 1), A-haemolytic Streptococcus spp. (n = 1)
Jaboñska-Jesionowska et al., 2017 [19]	S. aureus (n = 2)
Kim et al., 2018 [20]	No yield (n = 5), P. aeruginosa (n = 1), P. intermedia (n = 1), S. epidermidis (n = 1); P. acnes (n = 1)
Lakshmi Narayana et al., 2015 [21]	No yield (n = 2), MSSA (n = 3), B-Haemolytic Streptococcus spp. (n = 1), E. coli (n = 1)
Laskawi et al, 2005 [22]	S. aureus (n = 5)
Mahawerawat and Kasemsiri, 2018 [23]	B. pseudomallei (n = 22)
Nusem-Horowitz, 1995 [24]	No yield (n = 1), Gram-negative cocci (n = 1), coagulase negative Staphylococci (n = 1), anaerobic Streptococci (n = 1)
Saarinen et al., 2007 [25]	No yield (n=3), H. Influenzae (n = 3), S. pneumoniae (n = 1), P. mirabilis (n = 1), M. tuberculosis (n = 1)
Stong et al., 2005 [26]	S. Viridans (n = 1), S. aureus (n = 1)
Tan and Goh, 2006 [2]	No yield (n = 5), S. aureus (n = 2), MRSA (n = 1), S. milieri (n = 1), S. pyogenes (n = 1), Klebsiella spp (n = 3), Psuedomonas spp. (n = 1), Haemophilus spp. (n = 1)
Thiede et al., 2002 [3]	No yield (n = 10), S. aureus (n = 9), S. epidermidis (n = 1), Streptococcu spp. (n = 5), Peptostreptococcus spp. (n = 4), M. tuberculosis (n = 2), atypical mycobacteria (n = 2)

by antibiograms performed on collections from incision and drainage and aspiration.

Lastly, our data show a low prevalence of anaerobic bacteria, which may be nevertheless due to inadequate collection methods. A more thorough investigation of PA microbiology and drug susceptibility represents a future challenge for clinicians.

Our data geographical breakdown points towards a strong research interest in PA in eastern Asia, possibly mirroring a higher local incidence of PA. This could be either due to the local distribution of specific pathogens such as *B. pseudomallei* or to tropical climate as a facilitating factor in the development of PA [23].

Our study has two significant limitations. First of all, the small number of patients included is reflected by underpowered results, especially for what concerns aspiration and exclusive medical management. Conversely, the inclusion of wide-focus case series with a single or few PA patients, while providing a comprehensive evaluation of the literature, introduces a potential reporting bias. Secondly, we encountered a significant heterogeneity in patient samples and medical therapies. Although we are aware that some patient-/disease-specific characteristics such as abscess size, superficial versus deep lobe location, facial nerve involvement, co-existing sepsis, immune status influence therapeutic choices and outcomes, we were unable to systematically explore their role, as these important features are reported inconsistently and sporadically in the reviewed articles. This heterogeneity made the initially planned meta-analysis potentially misleading. Important variables for making a decision in terms of management, such as the location of the abscess (superficial or deep lobe), the volume of the collection, risk of fistulisation or septicaemic complications, are required both to compare different studies and to question the drainage timing.

Data collected in our review did not allow to allocate patients to an adult or paediatric population in 7 of 18 articles and often allowed a wide age range to the paediatric population thus making assumptions on the validity of our data in a specific age group impossible. Therefore, future prospective studies should also separately take into account paediatric and adult patients, given the inherent treatment differences between the two groups in terms of compliance to therapy and invasive procedures [29]. On a side note, this review does not cover the role of steroid drugs, which have been shown to offer some symptomatic relief in other head and neck abscesses [30]. Given the far less benignant course of PA compared to peritonsillar abscesses, the role of corticosteroids should be explored also with regards to prognosis.

Lastly, we chose to exclude from this review articles focusing only on mycobacterial abscess as they tend to have a slightly different clinical course and management[31], and thus the conclusions drawn from our analysis might not extend to this patient population.

Conclusions

Our findings suggest that antibiotics are the mainstay of PA treatment, with excellent success rates, while the exact role for incision and drainage and aspiration should be further explored in adequately designed prospective studies. Given the higher (albeit still small) proportion of treatment complications in the incision and drainage group, a more conservative yet watchful approach towards PA might be advisable, but we are at present unable to define evidence-based strategies. Furthermore, incision and drainage emerged as a preferential management choice for management failures independently of the original therapeutic choice. Therefore, incision and drainage might be recommended as a salvage option for PA in the case of failure of aspiration or exclusive medical therapy.

Conflict of interest statement

The authors declare no conflict of interest.

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Authors' contributions

AMS and FA: study design, article search and selection, data extraction. TA, JRL, MM-Y and KP: drafting of the article. CMC-E: study design and critical revision of the article.

Ethical consideration

No formal ethics committee approval was required for this article as it is based on already published clinical data from other studies available in the literature.

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