J Microbiol Immunol Infect 2010;43(1):47–52

Contents lists available at ScienceDirect

Journal of Microbiology, Immunology and Infection

Journal homepage: http://www.e-jmii.com

Original Article

Deep Neck Infections in Different Age Groups of Children

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BACKGROUND/PURPOSE: Deep neck infections (DNIs) can cause significant morbidity in children. This study analyzes the clinical presentations, diagnostic clues, and age relationship of DNI in pediatric patients.

METHODS: Pediatric patients admitted to our hospital from January 1996 to December 2007 with a diagnosis of DNIs were reviewed retrospectively. Diseases were categorized according to the site of infection: peritonsillar, parapharyngeal, and retropharyngeal spaces. Patients were divided into two groups: children (aged < 10 years) and adolescents (aged 10–18 years).

RESULTS: Fifty pediatric patients were enrolled, including nine with DNI in the retropharyngeal space, 17 in the parapharyngeal, 21 in the peritonsillar and three with mixed type abscesses. A total of 21 patients belonged to the child group, and 29 were adolescents. All retropharyngeal abscesses occurred in children; whereas most peritonsillar abscesses (81%) were found in adolescents. Most retropharyngeal and parapharyngeal abscesses were associated with fever (100% and 65%, respectively) and neck masses (67% and 94%, respectively); while odynophagia was the most common symptom in peritonsillar abscess (100%). Thirty-two abscess cultures were obtained and seven grew mixed pathogens, followed by *Streptococcus pyogenes* ($n = 5$), and normal flora ($n = 5$). Complications of airway obstruction arose in one patient with parapharyngeal abscess, and mediastinitis in another two patients with retropharyngeal abscesses. Recurrent DNIs were observed in six patients; three had congenital bronchogenic cysts.

CONCLUSION: The location of the DNI appears to vary in different pediatric age groups. Its insidious presentation, with a potentially complicated course, warrants careful inspection in children with fever and neck masses, especially young children.

KEYWORDS: children, parapharyngeal abscess, peritonsillar abscess, retropharyngeal abscess

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Article History:
Received: Dec 31, 2008
Revised: Feb 10, 2009
Accepted: Feb 23, 2009

Introduction

Deep neck infection (DNI) is a life-threatening disease affecting children. The disease can be categorized according to the sites of infection as retropharyngeal, parapharyngeal, and peritonsillar abscess.[1] Onset of DNI is usually insidious, and early diagnosis remains a challenge to pediatricians.[2] The initial diagnosis may be delayed due to insidious symptoms and poor verbal communication in

young pediatric patients.[3] The purpose of this study is to delineate the initial clinical presentations and diagnostic clues of DNI, and to determine whether there are age-related differences.

Methods

Subjects

Medical records of pediatric patients (≤18 years) admitted to the Pediatrics and Otorhinolaryngology wards in Mackay Memorial Hospital, Taipei, Taiwan, with a diagnosis of DNI from January 1996 to December 2007 were reviewed. Patients with submandibular abscesses and thyroid gland infections were excluded.

DNI cases were separated into retropharyngeal, parapharyngeal, and peritonsillar types. Abscess formation surrounding the tonsils is defined as a peritonsillar abscess. Likewise, parapharyngeal abscess is localized medially to the space surrounded by pharynx, the carotid sheath posteriorly, and the muscles of styloid process laterally. Retropharyngeal abscess is confined to the pharynx and cervical vertebrae, and may extend down into superior mediastinum.[4] Abscesses that are localized to more than one compartment are defined as mixed type DNI. The diagnosis of DNI, including the location of the infection, is based on clinical presentations and/or image findings on contrast-enhanced computer tomography (CT).

