Impact of COVID-19 pandemic restrictions in pediatric cervical abscesses

Original Article

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Abstract

Objective: Compare the incidence and management of pediatric cervical abscesses (PCA) during the COVID-19 pandemic with a reference cohort.
Study Design: Retrospective observational.
Methods: Surgically treated PCA cases from January/2015 to July/2021 were reviewed, categorized into pre-COVID-19 (January/2015 to February/2020) and COVID-19 (March/2020 to July/2021) groups. Incidence, demographic data, etiology, diagnostic methods, surgical approaches and outcomes were evaluated.
Results: Sixty-eight cases were included, seven in the COVID-19 group. During this period, there was a lower incidence rate ($p < 0.01$) of PCA with a higher proportion originated from salivary gland's infections ($p = 0.020$) and involvement of the parotid space ($p = 0.042$). *Staphylococcus aureus* was the most frequently isolated pathogen in the COVID-19 group ($p = 0.002$). No differences were found regarding hospital stay, need for re-intervention, or intensive care.
Conclusion: There was a decline in pediatric cervical abscess incidence during the COVID-19 pandemic with similar approaches and outcomes.

Keywords: Abscess, pediatrics, COVID-19, pandemics, incidence.

Introduction

Deep neck infections pose a significant risk to pediatric patients, potentially leading to life-threatening complications such as airway compromise, necrotizing fasciitis, mediastinitis and sepsis[1]. Summed to their severity, these infections can present challenging diagnosis, particularly in children, due to the subtlety of symptoms and the inability of young patients to communicate or cooperate during physical examination[2]. Therefore, awareness and a high level of suspicion are crucial to promptly recognize and manage these conditions. The approach to pediatric cervical abscesses

(PCA) varies widely in the literature, with little consensus among clinicians[1,3]. Some advocate for conservative treatment, particularly in cases of small abscesses, without respiratory compromise or other signs of severity. Others recommend early surgical intervention, especially in young children[3-5]. Furthermore, regarding peritonsillar abscess management, surgical options may range from needle aspiration to incision and drainage[6].

Cervical abscesses may result from a spectrum of etiologies, including respiratory, odontogenic, salivary gland, and infection of congenital malformations. Microorganisms commonly associated with deep cervical infections originate from the oral cavity and upper respiratory tract[4]. *Staphylococcus aureus* and *Streptococcus pyogenes* are frequently isolated pathogens, and polymicrobial cultures, including anaerobic agents, are not uncommon. Reports indicate an increase of methicillin-resistant *Staphylococcus aureus* cases, often attributed to empirical antibiotic overuse[7]. The etiology of these infections significantly influences microbiological profiles[8]. For instance, submandibular or parotid infections commonly involve polymicrobial agents or *Staphylococcus aureus* rather than organisms associated with tonsillar infections such as *Streptococcus pyogenes* [9, 10]. The COVID-19 pandemic has reshaped healthcare resources access and patient behavior, potentially affecting admission to medical services, including emergency care. Reduced patient-doctor interactions and limited access to emergencies care center facilities may have functioned as a filter of non-severe cases, though it may have delayed or limited the management of truly urgent conditions[11]. Furthermore, pandemic mitigation measures such as social distancing and schools shutdown likely influenced pediatric infection patterns, including cervical abscesses[12]. Thus, our aim was to compare the incidence and management of pediatric cervical infections during the COVID-19 pandemic with previous years in a tertiary universitary hospital in the north of Portugal.

Methods

A retrospective observational study was conducted at the department of otorhinolaryngology from January 2015 to July 2021. We divided the study period into two groups: pre-COVID-19, spanning from January 2015 to February 2020, and COVID-19, from March 2020 to July 2021, corresponding to the onset and easing of COVID-19 pandemic precautions, respectively[13,14]. The study included patients younger than 18 years old diagnosed with cervical abscess who underwent surgical intervention. Those with isolated peritonsillar abscess were excluded.

