Acute neck infections in children

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A retrospective review was conducted on 132 patients aged between two and 15 years with cervical lymphadenitis and/or with abscess formation to determine the epidemiologic and clinical presentation of these infections. The most common locations were the upper anterior cervical space (43.2%) and the submandibular space (27.3%). The duration of symptoms ranged from 12 hours to 20 days. Results of the pus cultures were available in 31 patients (23.5%). Of these, 16 cultures (51.6%) were positive. The isolated organisms were Staphylococcus aureus (50%), Staphylococcus epidermidis (31.3%), group A beta-hemolytic streptococcus (12.5%), Streptococcus pneumoniae (6.3%) and Escherichia coli (6.3%). One of the specimens yielded mixed organisms (Staphylococcus epidermidis and Streptococcus pneumoniae). Penicillin resistance was documented in six (37.5%) of the 16 Gram-positive bacteria isolated from the pus culture. Both throat and blood cultures were available in all 132 patients. Seven throat cultures (5.3%) were positive for group A beta hemolytic streptococci, whereas five blood cultures (3.8%) were reported to have bacterial growth. Sixty-seven patients (50.8%) were treated with ampicillin-sulbactam, 53 patients (40.1%) with ampicillin-sulbactam and ornidazole and 12 patients (9.1%) with ceftriaxone parenterally. The mean duration of hospital stay related to the infection was 7.30±3.89 days (range, 2-28 days). The mean period for downsizing of the cervical mass by half was 4.05±2.05 days, and the recovery period (total antibiotic usage period) was 13.72±5.33 days. All of the patients had an uneventful recovery without complications. Results of both throat and blood cultures were not predictive for etiologic agents in our study group. Since ultrasonographic evaluation of each patient has limited additional benefits in clinical management, it must be reserved for selected cases to document abscess formation.

Key words: neck infection, children, ampicillin-sulbactam.

Infectious cervical lymphadenitis is common in children[1]. Cervical bacterial infection may result from endogenous oropharyngeal, nasal or dental flora or skin infections on the scalp or face or from person-to-person spread by airborne droplets[1-6]. Prompt diagnosis and treatment of bacterial cervical infection are important due to the presence of so many vital structures in proximity. In the case of infectious cervical lymphadenitis, Staphylococcus aureus (S. aureus), group A beta-hemolytic sterptococcus (GABHS) and anaerobic bacteria are the common etiologic agents[1-7]. In this retrospective study we would like to point out the clinical characterization of cervical infections and interpret the treatment results. We also aimed to determine whether ultrasound investigation was beneficial in predicting the clinical course or management.

Material and Methods

The record of all hospitalized patients with a diagnosis of a neck infection from January 1995 to December 2001 at Hacettepe İhsan Doğramacı Children's Hospital were reviewed. One hundred and thirty-two children who were two years of age or older with acute cervical lymphadenitis or cervical lymphadenitis with either cellulitis or abscess formation were enrolled.

Age; sex; anatomic location of cervical swelling and characteristics of the enlarged lymph node; signs of inflammation in addition to swelling, including tenderness, erythema and warmth; evidence of fluctuation; size of cervical swelling; associated fever, neck pain, limited range of neck motion or torticollis; head and neck disease or skin lesions on the scalp or face; dental problems; presence of an upper

respiratory tract infection, symptoms and their duration; family history of tuberculosis or close exposure to the disease; animal exposure or ingestion of undercooked meats or unpasteurized milk; and underlying diseases for each case were noted from hospital records. Laboratory evaluations including complete blood count, erythrocyte sedimentation rate, C-reactive protein, bacterial and viral serology, bacterial culture, tuberculin skin test, chest radiograph, ultrasound of the neck, duration of therapy and clinical outcome were recorded.

The statistical analysis was performed by using SPSS for Windows Release 7.5 program. For statistical significance a P value was accepted to be 0.05 or less.

