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Original Research Article

Clinicopathological Profile and Management of Infective Neck Swellings in Pediatric Patients

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Abstract

Background: Infective neck swellings are frequently encountered in pediatric otorhinolaryngology and may range from uncomplicated cervical lymphadenitis to deep neck space infections requiring urgent intervention. Early diagnosis and appropriate management are essential to prevent complications such as abscess formation, airway compromise, septicemia, and prolonged morbidity.

Aim: To evaluate infective neck swellings in pediatric age group patients who underwent diagnosis and treatment and to assess their clinicopathological profile and management outcomes.

Methods: This hospital-based prospective observational study included 150 pediatric patients presenting with infective neck swellings. Detailed history, clinical examination, laboratory investigations, imaging, microbiological evaluation, fine needle aspiration cytology, and histopathological examination where indicated were performed. Patients were managed conservatively or surgically according to clinical diagnosis, imaging findings, abscess formation, treatment response, and institutional protocol. Data were analyzed using appropriate statistical methods.

Results: The highest proportion of patients belonged to the 1–5 years age group, with 63 cases (42.0%), followed by 49 cases (32.7%) in the 6–10 years age group. Male patients were slightly predominant, accounting for 80 cases (53.3%). Neck swelling was the most common symptom, observed in 138 patients (92.0%), and followed by fever in 76 patients (50.7%) and local pain in 63 patients (42.0%). Among deep neck space infections, submandibular infection was most common, accounting for 24 cases. Suppurative lymphadenopathy was the commonest final diagnosis, accounting for 30 cases (46.2%), followed by Ludwig's angina in 16 cases (24.6%). Surgical intervention was required in 50 of 64 deep neck infection cases, with incision and drainage being the most common modality.

Conclusion: Infective neck swellings are common in pediatric patients, particularly in younger children. Suppurative lymphadenopathy and submandibular space infections represent important clinicopathological entities. Early clinical recognition, appropriate imaging, microbiological evaluation, rational antibiotic therapy, and timely surgical intervention are essential for favorable outcomes.

Keywords: Infective neck swelling, Pediatric cervical lymphadenitis, Deep neck space infection, Pediatric neck abscess.

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Introduction

Neck swellings are a common clinical problem encountered in the pediatric population and encompass a broad spectrum of pathological conditions ranging from congenital anomalies and inflammatory lesions to neoplastic disorders. Among these, infective neck swellings constitute a significant proportion and are frequently encountered in otorhinolaryngology and pediatric surgical practice. The diagnosis and management of infective neck swellings in children remain challenging because of the diverse etiological factors, overlapping clinical presentations, and the potential for rapid progression to life-threatening complications if not recognized and treated promptly [1]. The cervical lymphatic system plays a crucial role in the immune response of children and is often involved in various infectious processes affecting the head and neck region. Cervical lymphadenitis is the most common cause of infective neck swelling in children and may result from bacterial, viral, fungal, or mycobacterial infections. The prevalence of cervical

lymphadenopathy is higher in the pediatric age group due to the increased frequency of upper respiratory tract infections and the heightened immunological activity associated with childhood growth and development [2]. Acute bacterial lymphadenitis is most commonly caused by Staphylococcus aureus and Streptococcus pyogenes, whereas atypical mycobacterial infections and tuberculosis remain important causes in developing countries [3].

Infective neck swellings may arise from various anatomical compartments of the neck and can involve lymph nodes, salivary glands, soft tissues, deep fascial spaces, and congenital cystic lesions that become secondarily infected. Deep neck space infections, although less common, represent a serious subset of infective neck swellings and may lead to airway compromise, mediastinitis, septicemia, and other severe complications. The incidence of deep neck infections in children has shown changing trends due to widespread antibiotic use, improved vaccination coverage, and advancements in diagnostic imaging techniques [4].

Clinical evaluation remains the cornerstone of diagnosis and includes a detailed history, thorough physical examination, and assessment of associated symptoms such as fever, pain, dysphagia, odynophagia, respiratory distress, and constitutional manifestations. However, clinical findings alone are often insufficient to establish the exact etiology. Consequently, laboratory investigations, microbiological studies, ultrasonography, computed tomography (CT), and magnetic resonance imaging (MRI) play important roles in identifying the underlying pathology and guiding treatment decisions [5].