The following data was collected: number of cases per year, demographic (age, sex), symptoms and its duration at admission, prior antibiotic administration and etiology, blood test evaluation (C-reactive protein, leucocytes and neutrophyles count and neutrophil-to-lymphocyte ratio (NLR)) and microbiologic culture. Regarding computed tomography (CT) data, highest dimension, presence of gas and involved cervical spaces (peritonsillar, masticator, parotid, submandibular, sublingual, submental, parapharyngeal, retropharyngeal, and prevertebral) were assessed. Duration of hospital stay, antibiotherapy, corticotherapy, surgical approach (external, trans-oral or both), need of intensive care or re-intervention were analysed. Statistical analysis was performed using IBM® SPSS® Statistics version 27 (IBMCorp., Armonk. NY, USA) with statistical significance defined as $p<0.05$. Categorical variables were examined through absolute and relative frequencies. The Kolmogorov-Smirnov test was employed to determine the normality of continuous variables. Continuous variables with normal distributions were analysed using mean and standard deviation, while those with non-normal distributions were assessed through median and interquartile range. For categorical variables, analysis was performed using either the Chi-square test or Fischer's Exact test. Student's T test was employed for normally distributed continuous variables, while the Mann-Whitney U test was used for non-normally distributed.

Results

Sixty-eight cases were included and seven (10.2%) PCA occurred during the COVID-19 period. Within the pre-COVID-19 group, there were eight (11.8%) cases in 2015, 17 (25%) in 2016, 12 (17.6%) in 2017, six (8.8%) in 2018, 13 (19.1%) in 2019 and five (7.4%) in 2020 before COVID-19. The incidence rate during the pre-COVID-19 period was 11.3 cases per year and 5.6 in the COVID-19 group ($p<0.01$) (Figure 1).

Both groups were homogenous, revealing a female predominance and similar age between groups. The main symptoms were fever, odynophagia, cervical swelling, and torticollis. Symptoms duration was similar in both groups. Demographics and clinical data at admission was illustrated in Table 1. None of these parameters reached statistical significance.

Prior to the onset of the COVID-19 pandemic, the leading causes of PCA were tonsillitis (32.8%) and lymphadenitis (42.8%), as shown in Table 2. In the COVID-19 group, there was a significant increase in PCA due to salivary gland infection (6.6% vs. 42.8%, $p = 0.020$), which was the most frequent cause of PCA along with tonsillitis. The incidence of PCA originating from salivary glands was 0.77 cases per year in the pre-COVID-19 group and 1.42 during COVID-19 ($p = 0.057$).

Analysis of CT scans revealed that the abscess largest diameter did not differ significantly between groups (33.1mm vs. 28.3mm, $p = 0.480$). The visceral space was not involved in any of the cases. Parapharyngeal, retropharyngeal, and submandibular were the most commonly involved spaces in both groups. Involvement of the parotid space was more frequent in the COVID-19 group ($p = 0.042$) (Table 3).

Treatment outcome evaluation in Table 4 revealed no difference across variables such as length of hospital stay, type of surgical approach, need for re-intervention, or intensive care unit admission. Eight cases needed pediatric intensive care, mainly due to airway risk related to cervical abscess or postoperative respiratory events, such as tracheal edema or bronchospasm. There were no fatalities in both groups. Antibiotic treatment during hospitalization in most cases consisted in a association of ceftriaxone and clindamycin - 53 (86.9%) cases in the pre-COVID-19 group and seven (100%) cases in the COVID-19 group. Twenty-nine pre-COVID-19

Figure 1
Incidence of pediatric cervical abscess (PCA)

