



Clinical and bacteriological differences of deep neck infection in pediatric and adult patients: Review of 123 cases



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ABSTRACT

Objectives: Deep neck infections (DNIs) can lead to life-threatening disease. However, the detailed pathophysiology remains unclear due to its rarity and only a few reports have directly compared DNIs in children and adults. This study aimed to reveal the clinical differences between DNIs in children and adults.

Methods: We retrospectively reviewed 123 patients who suffered from DNIs at Tohoku University Hospital from August 2005 to July 2015. We extracted data on patient sex, age, antecedent illness, extension of infections, operative procedures, and bacteriology results. The patients were categorized into pediatric (≤ 18 years) and adult (> 18 years) groups. Fisher's exact test was performed to determine significant differences between the two groups.

Results: Fifteen children (6 males and 9 females) and 108 adults (71 males and 37 females) were identified. The most common antecedent illness in pediatric patients was lymphadenitis, which was the least common in adult patients (73% vs 7%, $p < 0.0001$). The incidence of DNIs extending below the hyoid bone was significantly lower in pediatric patients than in adult patients (20% vs 53%, $p < 0.05$). Regarding bacterial culture analysis, *Staphylococcus* species was the most common pathogen in children (60%), whereas only 9% of adults were positive for *Staphylococcus* ($p < 0.001$). *Streptococcus* species were significantly less common in children than in adults (27% vs 56%, $p = 0.05$). Anaerobes were also significantly less common in children than in adults (13% vs 45%, $p < 0.01$). Concerning surgical intervention, 53% of pediatric patients underwent external incision compared with 70% of adults. Specifically, tracheostomy was significantly less frequently performed in children than in adults (7% vs 54%, $p < 0.01$).

Conclusion: DNIs in children feature different characteristics from those in adults regarding severity, antecedent illness, bacteriology, and clinical management.

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1. Introduction

Deep neck infection (DNI) is a rare disease that can have a rapid onset and cause serious complications such as airway obstruction, jugular vein thrombosis, and mediastinal involvement, leading to potential mortality and morbidity [1]. Because the incidence of DNI has increased especially in children [2], early diagnosis is critical to

prevent such conditions and improve patient survival. DNI in children has been reported to have different characteristics from that in adults. The initial diagnosis may be delayed due to difficulties in physical examinations and poor verbal communication [3]. Additionally, studies have shown that pediatric DNIs are more commonly attributed to lymphadenitis than adult DNIs, presumably because of decreased prevalence of dental infection and predominance of retropharyngeal abscess [4,5]. Regarding causative bacterial pathogens, *Streptococcus* species and anaerobes, which are often cultured in adults, are less frequently encountered in children [1]. However, DNI is rarer in children than in adults, and there have subsequently been only a few recent reports that

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directly compared DNI in children and adults [5–7]. Moreover, these reports did not address potential differences in causative bacterial pathogens.

Thus, the goal of the present study was to clarify the differences in pediatric and adult DNIs encountered in our department during the past 10 years according to clinical course, antecedent illness, bacterial pathogens, and operative approaches.

2. Materials and methods

2.1. Study population

Retrospective chart review was performed for all DNI cases treated at Tohoku University Hospital between August 2005 and July 2015. A total of 123 patients undergoing treatment including aspirational and/or incisional drainage were reviewed after excluding cases of abscess limited to the peritonsillar space, isolated salivary gland infection without objective evidence of deep neck space involvement, associated with tuberculosis, or caused by a foreign body or malignancy. Cultures were obtained by needle aspiration or incisional drainage. The material collected was immediately sealed and transported to the laboratory within 12 h. The diagnosis of DNI was based on clinical characteristics, imaging studies [contrast-enhanced computed tomography (CT)], and surgical finding. We performed contrast-enhanced CT in all patients except for two patients: an 80-year-old male patient with chronic kidney disease who alternatively underwent non-enhanced CT and magnetic resonance imaging (MRI), and a 65-year-old female patient with Sjögren's syndrome who alternatively underwent MRI because of her past history of allergy to CT contrast materials. Other than these two cases, we did not routinely perform MRI during the study period. Abscess was defined as the presence of purulence on operative incision and/or drainage. Relevant clinical findings including age, sex, underlying disease, clinical manifestation, laboratory data (including human immunodeficiency virus serology before surgical operations), and management of each patient were reviewed.

