



Original article

Diagnosis and management of deep neck infections in children: the experience of an Italian paediatric centre



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ABSTRACT

Deep neck infection (DNI) is a severe occurrence in children. We've examined the presenting signs and symptoms, the value of single diagnostic procedures, the rate of complications and the impact of the therapeutic options on the final outcome, in children with a DNI.

We retrospectively evaluated patients, aged 0–18 years, who were admitted for a DNI, from January 2006 through December 2012, at Regina Margherita Children's Hospital, Turin, Italy. We subdivided them on the basis of type of treatment: pharmacological treatment alone or antimicrobial treatment plus surgery. An univariate analysis has been performed to examine the differences between the two groups.

Sixty patients (32 males, 28 females) with diagnosis of DNI were enrolled; 33 children only received medical treatment (group 1), whereas 27 patients underwent also surgical interventions (group 2). The mean abscess size was significantly higher in group 2 than in group 1 ($p = 0.01$). The predominant organisms were *Streptococcus* sp. (11 cases, 52.4%, mostly *Streptococcus pyogenes*). The most frequent antibiotic regimen was a β lactam alone (either III generation cephalosporin or amoxicillin/clavulanate). The duration of intravenous antibiotic varied between the two groups, without statistical significance ($p = 0.052$); whereas the oral antibiotic administration was significantly shorter in group 1 than in group 2 ($p = 0.0003$). Three patients (5%) developed complications.

This research confirms that the medical approach, with high doses of intravenous antibiotics for a minimum of 5 days, could be a tolerable and safe option for the treatment of patients with stable condition and/or small DNIs.

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1. Introduction

Deep neck infections (DNIs) are a group of life-threatening diseases localized in the potential spaces and fascial planes of the neck. Deep neck abscesses can be categorized into retro-pharyngeal, peritonsillar, masseteric, pteropalatine maxillary, parapharyngeal, submandibular, parotid and floor of mouth abscesses [1]. Despite the improved diagnostic techniques and the widespread availability of antimicrobial therapy, DNIs are still associated with significant morbidity and mortality rates and represent a diagnostic challenge to emergency physicians, paediatricians and otolaryngologists, because clinical signs and

symptoms often overlap with those of other common clinical pictures (i.e. pharyngitis, tonsillitis and torticollis), particularly in children, in whom physical examination may be more difficult than in adults. In addition, use of analgesic and anti-inflammatory drugs may mask presentations.

DNIs require prompt diagnosis and management to avoid life-threatening complications, such as airway obstruction, cervical necrotizing fasciitis, empyema, mediastinitis, aspiration pneumonia or thrombosis/aneurysm of the carotid artery. However, there are no specific guidelines to outline the best management and treatment of DNIs.

We revised the diagnostic investigations and the outcomes of a series of children admitted to a tertiary care children's hospital for DNIs to evaluate the presenting symptoms and signs, the value of single diagnostic procedures, the rate of complications and the impact of the therapeutic options on the final outcome.

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2. Materials and methods

We retrospectively evaluated all consecutive patients, aged 0–18 years, who were admitted, from January 2006 through December 2012, at a tertiary paediatric Centre, Regina Margherita Children's Hospital, Turin, Italy, for a DNI.

DNIs were defined as infections involving the deep neck spaces [2]. DNIs were divided into peritonsillar (PTA), retropharyngeal (RPA), parapharyngeal (PPA) and mixed, according to the usual literature criteria [3]. In particular, RPA is an infection initially confined to the pharynx and cervical vertebrae that may extend particularly into the superior mediastinum. PPA is localized medially to the space surrounded by pharynx, posteriorly to the carotid sheath and laterally to the muscles of styloid process. The PTA is an infection surrounding the tonsil. Abscesses involving more than one compartment are defined as mixed type [3].

The diagnosis of DNI was made according to clinical and/or radiological findings, such as ultrasound imaging or contrast-enhanced Computed Tomography scan (CT).

Patients with masseteric, pteropalatine maxillary, submandibular, parotid and floor of mouth abscesses were excluded.

All medical records were reviewed for demographic characteristics, presenting signs and symptoms, previous use of antibiotics or anti-inflammatory drugs, laboratory results, clinical evolution, medical treatment and type of surgical drainage (oral or external approach).

According to the literature, the major complications analysed were: respiratory obstruction, mediastinitis, jugular vein thrombosis and sepsis [4].

Final outcomes were categorised as: complete recovery, persistence of infection or relapse, the latter being defined as the reappearance of the infection after clinical remission [3].

Patients were stratified on the basis of type of treatment: pharmacological treatment alone (group 1) or antimicrobial treatment plus surgery (group 2).

Statistical analysis was performed using SPSS 15 for Windows. The differences between groups were analysed using the χ^2 test or the Fisher exact test for categorical data and the *t* test or Mann–Whitney test for continuous data, as appropriate. All tests were two sided and significance was set at *p* value ≤ 0.05 .

3. Results

A total of 60 patients (32 males, 28 females) with diagnosis of DNI were enrolled; their median age was 6.1 years (IQR 3.5–10.5 years). Three children had an underlying heart disease; one chronic renal failure.

Twenty-two children had PTA (36.7%), 19 RPA (31.7%), 13 PPA (21.6%), and 6 (10%) had mixed abscesses.

