Retropharyngeal Abscess in Children: The Rising Incidence of Methicillin-Resistant Staphylococcus aureus

Nahed Abdel-Haq, MD,*† Marianela Quezada, MD,‡ and Basim I. Asmar, MD*†

Background: Because of a recent upsurge in retropharyngeal abscess (RPA) cases due to community-associated methicillin-resistant Staphylococcus aureus (MRSA), we reevaluated the microbiology, clinical manifestations and treatment outcome of RPA over the past 6 years (2004 to 2010). Findings were compared with those of a previous 11-year study (1993 to 2003) period.

Methods: A retrospective review of medical records of children with RPA.

Results: One hundred fourteen children (61 males) with RPA were identified representing a 2.8-fold increase in incidence (per 10,000 admissions) over the previous 11-year period. Abscess drainage was performed in 74 (65%). A total of 116 isolates (93 aerobes, 23 anaerobes) were recovered from 66 specimens. S. aureus was recovered from 55 (38%) of the 66 specimens compared with 6 (4.9%) of 135 in the previous 11 years; 16 (64%) of 25 were MRSA compared with none in the previous 11 years. Children whose abscess grew MRSA were younger (mean 11 months) than the others (mean 62 months) (P < 0.001) and required longer duration of hospitalization (mean 8.8 days) than the rest (mean 4.5 days) (P = 0.002). Five children had mediastinitis; all caused by MRSA. All MRSA isolates were susceptible to clindamycin. Ceftriaxone plus clindamycin was the most common treatment regimen. All patients had resolution of their abscesses.

Conclusions: RPA has increased in frequency in our pediatric population with an associated increase of Staphylococcus aureus, mainly community-associated MRSA. This is likely due to the overall increase in community-associated MRSA infections in our pediatric patients. Treatment with ceftriaxone and clindamycin in addition to surgical drainage was effective.

Key Words: retropharyngeal abscess, children, methicillin-resistant Staphylococcus aureus, incidence

(Pediatr Infect Dis J 2012;31: 696–699)

Retropharyngeal abscess (RPA) is a potential life-threatening deep space neck infection in children that results from suppuration of retropharyngeal lymph nodes. Abscess formation may be preceded by upper respiratory tract infection, pharyngeal trauma or foreign body ingestion, but a substantial proportion appears to be idiopathic in origin. Most cases (96%) occur in children <6 years of age because the retropharyngeal lymph nodes usually atrophy after this age and 50% of cases occur in patients between 6 and 12 months of age. Most retropharyngeal abscesses are polymicrobial in origin, the most common causative organisms have been group A beta-hemolytic streptococcus (GABHS), Staphylococcus aureus and upper respiratory tract anaerobic organisms. The rising incidence of RPA has increased in frequency in our pediatric population with an associated increase of Staphylococcus aureus, mainly community-associated MRSA. This is likely due to the overall increase in community-associated MRSA infections in our pediatric patients. Treatment with ceftriaxone and clindamycin in addition to surgical drainage was effective.

Accepted for publication March 19, 2012.
From the *Division of Infectious Diseases, Children’s Hospital of Michigan; †Carman and Ann Adams Department of Pediatrics, Wayne State University; and ‡Henry Ford Hospital Health System, Detroit, MI. The authors have no funding or conflicts of interest to disclose.
Address for correspondence: Nahed Abdel-Haq, MD, Division of Infectious Diseases, Children’s Hospital of Michigan, 3901 Beaumont Blvd, Detroit, MI. E-mail: nabdel@dmc.org.
Copyright © 2012 by Lippincott Williams & Wilkins ISSN: 0891-3668/12/3107-696 DOI: 10.1097/INF.0b013e318256f5f0

PATIENTS AND METHODS

Children admitted to Children’s Hospital of Michigan with the diagnosis of RPA during the period from January 2004 to January 2010 were included in this study. The Children’s Hospital of Michigan is a tertiary care teaching, pediatric institution with a 220-bed capacity. For this study, we reviewed the patients’ demographic data, laboratory findings including microbiologic and radiographic data, clinical course, response to treatment and outcome. Patients with immunodeficiency, malignancy or traumatic injury were excluded.