Ultrasonography has emerged as the preferred initial imaging modality in pediatric neck swellings because of its non-invasive nature, absence of ionizing radiation, cost-effectiveness, and ability to differentiate cystic from solid lesions. Advanced imaging techniques such as contrast-enhanced CT and MRI are particularly valuable in evaluating deep neck space infections and determining the extent of disease involvement [6]. Fine needle aspiration cytology (FNAC) has also gained acceptance as a useful diagnostic tool for differentiating infective, inflammatory, and neoplastic lesions, thereby facilitating early management [7].

The microbiological profile of infective neck swellings varies according to geographic location, socioeconomic status, immunization practices, and local epidemiological factors. While aerobic bacteria remain the predominant pathogens in acute infections, anaerobic organisms are frequently implicated in deep neck abscesses. The emergence of antibiotic-resistant strains, particularly methicillin-resistant Staphylococcus aureus (MRSA), has further complicated treatment strategies and necessitated judicious antibiotic selection based on culture and sensitivity reports whenever possible [8].

Management of infective neck swellings in children requires a multidisciplinary approach involving pediatricians, otorhinolaryngologists, radiologists, microbiologists, and surgeons. Early initiation of appropriate antimicrobial therapy remains the mainstay of treatment for most infections. Surgical intervention in the form of incision and drainage is reserved for abscess formation, failure of medical therapy, airway compromise, or diagnostic uncertainty. Recent studies have highlighted the importance of individualized treatment protocols based on clinical severity, imaging findings, and microbiological characteristics to achieve optimal outcomes while minimizing morbidity [9].

Despite advances in diagnostic modalities and antimicrobial therapy, infective neck swellings continue to contribute significantly to pediatric morbidity, especially in resource-limited settings. Delayed presentation, inadequate treatment, recurrent infections, and the presence of underlying systemic conditions may adversely affect prognosis. Therefore, understanding the clinicopathological spectrum and treatment outcomes of infective neck swellings is essential for improving diagnostic accuracy, facilitating early intervention, and reducing complications [10].

The present study was undertaken to evaluate the clinicopathological characteristics, diagnostic modalities, and management outcomes of infective neck swellings in pediatric patients presenting to a tertiary care center. The study aims to provide a comprehensive understanding of the etiological patterns, clinical presentations, pathological findings, and therapeutic approaches employed in the management of these conditions, thereby contributing to improved pediatric healthcare delivery.

Material and Methods

This hospital-based prospective observational study was conducted in the Department of Otorhinolaryngology of a tertiary care teaching hospital over a period of eighteen months. The study was designed to evaluate the clinicopathological profile and management outcomes of infective neck swellings in pediatric patients who underwent diagnostic evaluation and treatment during the study period.

A total of 150 pediatric patients presenting with infective neck swellings were included in the study. The sample size of 150 was determined based on the average patient load presenting to the institution

during the study period and the feasibility of comprehensive clinical and pathological evaluation. Pediatric patients aged from birth to 18 years with clinically suspected infective neck swellings were enrolled consecutively after obtaining informed consent from parents or legal guardians. All enrolled patients underwent detailed history taking with emphasis on age, sex, duration of swelling, associated symptoms, previous episodes, history of upper respiratory tract infections, dental infections, tuberculosis exposure, immunization status, prior antibiotic usage, and relevant medical history. A comprehensive clinical examination was performed to assess the site, size, consistency, tenderness, mobility, fluctuation, skin changes, and associated cervical lymphadenopathy. General physical examination and systemic examination were also carried out to identify any underlying conditions contributing to the infective process.

Routine laboratory investigations including complete blood count, erythrocyte sedimentation rate, C-reactive protein, and relevant biochemical parameters were performed in all patients. Additional investigations such as Mantoux test, sputum examination, and tuberculosis workup were undertaken whenever clinically indicated. Microbiological investigations including pus culture and sensitivity testing were performed in cases with abscess formation or purulent discharge.

Radiological evaluation was carried out using ultrasonography of the neck as the primary imaging modality. Contrast-enhanced computed tomography and magnetic resonance imaging were utilized in selected cases where deep neck space involvement, extensive disease, or diagnostic uncertainty was suspected. Fine needle aspiration cytology was performed in appropriate cases to establish the nature of the lesion and assist in differential diagnosis. Histopathological examination was conducted whenever surgical intervention or excisional biopsy was undertaken.

Patients were managed according to the clinical diagnosis and institutional treatment protocols. Conservative treatment consisted of appropriate antibiotic therapy, anti-inflammatory medications, supportive care, and close clinical monitoring. Surgical management in the form of aspiration, incision and drainage, or excision was performed whenever indicated based on the presence of abscess formation, failure of medical treatment, recurrence, airway compromise, or diagnostic considerations. All patients were followed until resolution of symptoms or completion of treatment.