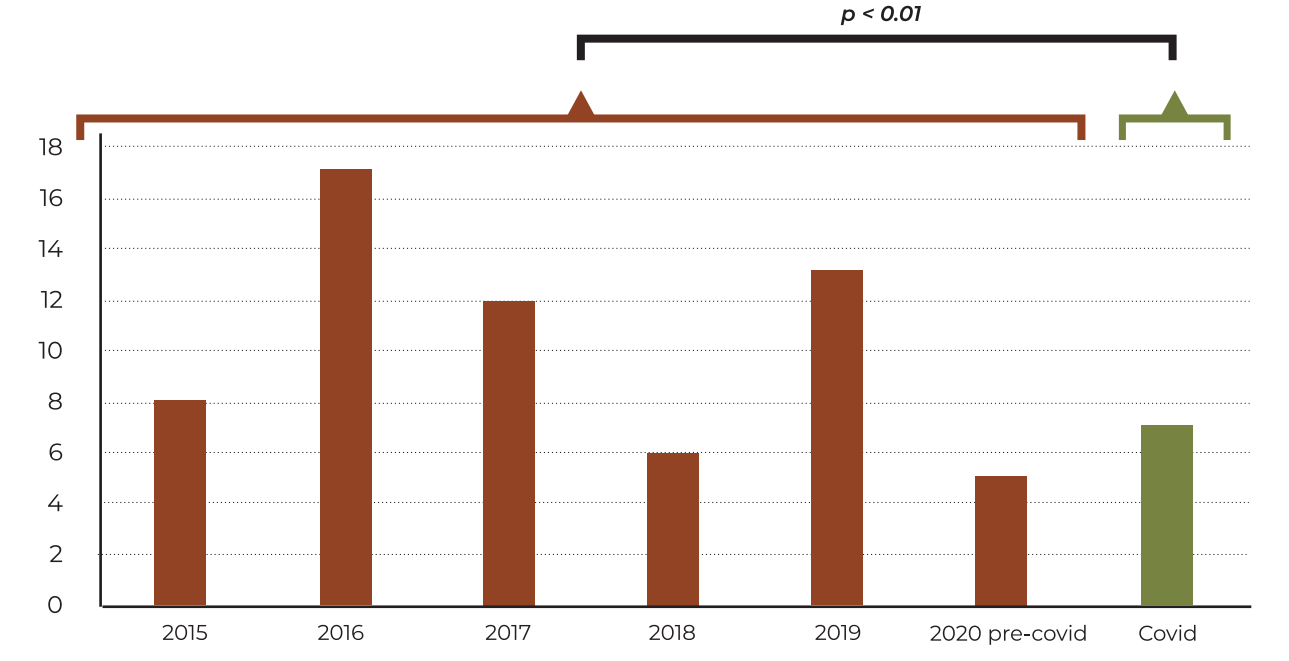

Table 1
Demographics and clinical data at admission

	Pre-COVID-19 (n = 61)	COVID-19 (n = 7)	p
Age, years^	3 (7.5)	2 (1)	0.218
Sex°			0.452
Female	33 (54.1)	5 (71.4)	
Male	28 (45.9)	2 (28.6)	
Symptoms°			
Fever	48 (78.7)	6 (85.7)	0.588
Odynophagia	35 (57.4)	2 (28.6)	0.396
Cervical swelling	35 (57.4)	4 (57.1)	1
Torticollis	25 (41)	2 (28.6)	1
Trismus	4 (6.6)	0 (0)	1
Rinorrhea	15 (24.6)	0 (0)	0.325
Dysphagia	3 (4.9)	0 (0)	1
Symptoms duration, days^	4 (3)	4.5 (3)	0.280
Previous antibiotherapy°	25 (37.7)	1 (14.3)	0.408
Laboratory parameters			
Leucocytes, x 109^	18.6 (9)	22.3 (19)	0.345
Neutrophils, %^	75 (15)	68.4 (17)	0.300
Lymphocytes, %^	15 (12)	25.8 (10)	0.068
C-reactive protein, mg/dL^	98.1 (95)	90.7 (128)	0.703
NLR^	5 (5.3)	3 (1.9)	0.087

^presented in median (range); °presented in n (%); NLR neutrophil-to-lymphocyte ratio.

Table 2
Etiology of cervical abscesses

	Pre-COVID-19 (n = 61)	COVID-19 (n = 7)	p
Tonsillitis	20 (32.8)	3 (42.8)	0.681
Lymphadenitis	19 (31.1)	1 (14.3)	0.664
Odontogenic	7 (11.5)	0 (0)	1
Salivary gland	4 (6.6)	3 (42.8)	**0.020**
Congenital	6 (9.8)	0 (0)	1
Unknown	5 (8.2)	0 (0)	1

°presented in n (%).