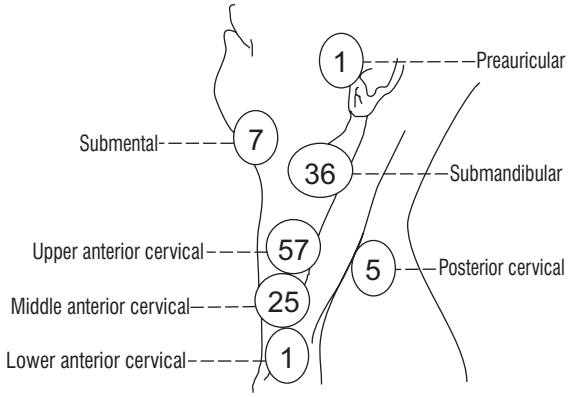

Fig. 2. Location of cervical lymphadenitis.

Results

In our study, patients' ages ranged from two to 15 years (mean 5.83±2.78 yr) (Fig. 1). There were 67 patients (50.8%) in the 2-5 year age group; 55 cases (41.6%) in the 6-10 year age group and 10 cases (7.6%) in the 11-15 year age group. Of the 132 patients, 71 (53.8%) were male and 61 female (46.2%).

swelling size was 3-6.5 cm in 84 patients (63.6%) and larger in others. In 30 patients (22.7%) lymphatic drainage line was involved. Thirty-one patients (23.5%) had fluctuant neck abscess on admission.

The duration of symptoms ranged from 12 hours to 20 days, with a mean period of 4.30±3.42 days. Ninety-eight patients (74.2%) applied to

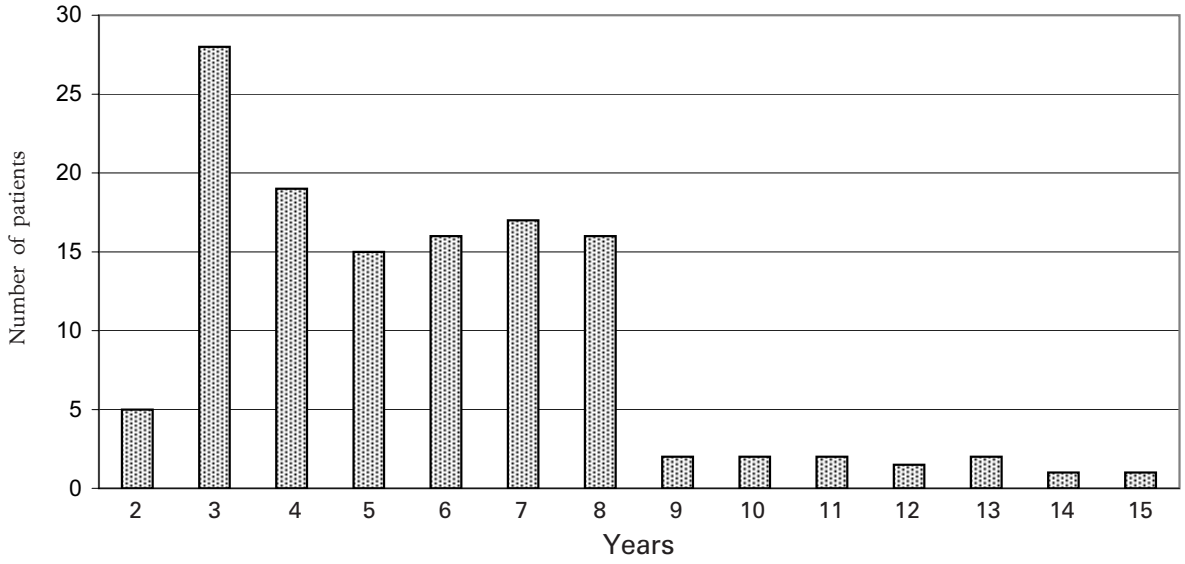

Fig. 1. Age distribution (n=132).