Purulent material obtained at surgery from RPA was transported anaerobically to the microbiology laboratory within 30 minutes and inoculated onto plates supportive for aerobic and anaerobic growth. For aerobic growth, the material was plated onto sheep blood agar plates, colistin-nalidixic acid plates, chocolate agar plates and MacConkey agar plates. All plates were incubated at 37°C, the MacConkey plates aerobically and the other plates under 5% carbon dioxide. All plates were examined at 24 and 48 hours. Aerobes were identified using conventional methods. Susceptibility testing was performed using the minimal inhibitory concentration method.

For anaerobes, the material was plated on prereduced kanamycin-vancocmycin agar plates, anaerobic blood agar plates, colistin-nalidixic acid plates and into brain heart infusion broth. The plates were incubated in anaerobic jars (GasPak) and examined at 48 and 96 hours. The broth was incubated for 4 days. Anaerobes were identified by colony morphology, Gram stain, automated identification.
biochemical testing (Innovative Diagnostic Systems, Norcross, GA) and gas chromatography.

**RESULTS**

During the 6-year study period, 114 children (61 males, 53 females) were admitted to our hospital with the diagnosis of RPA. The mean annual hospital admissions during the same period were 13,771. The 114 patients represented an incidence of 13.8 cases per 10,000 admissions. This was a 2.8-fold increase in incidence when compared with a previous study from our hospital during the preceding 11-year period (1993 through 2003) (Table 1), 4- and 12.5-fold increase when compared with a similar study during the period 1978 to 1989.13 The age range was 4 months to 17 years (mean 54 months; median 29 months). The majority (63%) were African American. Complaints included neck swelling (97%), neck pain (95%), fever (90%), sore throat (82%), dysphagia (75%) and increased drooling (65%). The most common physical findings were decreased neck movements or torticollis (99%), cervical adenopathy or swelling (95%) and tonsillitis (87%). Nine (8%) were presented with stridor and breathing difficulty.

The mean blood leukocyte count of all patients was 21,578/mm³ (range 2200–54,500). The mean leukocyte count in patients with MRSA RPA was 17,844/mm³ compared with a mean white blood cells of 23,106/mm in patients with other organisms. Lateral neck radiographs showed enlarged retropharyngeal space in 78 of the 80 patients. CT of the neck revealed inflammation or ring enhancing abscess/ fluid collection in all patients. Five children had extension of the inflammatory changes to the mediastinum.

Surgical management including aspiration or incisional drainage was performed in 74 (65%) of the 114 patients. Purulent material was obtained from 66 children. Sixty-six drainage or aspirated material specimens were sent for culture of which 61 yielded a bacterial growth. A total of 116 bacterial isolates were recovered (Table 2). All anaerobes recovered were mixed with aerobes. *Staphylococcus aureus*, the most common aerobe, was recovered from 25 of 66 (38%) specimens. Sixteen (64%) of these isolates were MRSA. GABHS was recovered from 11 of 66 (17%) specimens (Table 2). *S. aureus* was the only organism recovered in 10 samples and GABHS was the only organism in 6. Five children were bacteremic with the same organism recovered from the RPA; 3 GABHS and 2 MRSA. GABHS was also isolated from throat of 3 GABHS and 2 MRSA. GABHS was also isolated from throat of 25 of 66 (38%) specimens. Sixteen (64%) of these isolates were MRSA. GABHS was recovered from 11 of 66 (17%) specimens (Table 2). *S. aureus* was the only organism recovered in 10 samples and GABHS was the only organism in 6. Five children were bacteremic with the same organism recovered from the RPA; 3 GABHS and 2 MRSA. GABHS was also isolated from throat of 7 additional patients whose retropharyngeal lesions did not yield pus. Twenty-five patients had received oral antibiotics for a period of 1–7 days before admission. The most commonly used antibiotics to treat hospitalized patients (each alone or in combination) were IV clindamycin in 92 (81%), IV ceftriaxone in 70 (61%), IV ampicillin/sulbactam in 35 (31%) and IV vancomycin in 8 (7%). The most common treatment regimens were IV clindamycin and ceftriaxone in 52 (46%) and IV clindamycin alone in 17 (15%) patients. After discharge, 95 (83%) patients received subsequent oral antibiotic therapy; 18 (13%) completed their IV therapy at home via a peripherally inserted central catheter; and 1 completed total therapy as inpatient. The most common oral antibiotics used were clindamycin (43%) and amoxicillin/clavulanate (39%) for a total duration of 2–3 weeks.

