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Retropharyngeal Abscess in Children: A Retrospective Study

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Abstract

Objectives: To enhance the clinician's awareness of Retropharyngeal Abscess (RPA) by discussing the clinical characteristics and different management approach in the diagnosis of retropharyngeal abscess.

Methods: A retrospective review was conducted on patients diagnosed with RPA during the period April 1999 to May 2016. Their demographics, presentations, radiology, etiology, bacteriology, hospital stay, complications, reasons for misdiagnosis and treatment were analyzed and evaluated.

Results: A total of 34 children were admitted from April 1999 to May 2016. The majority of the children were below 3 years old (66.7%), and the misdiagnosis rate was up to 61.8%. The presenting symptoms included sore throat, neck stiffness, fever, odynophagia, neck swelling, stridor, hoarseness, new-onset snoring and dyspnea. Three-dimensional computed tomographic scan was preferred for radiological diagnosis. Staphylococcus aureus was the most common organism found on culture (61%). Early surgical drainage, combined with systemic antibiotics treatment was the main effective method.

Conclusion: Three dimensional CT scan was the examination of choice for the diagnosis of retropharyngeal abscess. Conservative treatment should be followed-up by imaging in the absence of improvement within 24 h to 48 h. Antibiotics chosen should cover the most common pathogens causing RPA. It is easily misdiagnosed; therefore it is essential to increase awareness of practitioners for a prompt diagnosis and management.

Keywords: Retropharyngeal abscess; Children; Neck CT scan

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Abbreviations

RPA: Retropharyngeal Abscess; CT: Computer Tomography; PICU: Pediatric Intensive Care Unit; MRI: Magnetic Resonance Imaging; URTI: Upper Respiratory Tract Infections; PSG: Polysomnography; OSA: Obstructive Sleep Apnea; IV: Intravenous; OR: Operation Room; I&D: Incision and Drainage

Introduction

Retropharyngeal Abscess (RPA) is a potentially life-threatening infection involving the retropharyngeal space which requires prompt diagnosis and aggressive therapy. RPA usually occurring in children under the age of 7 years following an upper respiratory tract infection. This is likely due to the combination of prominent retropharyngeal nodal tissue and frequency of middle ear and nasopharyngeal infections. RPA is more common during the winter season and have a male predominance for an unknown reason [1,2]. However, RPA is serious and life-threatening partly as a result of the anatomic location and the potential to obstruct the upper airway which can cause significant morbidity and mortality. It is sometimes presented as a lack of readily visible physical signs. Also, it exhibits as a diagnostic challenge to practitioners because of its infrequent occurrence and variable presentation [2-5]. Occasionally retropharyngeal infections

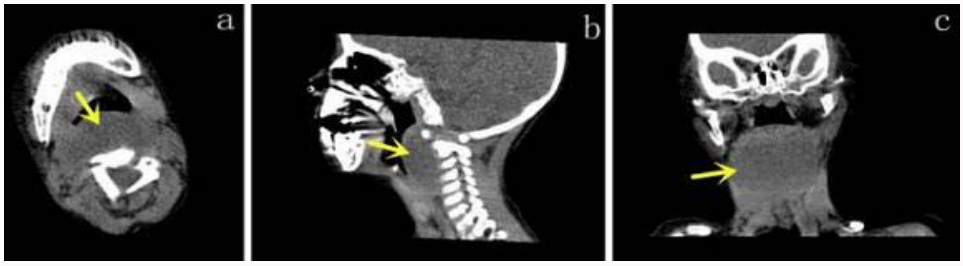

Figure 1: Three-dimensional computed tomography scans, showing a large marked retropharyngeal abscess causing narrowing of the airway and spreading to the deep neck tissues (arrows). The pharyngeal recess and the posterior pharynx had remarkable aposteme (The maximum size was 53 mm × 24 mm × 60 mm) showing a nearly circular lesion, occupied with low signal intensity, with clear Edge.