(47.5%) and four COVID-19 cases (57.1%) also received intravenous corticosteroids during hospitalization. None of these parameters revealed statistical difference.

Microbiological data is reported in Table 5. Purulent samples from 51 patients in the pre-COVID-19 group and five samples from the COVID-19 group were analysed. Among the pre-COVID-19 samples, 13.7% showed evidence of polymicrobial colonization, while in the COVID-19 group, this proportion was 25% (p = 0.178). Gram-positive aerobic bacteria,

Table 3
CT scan parameters

	Pre-COVID-19 (n = 61)	COVID-19 (n = 7)	p
Highest diameter, mm^	33.1 (17.6)	28.3 (6)	0.480
Cervical spaces°			
Parapharyngeal	37 (60.7)	3 (42.9)	0.410
Retropharyngeal	26 (42.6)	3 (42.9)	1
Submandibular	15 (24.6)	1 (14.3)	0.463
Peritonsillar	14 (23)	1 (14.3)	0.670
Parotid	5 (8.2)	3 (42.9)	**0.042**
Masticator	3 (4.9)	0	1
Sublingual	3 (4.9)	0	1
Submental	1 (1.6)	0	1
Prevertebral	1 (1.6)	0	1

^presented in median (range); °presented in n (%); CT: computed tomography.

Table 4
Treatment outcomes

	Pre-COVID-19 (n = 61)	COVID-19 (n = 7)	p
Hospitalization days†	10.6 (9.4)	10 (3.9)	0.864
Type of surgery°			
Trans-oral	34 (55.7)	4 (57.1)	1
External	26 (42.6)	3 (42.9)	1
Combined approach	1 (1.6)	0 (0)	1
Re-intervention°	7 (11.5)	1 (14.3)	1
Intensive care unit°	8 (13.1)	0	0.587

†presented in mean (standard deviation); °presented in n (%).

specifically *S.aureus, S.pyogenes, S.oralis, S.mitis,* and *S.anginosus*, were the most frequently identified organisms. *S.aureus* was more commonly observed in the COVID-19 group (p = 0.002). All agents were methicillin sensitive. In the pre-COVID-19 period, there were diverse etiologies of S. *aureus* infections isolated agents involved (lymphadenitis, odontogenic, congenital, salivary gland and unknown). In contrast, during the COVID-19 period, salivary gland-related infections were predominant, with just one case associated to tonsillitis.

Discussion

Our findings revealed a lower incidence of PCA requiring surgical intervention during the COVID-19 pandemic restriction period. These data are consistent with the literature [15]. Fadel et al. observed a decrease of PCA during the peak of pandemic restrictive measures. One of the factors that may explain this decrease was the population-wide interventions installed [12]. Measures such as schools shutdown and restriction of other collective activities involving children reduced direct exposure to infectious agents, typical of the pediatric population[16]. On the other hand, personal measures such as mask usage and heightened awareness of respiratory health may have alerted children and parents to adopt more cautious behaviours in their daily

Table 5
Microbiology of collected samples

	Pre-COVID-19 (n = 51)	COVID-19 (n = 5)	p
Negative °	25 (49)	0 (0)	0.058
Multiple bacteria °	7 (13.7)	2 (25)	0.178
Gram-positive aerobic °			
Staphylococcus aureus	5 (9.8)	4 (80)	**0.002**
Streptococcus pyogenes	4 (7.8)	0 (0)	1
Streptococcus oralis	2 (3.9)	1 (20)	0.249
Streptococcus mitis	2 (3.9)	1 (20)	0.249
Streptococcus anginosus	3 (5.9)	0 (0)	1
Streptococcus parasanguinis	2 (3.9)	0 (0)	1
Staphylococcus warneri	1 (2)	0 (0)	1
Streptococcus intermedius	1 (2)	0 (0)	1
Streptococcus constellatus	1 (2)	0 (0)	1
Paenibacilus provencensis	1 (2)	0 (0)	1
Gram-negative aerobic °			
Capnocytophaga sputigena	1 (2)	0 (0)	1
Sphingomonas paucimobilis	1 (2)	0 (0)	1
Anaerobic °			
Prevotella spp.	4 (7.8)	1 (20)	0.385
Actinomyces	2 (3.9)	0 (0)	1
Eikenella spp.	1 (2)	0 (0)	1
Atropobium rimae	1 (2)	0 (0)	1
Veillonella atypica	0 (0)	1 (20)	0.089

