Presentation, Diagnosis, and Management of Deep-Neck Abscesses in Infants

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Objective: To clarify the presenting signs and symptoms, clinical course, pathogenic organisms, and management of deep-neck-space abscesses in infants.

Design: Retrospective chart review.

Setting: Tertiary care academic children’s hospital.

Patients: Records of 25 patients 9 months or younger with deep-neck-space abscesses from July 1989 through May 1999 were reviewed.

Main Outcome Measure: Resolution of abscess.

Results: Presenting symptoms included neck mass, 92% (n = 23); fever, 60% (n = 15); and dysphagia and/or poor intake by mouth, 36% (n = 9). Overall, patients were symptomatic for a mean duration of 3.8 days before presenting to the hospital; 21 of 22 evaluated patients had elevated white blood cell counts. Imaging included 68% computed tomographic scan (n = 17) and 44% plain radiographs (n = 11). On the basis of radiology and operative findings, locations of the abscesses were as follows: anterior triangle, 8; parapharyngeal, 5; posterior triangle, retropharyngeal, and undefined, 3 each; submandibular, 2; and parotid, 1. Of 17 scanned patients, 13 had some degree of airway compromise evident on computed tomography. All were treated with incision and drainage, 3 of 25 introrally and 22 of 25 externally. Pus was identified in all 25; 20 of these grew Staphylococcus aureus, 1 grew group A Streptococcus, and 4 grew no organism. All patients received intravenous antibiotics for a mean of 4.8 days and oral antibiotics for a mean of 11 days. Only 1 patient required a second procedure.

Conclusions: Deep-neck-space abscesses in infants are rapidly progressive, often cause airway compromise, and usually present with fever and neck mass. The most common pathogen is S aureus. Patients are effectively treated with incision and drainage coupled with intravenous followed by oral antibiotics.


Although the use of antibiotics in modern medicine has decreased the incidence of deep-neck-space abscesses, those that do occur present a diagnostic and management dilemma to otolaryngologists and pediatricians. Various studies have evaluated the presentation, diagnosis, and management of these infections in the pediatric population. However, none has focused specifically on infants. This is a particularly important group to study because symptoms such as sore throat, odynophagia, voice changes, and other common subjective complaints, which play a prominent role in abscess diagnosis in older children, are not easy to evaluate in infants. Furthermore, no study has yet shown if differences exist in the microbiology of such infections in infants vs older children. Therefore, this study is focused on infants 9 months or younger to evaluate the predisposing factors, common presenting symptoms, usefulness of physical examination and radiologic studies, and appropriate medical and surgical management of deep-neck-space abscesses in this segment of the population.

METHODS

We reviewed the charts of 25 infants 9 months or younger who were admitted to Rainbow Babies and Children's Hospital of Cleveland, Cleveland, Ohio, from July 1989 through May 1999. The diagnosis of neck abscess in these patients was defined by the operating room finding of pus during incision and drainage (I&D). The charts were assessed for potential predisposing factors to infection, including immunosuppression, concurrent medical conditions, and prematurity. History of any infection was also noted, and the signs and symptoms associated with each patient's initial presentation were recorded. Preoperative complete blood count values were re-
corded. Radiologic findings, which included plain radiographs and computed tomographic (CT) scans, were also noted and correlated with operative findings. Particular attention was paid to the location of each abscess.

Medical and surgical interventions for each patient were evaluated, and cultures and antibiotic sensitivity results from organisms isolated from pus drained intraoperatively were recorded. Patient outcomes were evaluated on the basis of abscess resolution, length of hospital stay, complications, and requirement of a second surgical procedure.

RESULTS

Our data were obtained from a population of infants 9 months or younger. The mean age was 5.6 months with a range of 2.5 to 9 months. Fifteen were girls and; 10 were boys. Average weight of the infants was 7.1 kg, with a range of 4.9 to 9.1 kg. Of the 25 patients, 12 were black, 11 were white, 1 was Filipino-white, and 1 was unrecorded. None of the children was known to have any underlying medical condition.

The locations of the abscesses were determined based on radiographic and surgical findings. Each was then categorized as anterior triangle, posterior triangle, parapharyngeal, submandibular, parotid, or undefined. Relative frequencies were as follows: superficial anterior triangle, 8 (32%); parapharyngeal, 5 (20%); retropharyngeal, posterior triangle, and undefined abscesses, 3 each (12% each); submandibular space, 2 (8%); and parotid, 1 (4%).