Patient characteristics

The age, sex, underlying disease, clinical manifestation, hospitalization course, laboratory data, and management of each patient were recorded. Comparison of the data from patients with retropharyngeal, parapharyngeal, and peritonsillar abscesses was performed. According to our primitive data, we further categorized patients as children (<10 years) or adolescents (10–18 years) groups,[5] and compared these two groups. Data from patients with complications and recurrent DNI were collected for further evaluation. The following were recorded as DNI complications: airway obstruction, jugular vein thrombosis, descending mediastinitis, and emphysema or sepsis.[6] A recurrent disease was defined as the reappearance of infection after clinical remission. Bacteria isolated from non-sterile sites within the healthy oral cavity were regarded as normal flora.

Statistical analysis

Data are represented as mean±standard deviation. Comparisons between groups were made using Fisher's exact test and Student's *t* test for continuous and categorical variables, respectively. A p value < 0.05 was considered statistically significant.

Results

A total of 50 hospitalized patients were enrolled, with 21 patients in the children group (mean age, 4.2±3.1 years) and 29 patients in the adolescents group (mean age, 15.7±2.6 years). Nine patients had retropharyngeal abscess, 17 had parapharyngeal abscess, 21 had peritonsillar abscess, and three presented with mixed type abscesses. Male preponderance was noted in the children group (male: female=14:7), but not in the adolescents group (male: female=15:14).

The sites of DNI varied among the different age groups (Figure). Nine patients (42.8%) from the children group had retropharyngeal abscess, whereas none were observed in the adolescents group (Table 1). Peritonsillar abscesses occurred more frequently in adolescents compared with children (58.6% *vs.* 19.0%). Three patients (10.3%) from the adolescents group suffered from more than one focus of DNI (mixed type), as detected by CT. No anatomical abnormalities were found in these three patients. Length of hospitalization was also different between the two groups. The average stay for children

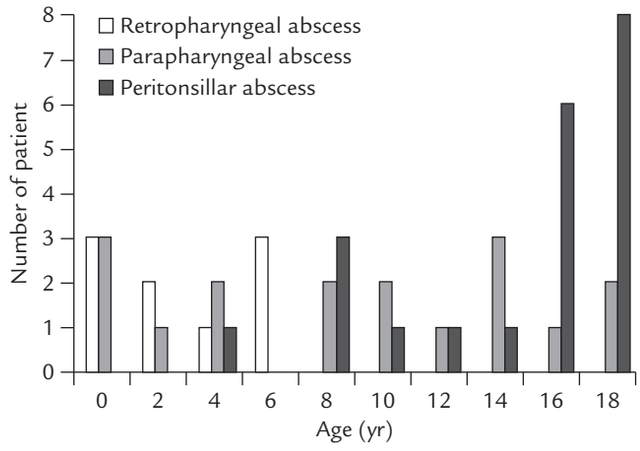

Figure. Age distribution of patients with different sites of deep neck infection.

was 12.9±9.7 days and this was significantly longer than the 5.7±3.3 days in adolescents (p=0.003; Table 1).

The clinical conditions of different infected sites are shown in Table 2. Fever was the most common symptom of DNI (72.0%). All patients afflicted with retropharyngeal abscesses had fever, but fever was also recorded in 64.7% and 61.9% of patients with parapharyngeal and peritonsillar abscesses, respectively. Neck masses, or nuchal pain, were common in patients with retropharyngeal (66.7%) and parapharyngeal (94.1%) abscesses, but were hardly seen in those with peritonsillar abscesses (4.8%). Conversely, odynophagia, trismus, and uvula deviation were unusual presentations of either retropharyngeal or parapharyngeal infection, in contrast to peritonsillar abscess.

All patients received treatment with intravenous antibiotics. Nearly half of the retropharyngeal abscess (55.6%) and parapharyngeal abscess patients (47.6%) underwent surgery (incision and drainage). However, only 14.3% of the peritonsillar abscess patients needed surgery, and needle aspiration was performed in 47.6% of cases.