Of all children with RPA, 4 required 2 or 3 incisions and drainage procedures (Table 3). All patients eventually recovered without sequelae except 1 child with MRSA RPA and mediastinitis and adhesions who suffered anoxic brain injury caused by intraoperative rupture of the innominate vein.

All 16 children with CA-MRSA RPA were ≤2 years (range 4–23 months, median 10.5 months); 11 were <1 year (Table 3). Twelve (75%) patients presented during the last half of the study period. Presenting symptoms were similar to those of other patients with RPA. Five presented with respiratory difficulty. Chest radiographs obtained on 11 patients showed abnormal findings including pleural effusions in 5. All 16 patients had neck CT scans that showed areas of low attenuation and in 11 there was rim enhancement. In 14, there was mass effect on the airway or blood vessels, 4 had compromised airways and 5 had extension of infection into the mediastinum. All 16 patients underwent incisional drainage. All 16 CA-MRSA isolates were susceptible to clindamycin; 14 were resistant to erythromycin with no induction of resistance to clindamycin/moxi-
TABLE 3. Comparison of Clinical Parameters of Children With RPA due to CA-MRSA and Other Bacterial Etiologies

| Clinical Parameter | RPA (CA-MRSA) Total 16 (%) | RPA (NonMRSA) Total 98 (%) | P |
|--------------------|-----------------------------|-----------------------------|----|
| ≥2 drainage procedures | 2 (13)                      | 2 (2)                       | 0.09 |
| Mass effect/compromised airways | 4 (25)                     | 25 (26)                     | 1.0  |
| Dyspnea/stridor | 6 (38)                      | 19 (19)                     | 0.11 |
| Mediastinitis | 5 (31)                      | 0 (0)                       | ≤0.001 |
| Mean/SD | 10.6±5.8 | 61.6±21 | 47 | 0.0002* |
| Hospitalization days before surgery (days) | 8.8±2.5 | 4.5±2.3 | 4.0 | 0.002‡ |
| Hospitalization days before surgery | 1.7±1.0 | 2.1±1.4 | 2.0 | 0.275 |
| Hospitalization days after surgery | 1.6±1.5 | 1.6±1.7 | 1.0 | 1.0 |
| Hospitalization days after surgery | 7.2±1.3 | 2.9±1.7 | 1.0 | 0.0005† |

†One patient had a complicated course and required hospitalization or 54 days.
‡95% CI 1.60–6.99.
§95% CI 1.94–6.67.
§§Standard Deviation

Our findings are in agreement with recent reports that showed an increase in incidence of RPA in recent years. This increase in our patient population is probably secondary to the general increase of CA-MRSA infections in our pediatric population. The increased use of imaging, specifically CT scans, may be another contributing factor. The increase in cases of RPA in our institution was not related to changes in the referral patterns or closure of pediatric inpatient units at any of our community hospitals. Recent case reports have also suggested that RPA may be increasing in parallel with the increasing prevalence of CA-MRSA infections.

Several virulence factors have been attributed to the invasiveness of CA-MRSA. The main factor appears to be the Panton-Valentine leukocidin, a pore-forming exotoxin. In a previous study, we have demonstrated that the majority of serious pediatric CA-MRSA infections in our pediatric patient population are caused by Panton-Valentine leukocidin-positive, SSCmec IVa positive USA300 strains.