The upper anterior neck was the most commonly involved anatomic area (43.2%), followed by the submandibular (27.3%) and middle anterior neck (18.9%) (Fig. 2). Neck swelling was on the right in 53 patients (40.1%) and on the left in 79 patients (59.9%). The neck

the hospital within the first five days and 117 patients (88.6%) within the first seven days. Fever was the most common associated symptom; 85 patients (64.4%) had fever (axillary temperature >38°C). History suggested that 25 patients (18.9%) had preceding upper

respiratory track infection. Fifty-six (42.4%) patients with neck infection had a concomitant disease. Of the 56 patients, 14 had dental caries alone; eight had combination of caries and dental abscess; 17 had tonsillitis; and 16 had sinusitis, including two preseptal cellulitis and one had otitis media. In patients with dental abscess, teeth extractions were performed in the first 48 hours of antimicrobial therapy. There were no patients with impetigo on the face or the scalp.

Neck pain was recorded in 37 patients (28.0%). Of the 36 patients with submandibular lesion, six (16.7%) had neck pain. Twenty out of 57 (35.1%) with upper anterior cervical lesion, and 11 of the 25 (44%) patients with middle anterior cervical lesion had neck pain. Sixteen patients had limited range of neck motion and two had torticollis.

Tuberculin skin test was negative in all of the patients. None of the patients had close contact with pets or had consumed unpasteurized milk or undercooked meat. Salmonella and Brucella agglutination tests and/or cytomegalovirus, Epstein-Barr virus and Toxoplasma gondii serologies were studied in 55 (41.7%) cases, and none of these infections were identified. All 132 patients were studied radiographically with posteroanterior chest film and two patients had infiltration on chest X-ray. Seventy-two patients underwent ultrasound examination.

Breakdown of the cases by seasons was as follows: winter 41 patients (31.1%), spring 20 patients (15.1%), summer 34 patients (25.8%) and autumn 37 patients (28.0%) (Fig. 3). The number of patients hospitalized in winter was higher than the number hospitalized in spring ($p<0.01$).

The mean value of white blood cell count of all 132 patients was 15,407 cells/ml, hemoglobin was 11.53 g/dl, C-reactive protein was 5.33 mg/dl and erythrocyte sedimentation rate was 56.12 mm/hr at presentation (Table I).

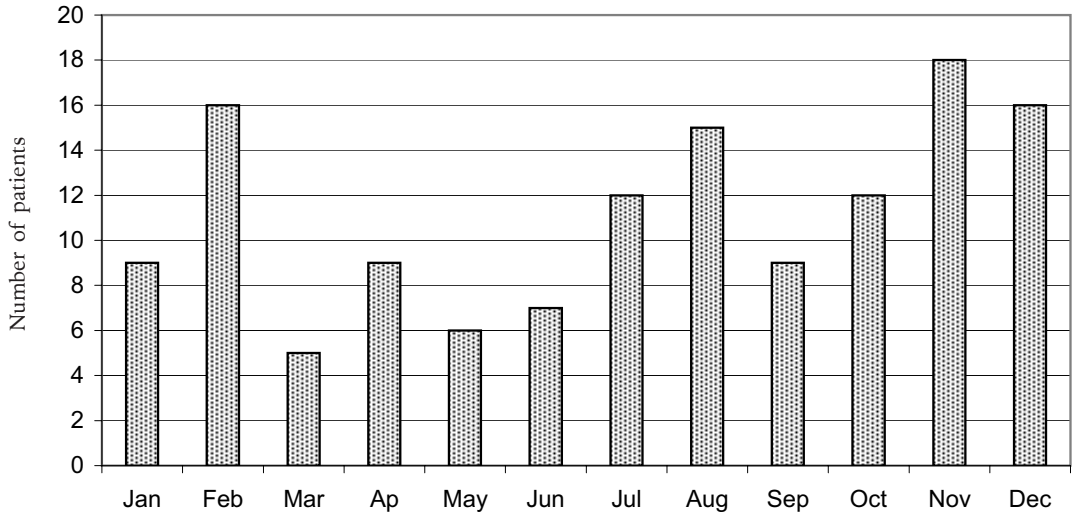

Fig. 3. The seasonal distribution of the cases.