Blood cultures were obtained from 70% of the patients, and none grew pathogens. A total of 32 pus cultures from infected sites were obtained: 11 by aspiration, 17 by surgical drainage, and four by throat cultures for peritonsillar

Table 1. Characteristics of patients with deep neck infection in children and adolescents groups[a]

Characteristics	Children (aged<10 yr) (n=21)	Adolescents (aged 10–18 yr) (n=29)	p
Male:female	14:7	15:14	
Mean age (yr)	4.2±3.1	15.7±2.6	
Hospital duration (d)	12.9±9.7	5.7±3.3	0.003
Retropharyngeal abscess	9 (42.8)	0 (0)	<0.001
Parapharyngeal abscess	8 (38.1)	9 (31.0)	0.207
Peritonsillar abscess	4 (19.0)	17 (58.6)	0.005
Mixed[b]	0 (0)	3 (10.3)	0.186

[a]Data presented as mean±standard deviation or n (%); [b]one patient had both peritonsillar and parapharyngeal abscesses, and two patients had peritonsillar, parapharyngeal and retropharyngeal abscesses.

Table 2. Clinical characteristics and management of patients with deep neck infections in different sites[a]

Characteristics	Retropharyngeal (n=9)	Parapharyngeal (n=17)	Peritonsillar (n=21)	Mixed (n=3)	Total (n=50)
Male:female	8:1	9:8	10:11	2:1	29:21
Mean age (yr)	3.4±2.4	9.4±6.2	14.8±4.2	15.7±1.5	10.9±6.3
Hospital duration (d)	17.8±12.6	9.6±4.2	4.1±1.1	9.7±4.5	8.8±7.6
Clinical presentation					
Fever	9 (100)	11 (64.7)	13 (61.9)	3 (100)	36 (72.0)
Odynophagia	1 (11.1)	2 (11.8)	21 (100)	2 (66.7)	26 (52.0)
Neck pain/mass	6 (66.7)	16 (94.1)	1 (4.8)	2 (66.7)	25 (50.0)
Uvular deviation	0 (0)	0 (0)	6 (28.6)	1 (33.3)	7 (14.0)
Trismus	1 (11.1)	0 (0)	4 (19.0)	1 (33.3)	6 (12.0)
Management					
Antibiotics alone	4 (44.5)	9 (53)	8 (38.1)	0 (0)	21 (42.0)
Surgery (I & D)	5 (55.6)	8 (47)	3 (14.3)	1 (33.3)	17 (34.0)
Aspiration	0 (0)	0 (0)	10 (47.6)	2 (66.7)	12 (24.0)

[a]Data presented as mean±standard deviation or n (%). I & D=incision and drainage.

Table 3. Pus cultures of patients with deep neck infection abscess cavity ($n=32$)

Microorganisms	No. of cases
Mixed flora[a]	7
No growth	6
Streptococcus pyogenes	5
Normal flora	5
Streptococcus other than pyogenes	4
Anaerobic bacteria[b]	2
Staphylococcus aureus	1
Klebsiella pneumoniae	1
Bartonella henselae	1

[a]Includes *Corynebacterium, Streptococcus pyogenes*, coagulase negative staphylococcus, streptococcus other than pyogenes, *Candida albicans, Fusobacterium, Neisseria* species; [b]includes *Fusobacterium naviforme* and *Bacteroid macacae*.

abscess. Seven of the 32 cultures yielded multiple microorganisms. Five cultures yielded *Streptococcus pyogenes*, four yielded streptococcus strains other than pyogenes, and two yielded anaerobic bacteria (Table 3). *Staphylococcus aureus* was isolated from a parapharyngeal abscess, and *Klebsiella pneumoniae* grew from the culture of a patient with type I diabetes mellitus who was suffering from a parapharyngeal infection. *Bartonella henselae* was detected by polymerase chain reaction in another subject with cat scratch disease and a retropharyngeal DNI. Normal flora grew in five cultures, and the remaining six showed no positive culture result.