Predisposing factors to neck abscess were rare in our population. Two patients with bilateral neck abscesses were evaluated for immunosuppression but received no diagnosis. One patient with an abscess at age 8 months was a 26-week-gestation triplet who had been diagnosed with *Staphylococcus epidermidis* sepsis shortly after birth and had spent 1 month in the neonatal intensive care unit with ventilator support secondary to bronchopulmonary dysplasia and moderate respiratory distress syndrome. Two other patients had been born prematurely at 35 and 29 weeks. The latter also had *S epidermidis* sepsis near birth and presented with a neck abscess at age 9 months.

Likewise, infection history was minimal in our population. One patient had bronchitis near birth. Two had current diagnoses of acute otitis media for 4 and 10 days, while a third had a history of 4 episodes of acute otitis media. Ten patients had a history of viral upper respiratory tract symptoms including cough, rhinorrhea, and mild fever.

The signs and symptoms of infection at presentation were many: neck mass or swelling occurred in 23 (92%) of 25 patients; lymphadenopathy was found in 17 (68%); 15 (60%) had documented fevers on admission, with a mean temperature of 38.7 °C; 3 additional patients had elevated temperatures reported at home, but had received acetaminophen prior to arrival at the hospital; 9 (36%) of 25 patients had rhinorrhea; 9 had poor intake by mouth for a mean of 3 days (range, 1-7 days); and 6 (24%) had documented cough at the time of presentation. Overall, patients were symptomatic for a mean of 3.8 days before presentation.

Of the 22 patients who had a complete blood cell count performed before treatment with antibiotics, 21 (95%) had white blood cell (WBC) counts greater than $16 \times 10^9/\mu L$. Overall for these 22 patients, the mean WBC count was $25.2 \times 10^9/\mu L$, with a range of $14.4 \times 10^9/\mu L$ to $40.9 \times 10^9/\mu L$. Left shift, defined as segmented neutrophils and band neutrophils totaling greater than 70% of WBCs, occurred in 8 (36%) of these 22.

At least 1 radiologic study was performed in 21 of our 25 patients. Of these, 10 had more than 1 study. Films obtained included CT scans of the head, neck, and/or thorax (17 patients) and anterior-posterior and/or lateral chest and neck radiographs (11 patients). No ultrasound studies were done.

Of the 17 patients in whom CT was performed, only 4 (24%) had no airway compromise. A total of 8 patients (47%) had mild airway compromise (<10% reduction in tracheal diameter), 3 had moderate compromise (10%-50% reduction), and 2 (12%) had severe compromise (>50% reduction).

All 25 patients were treated with I&D: 22 abscesses were drained externally; the other 3 were drained intraorally. Mean time until surgery was 2.0 days, with a range of 5 hours to 7 days. Additionally, 5 of 25 patients were treated with needle aspiration of the neck prior to I&D. Pus was obtained from 3 of these (quantities were “minimal,” 1 mL, and 9 mL).

Antibiotic therapy was begun empirically on admission in all patients and later tailored to organism sensitivities. Common choices for this empiric therapy, alone or in combination, were ampicillin-sulbactam (18 patients [72%]), various second- and third-generation cephalosporins (15 patients [60%]), amoxicillin-clavulanate (12 patients [48%]), nafcillin (6 patients [24%]), and clindamycin (4 patients [16%]). Specific therapies varied on a case-by-case basis, but the above choices were also common for this purpose. All patients received intravenous antibiotics for a mean of 4.8 days and oral antibiotics for a mean of 11 days.

*Staphylococcus aureus* was isolated from pus cultures in 20 of 25 patients, group A *Streptococcus* in 1 of 25, and no growth occurred in 4 of 25. Antibiotic sensitivity patterns varied, but penicillin resistance was universal. Amoxicillin resistance was found in 2 strains, with an intermediate level of resistance found in 1 other strain. No resistance to cefazolin or vancomycin was observed.

Of the 25 patients undergoing I&D and varying courses of antibiotics, 24 (96%) of 25 abscesses resolved without further intervention. One infant required reexploration. One other infant with an infected thyroglossal duct cyst received a Sistrunk procedure several weeks postoperatively. All children were abscess free at follow-up 1 to 2 weeks after surgery, and none has experienced a recurrence. The mean (SD) length of hospital stay was 6.2 (2.6) days, with a range of 3 to 11 days. There were no reported complications among our patient population.