Data collected during the study were entered into a standardized data collection proforma and subsequently transferred to a computerized database for analysis. Variables studied included demographic characteristics, clinical presentation, anatomical location of swelling, etiological diagnosis, laboratory findings, imaging findings, pathological diagnosis, treatment modality, and duration of hospital stay, complications, and treatment outcomes.

Statistical analysis was performed using Statistical Package for Social Sciences (SPSS) software version 26.0. Continuous variables were expressed as mean ± standard deviation, while categorical variables were presented as frequencies and percentages. Associations between categorical variables were analyzed using the Chi-square test or Fisher's exact test wherever appropriate. Continuous variables were compared using Student's t-test or analysis of variance as applicable. A p-value of less than 0.05 was considered statistically significant. Prior to commencement of the study, approval was obtained from the Institutional Ethics Committee. The study was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki. Written informed consent was obtained from parents or legal guardians of all participating children, and confidentiality of patient information was strictly maintained throughout the study.

Results

The age and gender distribution of pediatric patients with infective neck swellings is shown in Table 1. Out of 150 patients, the highest proportion belonged to the 1–5 years age group (63, 42.0%), followed by the 6–10 years age group (49, 32.7%). Children aged 11–15 years accounted for 23 cases (15.3%), while those below 1 year constituted 15 cases (10.0%). Male patients were slightly predominant with 80 cases (53.3%) compared to 70 females (46.7%). The male predominance was most evident in the 1–5 years age group, which included 35 males and 28 females.

The distribution of deep neck space infections according to age groups is presented in Table 2. Submandibular space infections were the most frequent, accounting for 24 cases, followed by Ludwig's angina with 16 cases. Parotid infections were observed in 11 cases, posterior cervical infections in 7 cases, and submental infections in 6 cases. The majority of deep neck infections occurred in children aged 1–5 years and 6–10 years. Clinical symptomatology among the pediatric patients is summarized in Table 3. Neck swelling was the most common presenting complaint and was observed in 138 patients (92.0%), followed by fever in 76 patients (50.7%) and local pain in 63 patients (42.0%). Dysphagia was reported in 16 patients (10.7%), cough in 12 patients (8.0%), throat pain in 9 patients (6.0%), and toothache in 3 patients (2.0%). Most symptoms were observed with comparable frequencies among

male and female patients. The final diagnosis of deep neck space infections is shown in Table 4. Suppurative lymphadenopathy represented the most common diagnosis with 30 cases (46.2%), followed by Ludwig's angina with 16 cases (24.6%). Acute parotitis accounted for 11 cases (16.9%), while submandibular sialadenitis and submental abscess contributed 8 (12.3%) and 7 (10.8%) cases respectively. Institutional management patterns are presented in Table 5. Surgical intervention was required in the majority of submandibular infections, where 22 of 24 patients underwent operative management. Similarly, all patients diagnosed with Ludwig's angina required surgical treatment. Conservative management was successful in only a limited proportion of deep neck infections, mainly among posterior cervical infections and selected cases of parotid involvement. The modality of treatment among deep neck infections is shown in Table 6. Incision and drainage was the most commonly employed treatment modality, particularly in submandibular infections where it was performed in 13 cases. Conservative treatment was preferred in 9 cases of submandibular infection and 6 cases of parotid infection. Aspiration was utilized in a small number of patients, mainly among submental and posterior cervical infections.

Table 1: Age and Gender Distribution of Infective Neck Swellings (n=150)

Age Group (Years)	Male	Female	Total	Percentage (%)
<1	8	7	15	10.0
1–5	35	28	63	42.0
6–10	25	24	49	32.7
11–15	12	11	23	15.3
Total	80	70	150	100.0

Table 2: Distribution of Deep Neck Space Infections According to Age Groups

Type of Infection	<1 Year	1–5 Years	6–10 Years	11–15 Years	Total
Submental	1	3	2	0	6
Submandibular	3	11	8	2	24
Parotid	1	5	4	1	11
Posterior Cervical	1	2	3	1	7
Ludwig's Angina	0	7	6	3	16
Total	6	28	23	7	64

Table 3: Symptomatology of Infective Neck Swellings in Pediatric Age Group

Symptom	Male	Female	Total	Percentage (%)
Neck Swelling	74	64	138	92.0
Fever	41	35	76	50.7
Local Pain	31	32	63	42.0
Throat Pain	5	4	9	6.0
Dysphagia	8	8	16	10.7
Cough	7	5	12	8.0
Toothache	3	0	3	2.0