All parts of the present study were performed in accordance with the guidelines of the Declaration of Helsinki and approved by the ethics committee of Tohoku University Hospital (approval number 2011-519).

2.2. Clinical evaluation

We categorized the patients into two groups, pediatric (≤ 18 years) or adult (> 18 years), and the following clinical findings were compared between the groups: sex, abscess development, classification (Stage), antecedent illness, bacteriology results, operative methods, and tracheostomy (yes/no).

The stage of DNI was classified according to a previous report [8] as follows: Stage I, infection limited to the original focus; Stage II, infection spreading to the parapharyngeal space without extension below the hyoid bone; Stage III, infection below the hyoid bone; Stage IV, descending necrotizing mediastinitis (DNM) above the tracheal carina; and Stage V, DNM extending below the tracheal bifurcation. Stage III was further subdivided into Stage IIIa (unilateral) and Stage IIIb (extending midline to the opposite side), and Stage V was further subdivided into Stage Va (lower anterior mediastinum) and Stage Vb (lower anterior and posterior mediastinum).

2.3. Statistical analysis

Differences in frequencies between the groups were statistically examined using Fisher's exact test. A p value < 0.05 was considered

statistically significant. All statistical analyses were conducted using StatView software (SAS, Cary, NC, USA).

3. Results

3.1. Demographic data

Table 1 shows the baseline demographics of all patients. During the 10-year study period, a total of 123 patients with DNI were identified. The pediatric group comprised 15 children (6 males and 9 females), and the adult group comprised 108 patients (71 males and 37 females). The mean age and standard deviation of the pediatric group were 6.2 ± 6.6 years (range, 2 months to 18 years). The mean age and standard deviation of the adult group were 57 ± 16.3 years (range, 20–91 years). In the earlier period (2005–2010), the pediatric group comprised 10 patients, while the adult group comprised 53 patients. In the later period (2011–2015), the pediatric group comprised 5 patients, while the adult group comprised 55 patients.

Concerning disease comorbidity, 34 patients (31%) in the adult group had diabetes mellitus (DM), whereas none of the pediatric patients had DM. Among DM patients, the number of patients in the poor control group (HbA1c $> 8\%$) was 7 in the adult group and 2 in the elderly group. The number of patients in the good control group (HbA1c $< 8\%$) was 14 in the adult group and 7 in the elderly group. In addition, among adult patients, 7 patients had cancers, 2 patients had hematological diseases, 5 patients had autoimmune diseases, 1 patient had chronic kidney disease, and 6 patients had chronic liver diseases.

3.2. Antecedent illness

In the pediatric group, the most common antecedent illness was lymphadenitis (73%), followed by sialoadenitis (13%). Conversely,

Table 1
Baseline characteristics of patients.

	Pediatric group (n = 15)	Adults (n = 108)
(a) Sex		
Female	9 (60%)	37 (34%)
Male	6 (40%)	71 (66%)
(b) Antecedent illness		
Recent URI	0	51 (47%)
Dental infection	1 (7%)	31 (29%)
Sialoadenitis	2 (13%)	9 (8%)
Lymphadenitis	11 (73%)	8 (7%)
Congenital cyst	1 (7%)	2 (2%)
Others or unknown	0	7 (6%)
(c) Stage		
I	7 (47%)	36 (33%)
II	5 (33%)	17 (16%)
IIIa	3 (20%)	33 (31%)
IIIb	0	12 (11%)
IV	0	3 (3%)
Va	0	2 (2%)
Vb	0	5 (5%)
(d) Operative approach		
Puncture only	0	7 (6%)
Intraoral	7 (47%)	24 (22%)
Endonasal	0	1 (1%)
External incision	8 (53%)	76 (70%)
(e) Tracheostomy		
Yes	1 (7%)	58 (54%)
No	14 (93%)	50 (46%)
(f) Morbidity and mortality		
Death	0	3 (3%)
Others morbidities	1 (7%)	8 (7%)

Abbreviation: URI, upper respiratory tract infection.

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