Six patients in our study had recurrent episodes of DNI, all within 1 year. Four of these patients belonged to the children group. Three of the patients suffered from congenital bronchogenic cysts complicated by parapharyngeal abscess.

Complications were recorded in three patients (6% of total samples). Two children with retropharyngeal abscess had protracted clinical courses complicated by mediastinitis. One of them also developed emphysema. These patients underwent prolonged antibiotic treatment (14 days and 20 days) and operative drainage. Airway compression occurred in a 3-year-old girl with a parapharyngeal abscess. This girl recovered completely after receiving antibiotic agents and steroid therapy, plus incision and drainage procedures. She was the only patient in this study who needed steroid therapy. The outcome for all our patients was good, and without mortality.

Discussion

Although it is not a common disease, DNI does occur in the young population. Initial diagnosis of DNI is usually difficult, especially in pediatric patients, due to subtle symptoms, the fact children can be uncooperative during physical examination, and that they are often unable to communicate their symptoms effectively.[7] Moreover, the clinical presentation of DNI widely overlaps with other diseases commonly encountered in children such as tonsillitis, viral pharyngitis, and lymphadenitis, which may confuse physicians and lead them to make incorrect diagnoses.

Both adults and children may share the same predisposing factors to DNI, such as upper respiratory tract infection, tonsillitis, sinusitis, odontogenic infection, and cervical adenitis, but different age groups may exhibit distinct clinical features. Congenital cyst with infection was noted more frequently in pediatric patients.[8] Three patients with bronchogenic cysts even developed recurrent infections. In contrast, malignancy of both nasopharyngeal carcinoma and laryngeal carcinoma should be included in the differential diagnosis of DNI in adult patients.[9,10]

DNI may develop in distinct spaces in different age groups. Peritonsillar abscess is the most common DNI in adults, and retropharyngeal abscess occur more frequently in young children,[11] as shown in our study. All our patients with retropharyngeal abscesses were young children, whereas 81.0% (17/21) of the peritonsillar abscesses occurred in adolescents. We surmise that young children are more prone to retropharyngeal abscesses due to the prominent lymph nodes in the nuchal region. Conversely, adolescents are often candidates for *Streptococcus pyogenes* throat infections that may lead to peritonsillar abscesses.[12] Complicated and protracted treatment courses were observed in patients with retropharyngeal abscesses compared with those with peritonsillar abscesses. This is explained by the fact that the former occurred mostly in young children.

Sites of DNI differ in their clinical manifestations. The most common symptoms of peritonsillar abscess are

odynophagia and fever. Findings of trismus, uvular deviation or unusual tonsil enlargement during physical examination should alert physicians to this disease.[13] However, in retropharyngeal or parapharyngeal abscesses, fever may be the only sign at initial presentation, so accurate diagnosis may be delayed unless parents or physicians disclose a neck mass or nuchal pain.[14]

Nuchal radiography for screening DNI may be helpful, but CT remains the optimal tool to detect abscess formation.[15,16] The detailed anatomical information provided by CT aids in surgical planning for abscesses that require operative intervention. However, cellulitis and Kawasaki disease may mimic DNI on a CT scan, resulting in a false-positive diagnosis.[17,18] Meyer et al recommended that physicians should arrange a neck CT for all children with a tentative diagnosis of DNI because deep neck abscess detected on CT does not necessary correlated with duration of symptoms.[19]

Out-patient management of peritonsillar abscesses involving the aspiration of pus and administration of oral antibiotics is advocated by many physicians,[20,21] but patients should be admitted if symptoms persist or without improvement during follow-up. Hospitalization is advised in all cases of parapharyngeal and retropharyngeal abscess due to the potential life-threatening clinical course, and the requirement for high dose antibiotics.[22]