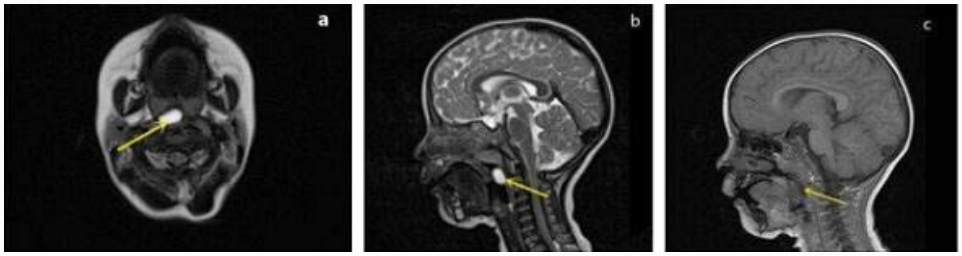

Figure 2: Mid-sagittal view of T1WI (c) showed abnormal low signal intensity and axial (a), mid-sagittal (b) view of T2WI showed high signal intensity in the retro-pharynx, the size was 7 mm × 12 mm × 15 mm causing airway obstruction.

can result from miscelaneous causes including trauma and foreign body [6]. Immunocompromised patients are also at increased risk of developing a retropharyngeal abscess. The diagnosis and management of RPA remain difficult for pediatricians, radiologists and Otorhinolaryngologists, as it can be misdiagnosed for epiglottises and under diagnosed as pharyngitis [2,7]. The presentations are variable but sometimes children present with non-specific symptoms including generalized weakness irritability, fever and poor appetite. In other cases, features are more pronounced; including drooling, fever, neck swelling, and stridor, and clinically presentation may be reminiscent of epiglottises, mostly in infants. Palpable cervical lymph nodes may also be present [8]. The most common organisms causing retropharyngeal abscesses include aerobes and anaerobes and gram-negative organisms. Often, mixed flora is also cultured. The incidence of RPA caused by Methicillin-Resistant Staphylococcus aureus (MRSA) is increasing [9]. In this study, a retrospective review was performed at the Second Affiliated Hospital and Yuying Children's Hospital of Wenzhou Medical University, and the children's hospital of Zhejiang University School of Medicine, Hangzhou with cases identified by a discharge diagnosis of RPA. Our aim was to analyze the clinical presentation, imaging studies, the contemporary means of diagnosis, infecting organisms, the complications, implications on management and prognosis of RPA in children to increase the awareness of practitioners.

Methodology

Subject selection

The retrospective review was conducted on the patients diagnosed as acute retropharyngeal abscess at The Second Affiliated Hospital and Yuying Children's Hospital of Wenzhou Medical University and Children's Hospital of Zhejiang University School of Medicine, Hangzhou during the period April 1999 to May 2016. The parents or guardians signed the consent form. Patients with peritonsillar abscess, superficial cellulitis or abscess, Ludwig's angina were excluded. Ultimately, 34 patients were included in this study. The information regarding the demography data, symptoms, hospital stay, etiology, organism, radiology, treatment, misdiagnosis, complications, and outcomes were gathered and analyzed. All of the imaging studies were interpreted by pediatric radiologists. An extensive review of the current literature was done to compare our results from other studies.

Ethics statement

The present study was conducted in conformity with the declaration of Helsinki 1975, revised in 1983, and approved by the Ethics Committee of the Second Affiliated Hospital of Wenzhou Medical University.

Results

Demographics

34 patients were discharged with a diagnosis of RPA. There were 14 male (41.1%) and 20 female (58.9%). Patient's age ranged from 1 month to 9 years old, with a mean age of 1 year old. Majority of the 34 children (66.7%) were younger than 3 years old. The duration of hospitalization ranged from 5 to 35 days, with a mean stay of 14 ± 8.9 days. Patients with more complications tended to have a longer hospital stay (19 ± 3 days). The duration from admission to definite diagnosis was (3.6 ± 3.1) days. The misdiagnosis rate was up to 61.8%. Most children presented during the winter (76%) season but 15% in autumn and 9% in spring season.

Etiology

The clinical picture of the patients varied widely. The most common symptoms and signs included fever, dyspnea, cervical mass, torticollis, hoarseness, croup, stridor, snoring and restricted neck movement. The physical examination showed abscess in posterior pharynx (n=10, 29.4%). The diagnosis on admission were retropharyngeal abscess (n=13, 38.2%), acute laryngitis (n=5, 14.7%), pharyngeal hemangioma (n=2, 5.9%), bronchopneumonia (n=5, 14.7%), intracranial infection (n=5, 14.7%), upper airway obstruction (n=2, 5.9%), congenital laryngeal stridor (n=2, 5.9%). The average

Figure 3: Ultrasonography shows a 70 mm × 60 mm lesion, nearly circular low echo area, with some bright spots in the lesion but no vascularity.

time of diagnosis was 3.6 ± 3.1 days, the longest duration up to 11 days. Six children had serious complications leading to life-threatening situations. They had to be transferred to Pediatric Intensive Care Unit (PICU) and were intubated or tracheostomy was performed.