COMMENT

Much work has been done on the presentation, diagnosis, and management of neck abscess in a pediatric population, but none has focused specifically on infants. The present retrospective chart review of 25 infants 9 months or younger from July 1989 through May 1999 reveals important differences between neck abscesses in infants and...
those in older children. The presence of subjective complaints such as sore throat, voice changes, and odynophagia is difficult to impossible to determine in infants. Other researchers have reported the most common presenting symptoms of various types of neck abscess in a pediatric population (Table). Our study found the most common presenting symptom to be neck mass or swelling (23/25, 92%), cervical lymphadenopathy (17/25, 68%), fever (15/25, 60%), and poor intake by mouth (9/25, 36%). These symptoms were present for a mean duration of 3.8 days. Fever is a common thread through all of the studies, but along with poor intake by mouth and neck mass, it takes on increased importance in an infant population because sore throat and odynophagia can generally not be evaluated. Poor intake by mouth may in fact be an indicator of odynophagia and/or dysphagia in an infant and is a useful piece of information to obtain. Additionally, we found that 21 (95%) of our 22 patients who had complete blood cell counts drawn had WBC counts greater than 10³/µL at the time of admission, and 8 (36%) of these displayed left shift. As expected, our mean WBC count of 25.2 × 10³/µL was significantly higher than that shown in studies for older children.

The most likely location of an abscess in infants is difficult to reliably determine with only 25 patients. Our data indicate that the more superficial anterior and posterior triangle abscesses (11/25) tend to be more common than those in the parapharyngeal (5/25) or retropharyngeal (3/25) spaces. Although only 3 of our 25 patients were diagnosed with retropharyngeal abscess, previous data have indicated that these abscesses are more likely to occur in infants and young children. For instance, Yeoh et al.10 reported 16 cases of retropharyngeal abscess. All 16 patients in that study were younger than 6 years, and 10 (63%) of the patients were younger than 1 year. Dodds and Maniglia3 backed this finding by reporting a mean age of 26.3 months in 9 patients with retropharyngeal abscess. This finding reflects the fact that retropharyngeal lymph nodes generally atrophy by about age 5 years.2 There is not yet strong evidence to suggest that any other type of abscess is relatively more likely in an infant population. Of the other types of abscess, peritonsillar is particularly rare in an infant population, although a case in a child as young as 7 months has been reported.5

Radiographic studies play an important role in the diagnosis of neck abscess. Neck CT with contrast is the current imaging study of choice for this purpose.6,7 As early as 1982, Holt et al.8 reported a series of 6 cases in which CT was used to diagnose neck abscess with no false positives or false negatives. Furthermore, in 1982, Endicott et al.9 described a series of 6 cases in which CT was used with significant impact on diagnostic and management decisions. In our present study, neck CT was used as a diagnostic modality in 17 of 25 patients. Sixteen of the 17 were correctly diagnosed on the basis of these CTs, for a sensitivity of 94%. This finding is concordant with previous studies, which have found sensitivities of 91%4 and 87.9%.7

In the case of retropharyngeal abscess, another useful diagnostic modality is the lateral neck film. Sharma et al.10 found this modality to be 88% sensitive for retropharyngeal abscess in 17 cases, and Tannebaum11 found it to be 100% sensitive in 47 cases. Our study revealed that 3 of 3 cases of retropharyngeal abscess showed abnormalities on lateral neck films, showing widening of the retropharyngeal space. Although lateral neck films may be considered the diagnostic modality of choice for retropharyngeal abscess, we should note that neck CT can still provide useful information if more accurate anatomic localization is desired.12

Some degree of airway compromise was present in 13 of 17 of our scanned patients. Although only 1 of these presented with a chief complaint of respiratory distress, the importance of prompt diagnosis and surgical intervention is underscored by this high prevalence of obstruction. Also noteworthy, of the 4 infants with moderate or severe airway compromise, 1 had a parapharyngeal abscess and 3 had retropharyngeal abscesses. These types of abscess should be managed with the risk of respiratory distress in mind.

Incision and drainage was the intervention of choice in all 25 of our patients. Twenty-four of the 25 were successfully treated with a single I&D procedure. The other patient required reexploration on postoperative day 3 for increasing WBC count and enlarging neck mass. No further pus was expressed. The mass and elevated WBC count resolved spontaneously, and the child was discharged 4 days after reexploration. Twenty-two of the 25 abscesses were drained externally, which is the recommended approach for anterior and posterior triangle and submandibular and parotid gland abscesses.1,3,13-16 The other 3 abscesses in our study, all retropharyngeal, were drained intraorally, which is the recommended approach for this type of abscess.