Table I. Laboratory Findings

Laboratory parameters	Mean	SD*	Range
At presentation			
WBC (cells/ml)	15407	6292	5800-35700
Hb (g/dl)	11.53	1.2	7.2-14.4
C-reactive protein (mg/dl)	5.33	5.92	0.1-45
Erythrocyte sedimentation rate (mm/hr)	56.12	29.58	7-160
At 3rd to 5th day			
WBC (cells/ml)	8379	3213	3200-19700
C-reactive protein (mg/dl)	1.40	1.49	0.01-7.91
Erythrocyte sedimentation rate (mm/hr)	31.71	21.17	4-150

* Standard deviation.

Thirty-one patients (23.5%) had purulent drainable collections. Abscess was aspirated by a sterile 20-gauge needle on a 20-ml sterile syringe in 15 patients. Incision and drainage were used in 16 patients after the local anesthesia. For all of the patients, Gram's stain, aerobic cultures, and anaerobic cultures were done on purulent material obtained by needle aspiration or incision and drainage. Bacteria were isolated in 16 (51.6%) of the 31 patients. Of these 16 specimens, S. aureus was isolated in 8 (50%) cases, Staphylococcus epidermidis (S. epidermidis) in 5 (31.3%) cases, GABHS in 2 (12.5%) cases, Streptococcus pneumoniae (S. pneumoniae) in 1 (6.3%) case and Escherichia coli (E. coli) in 1 (6.3%) case. In one culture, both S. epidermidis and S. pneumoniae were isolated. None of the specimens revealed anaerobic bacteria. Of the 16 positive pus cultures, eight occurred in winter, four in summer, and four in autumn. All of the GABHS were isolated in autumn, and most of the staphylococci in winter. The ages of the patients with pus culture yielding bacteria ranged from 2 to 13 years, with an average of 5.87. For S. aureus, age range was 2 to 13 with an average of 6.25. For S. epidermidis, the age range was 3 to 6 with an average of 5.4. GABHS was isolated from two patients aged 3 and 7. E. coli was isolated from a seven-year-old patient and S. pneumoniae from a six-year-old patient. Of the nine cultures obtained from submandibular lesions, three yielded S. aureus, one yielded S. epidermidis and one yielded GABHS. Of the 11 cultures obtained from upper anterior cervical lesions, two-yielded S aureus, two yielded S. epidermidis, one yielded GABHS and one yielded both S. epidermidis and S. pneumoniae. Of the eight-cultures obtained from middle anterior cervical lesions, two yielded S. aureus, one yielded S. epidermidis and one E. coli. Of the three submental cultures, one yielded S. aureus. In 99.2% of the patients for whom bacteria were detected on Gram's stain, cultures were positive.

Throat cultures yielded GABHS in seven (5.3%) cases. Of these seven cases, pus cultures were obtained from three patients; two yielded no bacterial growth and one yielded S. epidermidis. Blood cultures yielded S. epidermidis in three, GABHS in one and Streptococcus mitis in one.

Of the eight cases of S. aureus isolated in the pus culture, none were resistant to methicillin, but three of S. aureus and three S. epidermidis isolates were resistant to penicillin. All GABHS and S. pneumoniae isolates were sensitive to penicillin. Streptococcus mitis isolated from blood culture was resistant to penicillin.

Of the 132 patients, 67 patients (50.8%) were treated with ampicillin-sulbactam, 53 patients (40.1%) were treated with ampicillin-sulbactam and ornidazole and the remaining 12 (9.1%) with ceftriaxone.