Imaging and laboratory examination

Laboratory examination revealed white blood cells of 17 cases >10 × 10^9/L, up to 20.8 × 10^9/L, with neutrophils increased, the remaining 17 cases were normal, the average (16.4+4.32) × 10^9/L, C reactive protein (21.8+12.72) mg/dl (160), up to mg/dl. The lateral neck X-rays showed swelling in the posterior pharyngeal wall (n=5, 14.7%); Computerized Tomography (CT) was done in n=11 (32.4%) patients showed abscess in the posterior pharynx and Three-dimensional Computed Tomography scans in n=8 (23.5%) patients, which showed cavity with air sac in the posterior wall of the pharynx, visible fluid level, limited to pharyngeal recess and nasopharyngeal wall excrescence, with a maximum size of 53 mm × 24 mm × 60 mm, there was only enhancement of the wall of the lesion but not of the fluid inside (Figure 1). Cervical Magnetic Resonance Imaging (MRI) 17.6% revealed retropharyngeal space irregular cystic lesions of low signal intensity on T1 in n=2 patients, and high signal intensity on T2 in n=4 patients (Figure 2). Ultrasound of the neck (n=4, 11.8%) showed a nearly circular low echo area, and some bright spots within the abscess but no blood flow (Figure 3).

Culture and drug sensitivity tests

Pus cultures were collected from 23 cases either by surgery or needle aspiration and 9 strains of bacteria was detected, including 4 strains of *Staphylococcus aureus, Staphylococcus capitis, Streptococcus oralis, Streptococcus mitis, Burkholderia cepacia* and *Enterobacter cloacae* one each. Five strains of *Staphylococcus* (*Staphylococcus aureus* and *Staphylococcus capitis*), were resistant to penicillin. Three strains resistant to amino glycosides, 2 strains resistant to macrolides, 1 strain resistant to cephalosporins and we detected 1 case of Methicillin Resistant *Staphylococcus aureus* (MRSA). No strain was resistant to vancomycin and linezolid. Oral *streptococcus* was sensitive to penicillin, *Streptococcus mitis* was resistant to penicillin, and the 2 strains of *Streptococcus mitis* were resistant to macrolides and Lincosamides. No strain was resistant to vancomycin. One strain of Burkholderia cepacia was resistant to amino glycosides and cephalosporins, but was sensitive to co-trimoxazole. Enterobacter cloacae were resistant to penicillin and cephalosporins but sensitive to vancomycin.

Treatment

All patients were initially started on intravenous broad spectrum antibiotics coverage before the results of pus culture and sensitivity were available. The antibiotics included 3rd generation

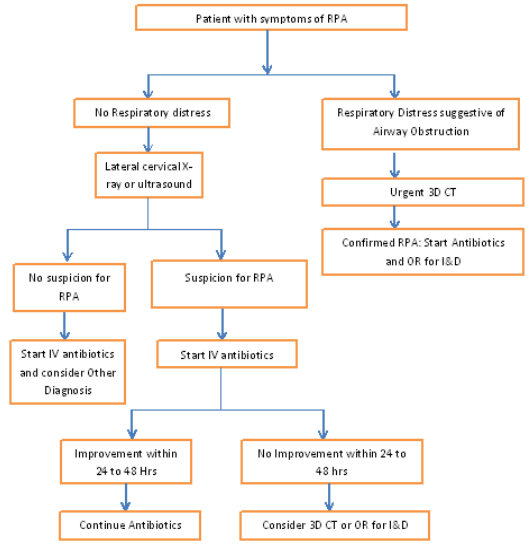

Figure 4: Diagnostic and medical decision algorithm.

cephalosporins, clindamycin, cefoperazone sulbactam, vancomycin, and meropenem. Most patients responded effectively. Some patients received intravenous antibiotics combined with methylprednisolone to relieve laryngeal edema. 13 patients (38.2%) underwent surgical drainage, 6 patients received endotracheal intubation and mechanical ventilation, and 5 cases incision and drainage. Five cases were complicated by bronchopneumonia, encephalopathy in 3 cases, and acute laryngeal obstruction in 2 cases. Three cases had mediastinal abscess, tracheoesophageal fistula, pleural effusion had serious complications and had to be transferred to superior hospital.