### Most Common Symptoms of Neck Abscess in 4 Studies

<table>
<thead>
<tr>
<th>Source</th>
<th>n</th>
<th>Mean Age (Range)</th>
<th>Types of Abscess*</th>
<th>Symptoms</th>
<th>Duration of Symptoms, d</th>
</tr>
</thead>
<tbody>
<tr>
<td>Present study</td>
<td>25</td>
<td>5.6 mo (2.5-9 mo)</td>
<td>ant, post, rp, pp, sal</td>
<td>Neck mass (92%), cervical adenopathy (68%), fever (60%), poor oral intake (36%)</td>
<td>3.8</td>
</tr>
<tr>
<td>Ungkanont et al</td>
<td>117</td>
<td>7.8 y (1 mo-18 y)</td>
<td>rp, pp, pt, sal, buc</td>
<td>Fever (74%), sore throat (47%), dysphagia (38%), trismus (36%)</td>
<td>4.3</td>
</tr>
<tr>
<td>Choi et al</td>
<td>70</td>
<td>3.4 y (1 mo-17.3 y)</td>
<td>rp, lp</td>
<td>Fever, stiff neck, odynophagia/dysphagia, cervical adenopathy</td>
<td>No data</td>
</tr>
<tr>
<td>Dodds and Maniglia</td>
<td>19</td>
<td>5.6 y (2 mo-18 y)</td>
<td>ant, post</td>
<td>Fever and neck mass (84%), sore throat (21%), upper respiratory tract infection (11%)</td>
<td>8</td>
</tr>
</tbody>
</table>

*ant indicates anterior triangle; buc, buccal/canine; lp, lateral pharyngeal; post, posterior triangle; pp, parapharyngeal; pt, peritonsillar; rp, retropharyngeal; and sal, salivary. Note that extensive overlap exists between lateral pharyngeal and anterior/posterior triangle abscesses.
We should note that intraoral drainage of other neck abscesses has been described and used successfully.² In fact, Choi et al³ suggest that intraoral drainage of these abscesses is technically simpler, with shorter procedures and recovery times for abscesses medial to the carotid sheath.

Five of our 25 patients received needle aspiration as treatment. Pus was obtained in 3 of these cases, but all went on to require I& D. Needle aspiration has been successful in the treatment of some abscesses as an alternative to open I&D.¹⁷,¹⁸ However, open I&D is regarded by most sources to be more reliable and less likely to require a second procedure.

No complications occurred among our population of 25. Mean time from presentation until surgical intervention was 2.0 days, and median time was 1 day. This underscores the utility of swift diagnosis and management of neck abscess in infants to avoid serious complications such as mediastinitis, sepsis, and pericarditis.

The most common organism cultured from neck abscesses in our study was S aureus (80% of cases; n = 20). This finding agrees with the study by Brook¹⁹ that also found S aureus to be the most common neck abscess isolate (56%). This organism, along with β-hemolytic Streptococcus, was also most common in the study by Ungkanont et al,¹ but these organisms were found in only 18% of cases. The discrepancy may be due to the large number of peritonsillar and buccal and/or canine abscesses in the study (72/117; 62%). Dodds and Maniglia² also cultured S aureus in 12 (63%) of 19 cases of anterior and/or posterior triangle abscess and 8 (40%) of 20 cases of submandibular/submental abscess. Streptococcal species have been found to be more common in retropharyngeal and peritonsillar abscesses.³,⁺¹,⁺¹¹,⁺¹²,⁺¹³ Empiric antibiotic choices should be tailored to these patterns. Resistance among these groups of organisms makes augmented penicillins an excellent choice for empiric therapy, although nafcillin and various cephalosporins were also used effectively in our patient population.

In conclusion, deep-neck-space abscesses in infants are rapidly progressive, often cause airway compromise, and usually present with fever and neck mass. Staphylococcus aureus is the most common pathogen. Empiric antibiotic treatment should be started immediately and tailored to specific organisms when cultures are available. When the diagnosis is confirmed clinically or through the use of radiologic imaging, prompt surgical management can help prevent complications.

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REFERENCES