° presented in n (%).

lives. The increased difficulty and caution in accessing healthcare could have manifested in more severe cases due to delayed diagnosis[11]. However, our sample did not exhibit this trend, as evidenced by direct parameters, such as time from symptoms onset until emergency department visit, and indirect measures, such as the need for intensive care unit admissions or duration of hospitalization. In the context of the COVID-19 pandemic, medical-surgical management for PCA remained consistent in our series, both in terms of hospitalization duration and surgical approach. The adhesion to established protocols underscores the resilience and adaptability of medical teams in maintaining standards of care amidst challenging circumstances. In our cohort, the COVID-19 group, revealed a higher proportion of cases originating from the salivary gland with involvement of the parotid space. At the same time, the incidence rate of PCA due to salivary gland infections was similar. We can speculate that this outcome could be related to the reduction of infections from other etiologies, including respiratory and odontogenic sources, potentially due to increased attention and vigilance regarding oral hygiene during pandemic restrictions in children, although there is no consensus among diverse authors[12,17-19]. The higher incidence of *Staphylococcus aureus* isolation in samples from the COVID-19 group may also

be attributed to the higher number of salivary gland cases, which are predominant in these infections[10]. Regarding the microbiological study, it is noteworthy to highlight the high number of cases which pus was not available for diagnosis. This procedure is crucial for tailoring and optimizing antibiotic therapy. Optimal methodology involves aspiration of the abscess to minimize contamination and enhance sensitivity, rather than alternative methods such as swab sample collection [10]. Inadequate utilization of appropriate isolation techniques may result in the overlooking of anaerobic bacteria[10]. Additionally, prior antibiotic therapy could be a contributing factor to reduced agent isolation[20].

Among our pediatric cohort, cases requiring intensive care were primarily attributed to airway complications, specifically, airway compromise due to the abscess or post-operative complications. This stands in contrast to adult cases, in which other infectious complications, such as mediastinitis, are more predominant [21].

Its retrospective design was an important limitation of this was its, characterised by occasionally inconsistent data reporting that manifested in a few cases with undetermined etiology, unscrutinized symptoms and suboptimal purulent sampling. The small sample size during the COVID-19 period adds complexity to interpreting the findings clearly. The study is constrained by its single hospital approach. However, it was conducted at a tertiary care center that hosts multiple emergency medical teams from different hospitals, potentially integrating varied medical practices, and handles cases from a broader metropolitan area, which helps address this limitation. Nonetheless, evaluating this trend within a national or international framework would provide a more comprehensive understanding by encompassing a larger patient cohort.

To our knowledge, this is the first study that compares the incidence and outcomes of PCA in the Portuguese population during the COVID-19 pandemic, revealing a reduction of incidence and highlighting the uniformity of treatment delivered during this challenging circumstances.

Conclusion

Amid the COVID-19 pandemic in Portugal, there was a notable decrease in the PCA incidence.

Despite pandemic-related challenges, treatment approaches remained consistent, with clinical outcomes remaining similar to those prior to the pandemic.

Conflict of Interests

The authors declare that they have no conflict of interest regarding this article.

Data Confidentiality

The authors declare that they followed the protocols of their work in publishing patient data.

Human and animal protection

The authors declare that the procedures followed are in accordance with the regulations established by the directors of the Commission for Clinical Research and Ethics and in accordance with the Declaration of Helsinki of the World Medical Association.

Privacy policy, informed consent and Ethics committee authorization

The authors declare that they have obtained signed consent from the participants and that they have local ethical approval to carry out this work.

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Scientific data availability

There are no publicly available datasets related to this work.

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