There was a marked increase in the number of patients with DNIs over the study period with a four-fold enhancement in the last year compared to the first two years of observation. The abscess site varied depending on the patient's age: in the pre scholar age (<4 years) RPAs were more frequent (*n* = 12); from 4 to 10 years, PTA e PPA have a similar incidence (*n* = 9 and *n* = 8 respectively), whereas in pre-adolescent age (age >10 years) PTAs were predominant (*n* = 11).

Thirty-three children only received medical treatment (group 1, 55%), whereas 27 patients underwent also surgical intervention (group 2, 45%). In twenty five (92.6%) patients the surgical intervention had been performed immediately after the radiological confirmation of DNI. This information was not available in two children.

The mean age was not statistically different between the two groups (6.1 \pm 3.4 years vs. 7.5 \pm 4.8 years; *p* = 0.19, see Table 1).

Signs and symptoms at admission are listed in Table 1: fever and pain were present in almost all cases; other common clinical manifestations included neck swelling, pharyngodynia, torticollis, dysphagia and odynophagia. These last ones, together with dyspnoea, were significantly more common in patients who underwent surgical procedures as compared to those who received only antibiotic therapy (*p* = 0.002 and 0.04 respectively), whereas the others had a similar distribution through the two study groups.

Thirty patients were given oral antibiotics (mainly amoxicillin/clavulanate or cephalosporins) before admission. Twenty-five (41.4%) subjects had also been treated with paracetamol, and 23 (38%) with non-steroid antinflammatory drugs.

Radiological evaluation was performed in 54 patients (90%) to establish the precise location and the extension of the infection, whereas 6 patients (admitted between 2006 and 2007) only had a clinical diagnosis. In 20 patients (34.5%), ultrasonography was the first step of investigations. CT was performed in 50 patients (83.3%), and in all cases confirmed clinical suspicion for DNIs.

The abscess diameter was calculated in 46 cases (23 in each group). The mean size was 3.4 \pm 1.6 cm. It was different for every type of DNI: 3.23 cm for PTA, for RPA was 3.78 cm, 2.58 cm for PPA and finally 3.85 cm for mixed ones.

The mean diameter was significantly higher in group 2 than in group 1 (4.0 \pm 1.8 vs. 2.8 \pm 1.2; *p* = 0.01, see Table 1). Twenty-one blood cultures and twenty-seven pus cultures were performed. Three blood cultures (14.3%) yielded a positive result, whereas 18 pus cultures (66.7%) grew pathogens. The predominant organisms were *Streptococcus* sp. (11 cases, 52.4%, mostly *Streptococcus pyogenes*), followed by *Staphylococcus aureus* (3 cases, 14.3%) and *Veillonella* (2 cases, 9.5%). *Mycobacterium scrofulaceum*, *Gemella morbillorum*, *Pseudomonas aeruginosa*, *Bacteroides uniformis*, and *Prevotella melaninogenica* were detected in single patients. In 5

Table 1

Comparison of demographic and clinical data between patients treated with medical and medical plus surgical therapy for deep neck infections.

Characteristics	Group 1 ^a	Group 2 ^b	<i>p</i> value
Age, years (Median, IQR)	5.1 (IQR 3.2–8.9)	7.4 (IQR 3.7–11.3)	0.19
Gender, N (%)			
Male	18 (54.5)	14 (51.9)	0.84
Female	15 (45.5)	13 (48.1)	
Clinical presentation, N (%)			
Fever	32 (97)	23 (85.2)	0.1
Pain	28 (84.8)	23 (85.2)	0.97
Neck swelling	27 (81.8)	19 (70.4)	0.3
Pharyngodynia	23 (70)	18 (66.7)	0.8
Torticollis	21 (63.7)	13 (48.2)	0.23
Dysphagia/odynophagia	10 (30.3)	19 (70.4)	0.002
Trismus	7 (21.2)	7 (26)	0.66
Otodynia	8 (24.2)	3 (11)	0.19
Cutaneous hyperemia	3 (9)	4 (14.8)	0.49
Drooling	1 (3)	4 (14.8)	0.1
Cough	1 (3)	3 (11)	0.21
Dyspnoea	0 (0)	3 (11)	0.04
Site of infection, N (%)			
PTA	12 (36.4)	10 (37)	0.96
RPA	10 (30.3)	9 (33.4)	0.8
PPA	8 (24.2)	5 (18.5)	0.59
Mixed	3 (9.1)	3 (11.1)	0.8
Abscess mean dimension (cm)	2.8 \pm 1.2	4.0 \pm 1.8	0.01
Mean hospital stay (days)	11.5 \pm 6.7	15.9 \pm 10.5	0.054
Mean duration i.v. antibiotic therapy (days)	10.9 \pm 5.9	14.9 \pm 9.6	0.052
Mean duration oral antibiotic therapy (days)	8.5 \pm 4.1	12.7 \pm 4.3	0.0003

IQR: interquartile range, N: number, PTA: peritonsillar abscess, RPA: retropharyngeal abscess, PPA: parapharyngeal abscess, i.v.: intravenous.

^a Group 1: Medical treatment alone.

^b Group 2: Medical plus surgical treatment.

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