Parental antibiotics without any surgical intervention were effective in the treatment of 101 of 132 patients (76.5%). The symptomatic improvement was usually seen within 48 hours in all 132 patients. It was determined that fever reduced to normal within the first day in 54 (40.9%) patients, and within the second day in 69 (52.3%) patients. In the laboratory evaluations conducted 3-5 days after admission, mean white blood cell count was 8,379 cells/ml, C-reactive protein was 1.40 mg/dl and erythrocyte sedimentation rate was 31.71 mm/hr (Table I). The mean duration of hospital stay related to the infection was 7.30±3.89 days (range, 2-28 days). In the 132 cases, the mean period for downsizing of the cervical mass by half was 4.05±2.05 days (range, 2 to 12 days) and the recovery period (total antibiotic usage period) was 13.72±5.33 days (range, 5-31 days). All of the patients had an uneventful recovery without complications.

Ultrasound was done in 72 patients (54.6%). By ultrasonography, neck infection represented lymphadenitis in 48 of the 72 (66.7%), lymphadenitis with cellulitis in 11 (15.3%), and an abscess in 13 (18.0%). The number of days of illness prior to presentation to the hospital was 4.04±3.08 days for the lymphadenitis group, 4.64±2.16 days for the cellulitis group and 5.00±3.72 days for the abscess group. Although no statistical test could be conducted since the number of patients in each group was not equal, no significant differences were observed in the clinical presentation of children with lymphadenitis, cellulitis and abscess.

Fever was detected in 62.5% of those in whom lymph nodes were found, in 54.5% of those with cellulitis and in 84.6% of those in whom abscess was found, by ultrasonography. The rates for neck pain were 29.2%, 18.2% and 46.2%, respectively. Intravenous antibiotic treatment periods for lymphadenitis, cellulitis and abscess groups were 7.62±4.42 days, 10.18±4.02 days and 10.69±3.77 days, respectively. Recovery periods for the groups

were 14.40±6.19 days, 15.73±5.14 days and 17.31±5.75 days, respectively. There was no relation between the recovery periods and location of the neck infections.

Discussion

In our study, the upper anterior neck was the most commonly involved anatomic area, followed by the submandibular and middle anterior neck. Similarly upper anterior deep cervical and submandibular locations were the most commonly involved areas in the series of Wright et al.[3] and Barton et al.[4] Since the submandibular and deep anterior and posterior cervical nodes receive most of the lymphatic drainage of the head and neck, these nodes are involved in more than 80% of children who develop infectious cervical adenitis[1,6].

In our series the duration of symptoms ranged from 12 hours to 20 days, compared to 1-28 days in the series of Dajani et al.[2], and 2-28 days in the series of Wright et al.[3].

In neck infections in children, upper respiratory track infections such as pharyngitis, tonsillitis and sinusitis are typically a predisposing factor[1]. There was a history of upper respiratory track infection in 18.9% of our cases. More importantly, out of the 132 patients, 17 had tonsillitis, and 16 had sinusitis, including two preseptal cellulitis cases and one had otitis media at presentation. However, dental infections were more commonly encountered in our study compared to other studies in the literature. In our series 14 patients had dental caries alone, and eight had a combination of caries and dental abscess, whereas in the series of Wright et al.[3] dental problems were detected in only 6.5% of cases.

In this study, 31 patients (23.5%) had purulent drainable collections. Bacteria were isolated in 16 (51.6%) of them. S. aureus was the commonest isolate [8 isolates (50%] like in other studies in the literature[3,4]. Other isolates included 5 (31.3%) S. epidermidis, 2 (12.5%) GABHS, and 1 (6.3%) S. pneumoniae and E. coli. In one culture, mixed isolates of S. epidermidis and S. penumoniae were detected. None of the specimens revealed anaerobic bacteria.

In the cervical infections, causative agents usually could not be documented. In the series of Dajani et al.[2], 35% of the lymph node bacterial cultures were unsuccessful. In the series of Wright et al.[3], etiological agents could be established in only 50% of the cases. Barton et al.[4] could not identify any etiologic bacteriologic agent in 24% of the children. Not surprisingly, in our study almost half of the pus cultures were negative.