All MRSA isolates were recovered from 16 children younger than 2 years and most were younger than 1 year. These children were significantly younger than those who had RPA resulting from other organisms (P = 0.0002). Previous studies have shown that only 15% of RPA occur in infants <1 year old,7,13 In those infants, a higher prevalence of S. aureus was also noted; however, the majority of cases were caused by methicillin-susceptible Staphylococcus aureus strains.16 Of the 16 patients with RPA due to MRSA, 5 had mediastinitis with no cases of mediastinitis in a preceding 11-year study period. Extension of infection from the retropharyngeal space to the mediastinum is well-known but is rare. However, with the emergence of virulent CA-MRSA strains, such extension may potentially become more common. Mediastinitis complicating RPA due to MRSA in children younger than 2 years was noted by others.13,14 Mediastinitis was also noted; however, the majority of cases were caused by methicillin-susceptible Staphylococcus aureus strains.16 All our patients with MRSA mediastinitis were diagnosed at the time of admission. Mediastinitis did not appear to be related to improper antibiotic treatment as all patients received clindamycin as part of their empiric antibiotic treatment. However, in 2 patients, delay in incision and drainage of RPA occurred because of the lack of ring enhancement appearance on CT scan.

Treatment of RPA consists of empiric antibiotic therapy and surgical drainage. The role of surgical drainage in the management of RPA is controversial. Similarly, the timing of surgical intervention for deep neck abscesses varies.1,4,7 It should be noted that the absence of contrast (ring) enhancement does not exclude pus formation caused by MRSA as shown in one of our patients. About a third (35%) of our patients were treated with antibiotics alone, a rate that is similar to other recent studies.6,7 In some cases in our series and other studies, surgical drainage yielded small amounts of pus. This was particularly true when cultures grew organisms other than S. aureus. With the rising incidence of MRSA in deep neck infections, it may be prudent to get cultures early in the course of management to direct definitive antibiotic therapy. In addition, early surgical drainage may prevent the progression of the abscess into descending mediastinitis in young children.14 The role of drainage of mediastinal fluid during the course of MRSA RPA once the neck is drained is not clear. Although incisional drainage of RPA was done in all 5 of our patients with mediastinitis, mediastinal fluid...
drainage was performed in only 1 child who developed intraoperative innominate vein rupture believed to be due to adhesions. It is possible that early mediastinitis can be managed with antibiotic therapy alone and close monitoring.17

Antibiotic treatment of RPA should be directed against the likely causative organisms. These infections are often mixed and beta-lactamase producing organisms are frequently isolated,13,20 the emergence of CA-MRSA as a RPA pathogen makes antibiotic treatment choices more challenging. The vast majority CA-MRSA strains at our institution belong to the USA300 clone and are susceptible to clindamycin and trimethoprim/sulamethoxazole.11 All CA-MRSA strains in our study patients were clindamycin-susceptible. Clindamycin was used successfully to treat RPA due to CA-MRSA in our patients. Ampicillin/subactam is no longer considered an appropriate empiric therapy of RPA at our institution. We currently use ceftriaxone and clindamycin as empiric therapy. Clindamycin alone should provide adequate coverage especially if the abscess is drained. A potential concern is occasional infection with a methicillin-susceptible Staphylococcus aureus strain that is resistant to clindamycin. In areas with increased frequency of clindamycin-resistant CA-MRSA, vancomycin should be used while awaiting the in vitro susceptibility results. Although vancomycin is not used routinely as empiric therapy for RPA, it should be considered in critically ill children and those with evidence of mediastinal extension while awaiting culture results.

Our data indicate that CA-MRSA should be considered as an important pathogen of RPA especially in children younger than 2 years who develop RPA with mediastinal extension. Prompt surgical drainage of the RPA and culture directed antibiotic therapy may help prevent complications.