Discussion

RPA and deep tissue neck infection have been less frequent since the use of the antibiotics. Although rare, they are conditions with great potential for morbidity and mortality if not detected early and timely. The retropharyngeal space is a region anterior to the pre vertebral fascia that continues inferiorly from the skull base along the length of the pharynx. The continuation of the retropharyngeal space into the posterior and superior mediastinum explains the potential pathway for the spread of infection into the chest. Moreover, the space contains connective tissues and lymph nodes that receive lymphatic drainage from adjacent structures (e.g. nose, paranasal sinuses, ear, nasopharynx, and adenoids). Infection can spread to adjacent structures and induce mediastinum infection [10]. Often infections of these areas will lead to infection in the retropharyngeal space [10,11]. Atrophy of retropharyngeal space lymph nodes at 4 to 5 years of age has been found as an explanation of the predominance of RPAs in young children [11,12]. Our study accentuated the predominance of RPA in early childhood. There were 8 non-traumatic cases under 3 years old (63% <1 year old, 38% <6 months old) which was similar to other surveys [10]. So atrophy of regional lymph nodes with increasing age decreases the disease risk. In adults, odontogenic infection, tuberculosis, intravenous drug abuse and regional trauma were the most common causes of RPA. However, in children, factors favoring RPA are: age distribution: most incidents occur in children aged 6 months to 6 years (mean age, 3 to 5 years), Upper Respiratory Tract Infections (URTIs), and adjacent organs infection of the nasopharynx, paranasal sinuses, or the middle ear [2]. It is hard to diagnose this type of deep neck space abscess as there is rarely any