Previous investigations in Taiwan disclosed that most cases of DNI were caused by infection with mixed pathogens.[7,8] Considering the bacteriology of DNI, antibiotics should cover *streptococcus*, *anaerobes*, and *staphylococcus* pathogens. Recommended antibiotics include cefoxitin, beta-lactam/beta-lactamase inhibitors, clindamycin, metronidazole, or carbapenem in critical patients.[23,24] *Haemophilus influenzae* is an common pathogen in some countries,[25] but it is rare in Taiwan. One of our patients had a retropharyngeal abscess caused by *B. henselae* and, although it is rare, there is a similar DNI case illustrated in the literature associated with cat scratch disease.[26] There is one particular case worth mentioning in our study. A 9-year-old girl with underlying type I diabetes mellitus underwent surgical drainage of parapharyngeal abscess, from which *K. pneumonia* was isolated. This illustrates that *K. pneumoniae* infection should always be considered in diabetic patients, regardless of whether they are adults or children.[27]

It is clear now that surgical intervention is not necessary in every case of DNI, especially in patients who respond well to medical treatment.[28,29] Needle aspiration is the procedure of choice for drainage of peritonsillar abscesses.[30] Incision and drainage procedures were performed in only half of the patients with retropharyngeal or parapharyngeal abscesses in our study. Surgical drainage should be reserved for patients with airway compromise, poor response to antibiotic treatment, those patients who are immunosuppressed, or those suffering from DNI complications.[29,31]

There are several limitations to our study. First, as in all retrospective studies, missing data from medical records is inevitable. Second, the value of nuchal radiography is unclear, probably due to the easy availability of CT in clinical practice. Third, our sample size is not large enough due to the relatively low prevalence of this disease in the general population, and can only reflect experiences from a single medical center. However, the characteristics of DNIs in children can still be deduced from our data.

In conclusion, we would like to emphasize that "age makes a difference". The clinical features and severity of DNI varied according to different pediatric age groups, perhaps due to the location of the infection. A vigilant approach to febrile children with the symptoms of odynophagia, neck mass or nuchal pain could help in the early diagnosis of this potentially lethal disease.

References

1. Herzon FS, Martin AD. Medical and surgical treatment of peritonsillar, retropharyngeal, and parapharyngeal abscesses. *Curr Infect Dis Rep* 2006;8:196–202.
2. Huang LM. Deep neck space infection: Still a challenge to pediatricians. *Acta Paediatr Taiwan* 2004;45:263.
3. Flanary VA, Conley SF. Pediatric deep space neck infections: the Medical College of Wisconsin experience. *Int J Pediatr Otorhinolaryngol* 1997;38:263–71.
4. Pappas DE, Hendley JO. Retropharyngeal abscess, lateral pharyngeal (parapharyngeal) abscess, and peritonsillar cellulitis/abscess. In: Kliegman RM, Behrman RE, Jenson HB, Stanton BF, eds. *Nelson textbook of pediatrics*. 18th edition. Philadelphia: Saunders 2007:1754–6.
5. Marcell AV. Adolescence. In: Kliegman RM, Behrman RE, Jenson HB, Stanton BF, eds. *Nelson textbook of pediatrics*. 18th edition. Philadelphia: Saunders 2007:60–5.