REFERENCES

1. Page NC, Bauer EM, Lieu JE. Clinical features and treatment of retropharyngeal abscess in children. Otolaryngol Head Neck Surg. 2008;138:300-306.
2. Philpott CM, Selvadurai D, Banerjee AR. Paediatric retropharyngeal abscess. J Laryngol Otol. 2004;118:919-926.
3. Shah S, Shareef GQ. Pediatric respiratory infections. Emerg Med Clin North Am. 2007;25:961-979, vi.
4. Abdel-Haq NM, Harahsheh A, Asmar BL. Retropharyngeal abscess in children: the emerging role of group A beta hemolytic streptococcus. South Med J. 2006;99:927-931.
5. Wright CT, Stocks RM, Armstrong DL, et al. Pediatric mediastinitis as a complication of methicillin-resistant Staphylococcus aureus retropharyngeal abscess. Arch Otolaryngol Head Neck Surg. 2006;134:408-413.
6. Courtney MJ, Mahadevan M, Miteff A. Management of paediatric retropharyngeal infections: non-surgical versus surgical. ANZ J Surg. 2007;77:985-987.
7. Craig FW, Schunk JE. Retropharyngeal abscess in children: clinical presentation, utility of imaging, and current management. Pediatrics. 2003;111(6 Pt 1):1394–1398.
8. Cabrera CE, Deutsch ES, Eppes S, et al. Increased incidence of head and neck abscesses in children. Otolaryngol Head Neck Surg. 2007;136:176-181.
9. Fleisch AF, Nolan S, Gerber J, et al. Methicillin-resistant Staphylococcus aureus as a cause of extensive retropharyngeal abscess in two infants. Pediatr Infect Dis J. 2007;26:1161–1163.
10. Popescu GA. The emerging role of group A beta hemolytic Streptococcus as retropharyngeal abscess pathogen in children—a change which doesn’t matter? South Med J. 2006;99:917-918.
11. Abdel-Haq N, Al-Tatari H, Chearskul P, et al. Methicillin-resistant Staphylococcus aureus (MRSA) in hospitalized children: correlation of molecular analysis with clinical presentation and antibiotic susceptibility testing (ABST) results. Eur J Clin Microbiol Infect Dis. 2009;28:547–551.
12. David MZ, Daum RS. Community-associated methicillin-resistant Staphylococcus aureus: epidemiology and clinical consequences of an emerging pathogen. Clin Microbiol Rev. 2010;23:616-687.
13. Asmar BL. Bacteriology of retropharyngeal abscess in children. Pediatr Infect Dis J. 1990;9:595–597.
14. Naidu SI, Donepudi SK, Stocks RM, et al. Methicillin-resistant Staphylococcus aureus as a pathogen in deep neck abscesses: a pediatric case series. Int J Pediatr Otorhinolaryngol. 2005;69:1367–1371.
15. Cmejrek RC, Coticchia JM, Arnold JE. Presentation, diagnosis, and management of deep-neck abscesses in infants. Arch Otolaryngol Head Neck Surg. 2002;128:1361–1364.
16. Coticchia JM, Getnick GS, Yun RD, et al. Age-, site-, and time-specific differences in pediatric deep neck abscesses. Arch Otolaryngol Head Neck Surg. 2004;130:201–207.
17. Shah RK, Chun R, Choi SS. Mediastinitis in infants from deep neck space infections. Otolaryngol Head Neck Surg. 2009;140:936–938.
18. Kirse DJ, Roberson DW. Surgical management of retropharyngeal space infections in children. Laryngoscope. 2001;111:1413–1422.
19. Nagy M, Pizzuto M, Backstrom J, et al. Deep neck infections in children: a new approach to diagnosis and treatment. Laryngoscope. 1997;107(12 Pt 1):1627–1634.
20. Brook I. The role of beta-lactamase-producing bacteria in mixed infections. BMC Infect Dis. 2009;9:202.