S. epidermidis was detected in 2.8% of the children with neck abscess[5]. In our study, on the other hand, this rate was 31.3%. Har-El et al.[8] found this rate as 22.7% in adults and children with deep neck infection, indicating that this organism can be detected at a variety of rates. S. pneumoniae[9] and E. coli are rarely recovered agents in neck infections and E. coli was only reported in the series of Wright et al.[3] at the rate of 3.1%. Streptococcus mitis is also an agent that may cause cervical infection, and it was isolated in the blood culture of one case in our study[8]. Detection of these bacteria in our series may have resulted from the magnitude of the number of our cases.

Brook[5] suggested that neck abscesses in children were polymicrobial in nature. However polymicrobial culture results are typically not encountered in superficial neck infections in children[1-4]. In our study only one mixed infection with two Gram-positive aerobic organisms was detected. Anaerobic bacteria originating from the oral flora and associated with dental caries may cause acute suppurative lymphadenitis[1,5,6]. In our series no anaerobic bacteria were found. It has been reported that no anaerobes were detected in the deep neck infections in children which are expected to host a mixture of both aerobic and anaerobic bacteria[10].

In our study, blood cultures yielded 3.8% bacterial growth. This rate was found as 10.5% in the series of Brook[5]. Therefore the role and the cost effectiveness of blood culture in the management of neck infection could be discussed in further studies. Our findings also suggested that in the case of detailed mouth examination, throat cultures were not illustrative in the management of neck infections.

Similar to other studies, leukocytosis was also prevalent in our cases[2,4]. The mean erythrocyte sedimentation rate was 38 mm/hr in the study of Barton et al.[4] and 56 mm/hr in our study.

Parenteral antibiotics, penicillin, nafcillin, second generation cephalosporins such as cefuroxime, third generation cephalosporins such as ceftriaxone, ampicillin-sulbactam, amoxicillin-clavulanate and clindamycin (or a

combination of antibiotics) are the antibiotics that can be used in the treatment of neck abscess in children[1,10-14]. Ampicillin-sulbactam has been shown to be effective also for anaerobic infections of the head and neck region[11]. Some authors have recommended the addition of metronidazole to penicillin or the use of ampicillin-sulbactam, ceftriaxone, and clindamycin for deep neck infection, in particular[5,10,12-14]. Surgical intervention is indicated when an abscess is established. In our study, recovery was achieved in 101 patients with antimicrobials alone, and the mean duration of intravenous antibiotic usage was 7.30±3.89 days; total antibiotic usage period was 13.72±5.33 days. The total duration of antimicrobial therapy in the literature is generally 10-14 days, regardless of whether a surgical procedure is performed[1,2,6]. Since a similar recovery period was achieved in our series and ampicillin-sulbactam was used successfully in 120 of our cases (90.9%), it can be inferred that this antibiotic is very effective.

In Brook's series[5], beta-lactamase producing organisms were isolated in 46% of the bacteria in head and neck abscess. Ungkanont et al.[15] in 117 children with head and neck space infections reported that beta-lactamase production by aerobic pathogens could be as high as 22%. In the series of Gidley et al.[12] beta-lactamase producers were found in 17%. In the treatment of head and neck space infections in children, empiric antibiotic therapy must cover Gram-positive organisms, anaerobes, as well as Gram-negative, and beta-lactamase producing organisms. Timely surgical intervention should be employed when indicated.

Generally, the diagnosis of a neck abscess is evident after a thorough history and physical examination. However, ultrasonographic examination might be beneficial in determining the content of the neck mass. Abscess may be drained with ultrasound-guided catheterization[16,17]. Ultrasonography was performed in 72 patients (54.6%) in our series. According to our observations, ultrasonography did not further contribute to clinical management except for detecting the presence of a neck abscess. Therefore, we suggest the usage of ultrasound be reserved only for determining the abscess formation in neck infections.

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