6. Vieira F, Allen SM, Stocks RM, Thompson JW. Deep neck infection. *Otolaryngol Clin North Am* 2008;41:459–83, vii.
7. Liu CH, Lin CD, Cheng YK, Lin HC, Tsai MH. Deep neck infection in children. *Acta Paediatr Taiwan* 2004;45:265–8.
8. Tan PT, Chang LY, Huang YC, Chiu CH, Wang CR, Lin TY. Deep neck infections in children. *J Microbiol Immunol Infect* 2001; 34:287–92.
9. Pak MW, Chan KL, van Hasselt CA. Retropharyngeal abscess. A rare presentation of nasopharyngeal carcinoma. *J Laryngol Otol* 1999;113:70–2.
10. Akdogan O, Ibrahim O, Selcuk A, Dere H. The association of laryngoceles with squamous cell carcinoma of the larynx presenting as a deep neck infection. *B-ENT* 2007;3:209–11.
11. Dawes LC, Bova R, Carter P. Retropharyngeal abscess in children. *ANZ J Surg* 2002;72:417–20.
12. Galioto NJ. Peritonsillar abscess. *Am Fam Physician* 2008;77:199–202.
13. Millar KR, Johnson DW, Drummond D, Kellner JD. Suspected peritonsillar abscess in children. *Pediatr Emerg Care* 2007;23: 431–8.
14. Hartmann RW. Recognition of retropharyngeal abscess in children. *Am Fam Physician* 1992;46:193–6.
15. Nagy M, Backstrom J. Comparison of the sensitivity of lateral neck radiographs and computed tomography scanning in pediatric deep-neck infections. *Laryngoscope* 1999;109:775–9.
16. Wetmore RF, Mahboubi S, Soyupak SK. Computed tomography in the evaluation of pediatric neck infections. *Otolaryngol Head Neck Surg* 1998;119:624–7.
17. Smith JL 2nd, Hsu JM, Chang J. Predicting deep neck space abscess using computed tomography. *Am J Otolaryngol* 2006;27:244–7.
18. Hung MC, Wu KG, Hwang B, Lee PC, Meng CC. Kawasaki disease resembling a retropharyngeal abscess—case report and literature review. *Int J Cardiol* 2007;115:e94–6.
19. Meyer AC, Kimbrough TG, Finkelstein M, Sidman JD. Symptom duration and ct findings in pediatric deep neck infection. *Otolaryngol Head Neck Surg* 2009;140:183–6.
20. Lamkin RH, Portt J. An outpatient medical treatment protocol for peritonsillar abscess. *Ear Nose Throat J* 2006;85:658–60.
21. Al Yaghchi C, Cruise A, Kapoor K, Singh A, Harcourt J. Out-patient management of patients with a peritonsillar abscess. *Clin Otolaryngol* 2008;33:52–5.
22. Wang LF, Kuo WR, Tsai SM, Huang KJ. Characterizations of life-threatening deep cervical space infections: a review of one hundred ninety-six cases. *Am J Otolaryngol* 2003;24:111–7.
23. Al-Sabah B, Bin Salleen H, Hagr A, Choi-Rosen J, Manoukian JJ, Tewfik TL. Retropharyngeal abscess in children: 10-year study. *J Otolaryngol* 2004;33:352–5.
24. Brook I. Microbiology and management of peritonsillar, retropharyngeal, and parapharyngeal abscesses. *J Oral Maxillofac Surg* 2004;62:1545–50.
25. Ungkanont K, Yellon RF, Weissman JL, Casselbrant ML, Gonzalez-Valdepena H, Bluestone CD. Head and neck space infections in infants and children. *Otolaryngol Head Neck Surg* 1995;112:375–82.
26. Yeh SH, Zangwill KM, Hall B, McPhaul L, Keller M. Parapharyngeal abscess due to cat-scratch disease. *Clin Infect Dis* 2000;30:599–601.
27. Lin HT, Tsai CS, Chen YL, Liang JG. Influence of diabetes mellitus on deep neck infection. *J Laryngol Otol* 2006;120: 650–4.
28. Broughton RA. Nonsurgical management of deep neck infections in children. *Pediatr Infect Dis J* 1992;11:14–8.
29. Sichel JY, Gomori JM, Saah D, Elidan J. Parapharyngeal abscess in children: The role of CT for diagnosis and treatment. *Int J Pediatr Otorhinolaryngol* 1996;35:213–22.
30. Weinberg E, Brodsky L, Stanievich J, Volk M. Needle aspiration of peritonsillar abscess in children. *Arch Otolaryngol Head Neck Surg* 1993;119:169–72.
31. Osborn TM, Assael LA, Bell RB. Deep space neck infection: Principles of surgical management. *Oral Maxillofac Surg Clin North Am* 2008;20:353–65.