presentation on palpation or visible external neck swelling. Fever, odynophagia, croup, hoarseness, dyspnea (especially on inspiration), new onset snoring, apparent cervical mass, torticollis, and restricted neck movement may be the typical symptoms. Attention should be paid to children with these symptoms and more imaging examination should be given to exclude RPA. This may lead to delay in diagnosis. In our study, 21 cases (61.8%) were initially misdiagnosed which led to life-threatening conditions. Imaging may also contribute to diagnosis and planning for invasive intervention. It is used to distinguish cellulitis and suppurative adenopathy from abscesses, which require surgical treatment. Till date, ultrasonography, plain X-ray, Computed Tomographic scanning and magnetic resonance imaging with or without intravenous contrast media are the choices for a child presenting with a neck mass. Ultrasonography is a convenient and relatively quick, inexpensive imaging modality which averts radiation and helps to define the shape, size, vascularity and location of the mass. If fine-needle aspiration is chosen for deep neck masses, ultrasonography guidance can be valuable but not readily available and requires an experienced radiologist for interpretation. Additionally, the negative result of ultrasound should not be considered final if clinical symptoms persist. In plain X-ray examination: it is difficult to perceive the retropharyngeal abscess because breathing, swallowing, and neck flexion/extension can lead to anterior cervical soft tissue space changes. The clinical application of plain X-ray is less. CT scanning is preferred to MRI because of its shorter scanning time, lower costs, consistently better quality and availability for evaluation of neck masses in the pediatric population [1,13,14]. Suppuration occurs, a focal hypo attenuating mass with an enhancing rim is seen on contrast-enhanced CT scans and a complex hypoechoic to anechoic mass with a variably thick rim of solid tissue is seen on US scans. The appearance of the fluid collection varies on T1- and T2-weighted MR images according to the protein content. Skin thickening and reticulated fat planes may be seen adjacent to the abscess margins on both CT and MR images; nevertheless, MR images can be more challenging to interpret than CT scans [15,16]. CT is excellent for evaluating the neck and requires a shorter time than MRI which is an important factor when imaging patients with a potential narrowing of the airway. It is noteworthy that the three-dimensional spiral CT scan is useful for surgeons to define the extension of the abscess and the area that needs to be explored [10,17,18]. Moreover it can help to discover complications such as mediastinitis, necrotizing fasciitis, and airway obstruction [19-22]. In our study, 8 cases had undergone the three-dimensional CT scan which showed an abscess in the deep neck tissues, but it should be reckoned that complete reliance on CT scanning may lead to unnecessary operations. Therefore, the decision to operate should be based on the clinical picture including the responsiveness of antibiotic treatment rather than merely CT findings. Throat cultures and nasopharyngeal swabs can guide an appropriate option of antibiotics. Most studies have established group a *streptococcus*, *Staphylococcus aureus* and anaerobes as the predominant pathogens in these infections [23-25]. Coticchia et al., [18] conducted a retrospective analysis of 169 patients diagnosed as the neck abscess during 10 years. They concluded that *staphylococcus aureus* were seen in 79% of children younger than 1 year old compared to 16% for children 1 year or older. Additionally, group a *streptococcus* was more frequently yielded in 29% of children 1 year or older in contrast with 6% in children younger than 1 year. In this study, 23 specimens were taken for culture and sensitivity, 9 strains of bacteria were detected, of them four strains of *staphylococcus aureus* (75% children younger than 1 year old), 1 strain *staphylococcus capitis*, *streptococcus oralis*, *Streptococcus mitis*, *Burkholderia cepacia*, and *Enterobacter cloacae*. Furthermore, multiple studies have proven that MRSA infection could also be a cause of neck abscess [9,26,27]. In a large cohort study by Inman, 228 patients with pediatric neck abscesses, between 1999 and 2007, showed the rate of MRSA abscess had statistically increased, and the characteristics which trend to predict that MRSA infection became more prevalent [26]. Pascu's case report demonstrated a 3-month-old infant diagnosed as RPA, whose blood and culture showed positive MRSA. After two weeks infusion of intravenous teicoplanin for 14-days, the baby's condition improved [28]. Commonly in this study an 84 days old infant infected by MRSA, had to undergo surgical drainage twice, and in addition was given meropenem, vancomycin combined with methylprednisolone for 13 days. After treatment the infant's condition became better. Although beta-lactamase stable penicillin or cephalosporin antibiotics may be the optimal choice in many cases, the increasing rates of culture of MRSA should also be considered. Hence, we recommend that MRSA should be suspected in the etiology and treatment of neck abscesses in newborns, infants and young children. The empirical use of clindamycin or other antibiotics like vancomycin, linezolid or teicoplanin could be beneficial to patients with positive MRSA culture. Moreover, related studies demonstrated the incidence of antibiotic resistance against Burkholderia cepacia was 98%, presenting as a highly drug-resistant phenomena [29-31]. In the present study, Burkholderia cepacia was resistant to cephalosporin and amino glycosides but sensitive to teicoplanin. Additionally, RPA is likely to be complicated by anaerobic infection. From Brook's study, 14 children who were diagnosed with retropharyngeal abscesses had anaerobes isolated [32]. In our study, no anaerobes were isolated. Some relevant literature demonstrated that most anaerobic bacteria were found together with other organisms. Moreover, anaerobes generally express their virulence in chronic infections [33]. Intravenous antibiotics are mostly the first line of treatment for the child suspected with RPA. This first line choice may vary according to some studies but mostly recommend covering Gram positive and anaerobic bacteria. The initial antibiotics may be altered later depending on the microbiological evidence of the causative organism. If needed, steroids such as, methylprednisolone/dexamethasone/prednisone may be started for 2 to 3 days to improve inflammation and relieve edema. Additionally, some investigations are in favor of prompt early and timely surgical management whereas others in favor of conservative management with the use of IV antibiotics as outlined above, but the question is remain unanswered, "when is surgical management appropriate?" (Figure 4). In this study, there were 6 severe cases that had endotracheal intubation and mechanical ventilation due to delay in diagnosis. Among them, 1 had apnea and sudden Cardiac arrest. Another patient had sudden upper airway obstruction and had to undergo tracheotomy. As for the others, 3 cases had secondary mediastinal abscess which ended up with serious complications such as referral for treatment of tracheoesophageal fistula. So for critically ill RPA patients, early diagnosis and drainage of abscess is very important. For serious morbidity including airway obstruction, the decision of operation should always be in conjunction to radiological evidence. The choice can be X-ray, ultrasound, Computer tomography scan or magnetic resonance imaging with or without contrast material. Patients who do not improve after incision and drainage by trans-oral approach should do a cervical CT scan to rule out if any additional loculations were left and have to undergo drainage again. Surgical drainage combined with proper antibiotic

may be the optimal management in cases which do not improve after drainage by trans-oral approach or antibiotics only.

Conclusion

This study reviewed a pediatric series of RPA; a meaningful protocol based on the evidence presented above for this condition would be as follows: Retropharyngeal abscess is more prone in children younger than 3 years old due to their anatomical features. The diagnosis should be suspected in patients presenting with fever, croup, stridor, dyspnea, snoring, cervical mass, acute torticollis, and restricted neck movement. Although lateral cervical X-ray, ultrasound or MRI is useful tools, the three dimensional computer tomographic scanning is the radiological examination of choice. Moreover, *staphylococcus aureus* was the predominant organism cultured. Antibiotic therapy for suspected bacterial lymphadenitis should target *Staphylococcus aureus* and group A *streptococcus* mostly. The initial antibiotics should later be changed depending on the microbiological evidence of the causative organism. Early surgical drainage accompanied with effective antimicrobial therapy is recommended for optimal management of RPA.

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