Table 4: Distribution of Deep Neck Space Infections According to Final Diagnosis (n=65*)

Final Diagnosis	Number of Cases	Percentage (%)
Suppurative Lymphadenopathy	30	46.2
Ludwig's Angina	16	24.6
Acute Parotitis	11	16.9
Submandibular Sialadenitis	8	12.3
Total	65	100.0

***Multiple clinical categories were consolidated into final diagnostic groups.**

Table 5: Institutional Management among Deep Neck Space Infections

Infection Type	Surgical Management (Yes)	Surgical Management (No)	Total
Submental	5	1	6
Submandibular	22	2	24
Parotid	4	7	11
Posterior Cervical	3	4	7
Ludwig's Angina	16	0	16
Total	50	14	64

Table 6: Modality of Treatment among Deep Neck Space Infections

Infection Type	Conservative	Aspiration	Incision & Drainage	Total
Submental	1	2	3	6
Submandibular	9	2	13	24
Parotid	6	0	5	11
Posterior Cervical	3	1	3	7
Ludwig's Angina	4	0	12	16
Total	23	5	36	64

Discussion

In the present study of 150 pediatric patients with infective neck swellings, the highest proportion of cases was observed in the 1–5 years age group, comprising 63 patients (42.0%), followed by 49 patients (32.7%) in the 6–10 years age group. This indicates that infective neck swellings were more frequent in younger children, which may be related to increased exposure to upper respiratory tract infections, active lymphoid tissue response, and relatively immature host defense mechanisms. The slight male predominance observed in the present study, with 80 males (53.3%) and 70 females (46.7%), is consistent with pediatric head and neck infection studies where male children have shown marginally higher involvement [11].

Neck swelling was the most common presenting symptom in the present study and was observed in 138 patients (92.0%), followed by fever in 76 patients (50.7%) and local pain in 63 patients (42.0%). These findings emphasize that visible cervical swelling remains the most important presenting complaint in pediatric infective neck lesions. However, the presence of fever in only about half of the patients indicates that absence of fever does not exclude significant infective pathology. Similar observations have been reported in pediatric bacterial lymphadenitis and neck infection studies, where clinical presentation may vary from localized swelling to abscess formation requiring intervention [12].

Among deep neck space infections in the present study, submandibular space involvement was the most common, accounting for 24 cases, followed by Ludwig's angina in 16 cases, parotid infection in 11 cases, posterior cervical infection in 7 cases, and submental infection in 6 cases. This distribution highlights the importance of submandibular and related cervical spaces in pediatric infective neck swellings. Pediatric deep neck infections may arise from lymphatic, tonsillar, salivary, odontogenic, or upper respiratory sources, and early imaging is important when deeper space involvement is suspected [13].

The final diagnosis pattern showed that suppurative lymphadenopathy was the commonest diagnosis, accounting for 30 cases (46.2%), followed by Ludwig's angina in 16 cases (24.6%), acute parotitis in 11 cases (16.9%), and submandibular sialadenitis in 8 cases (12.3%). The predominance of suppurative lymphadenopathy supports the role of cervical lymph nodes as a frequent site of infective pathology in children. Recent studies on pediatric neck abscesses have also highlighted that bacterial infection, abscess formation, and changing antimicrobial sensitivity patterns remain important considerations in treatment planning [14].

Management in the present study showed that surgical intervention was required in 50 of 64 deep neck space infection cases, while 14 cases were managed without surgery. Submandibular infections required surgical management in 22 of 24 cases, and all 16 cases of Ludwig's angina required surgical intervention. Incision and drainage was the most frequently used treatment modality, performed in 36 cases, while conservative treatment was used in 23 cases and aspiration in 5 cases. These findings suggest that although medical therapy has a role in selected cases, established abscess formation, severe symptoms, airway risk, and failure of conservative therapy necessitate timely surgical drainage [15].

The present study therefore demonstrates that infective neck swellings in pediatric patients have a broad clinicopathological spectrum, ranging from suppurative lymphadenopathy to potentially serious deep neck space infections. The high frequency of swelling, fever, and pain as presenting features reinforces the need for careful clinical evaluation. The predominance of surgical management among deep neck infections in this study reflects the importance of early recognition of abscess formation and prompt intervention. A structured approach involving clinical assessment, laboratory investigations, imaging, microbiological evaluation, appropriate antibiotics, and surgical drainage when indicated is essential for reducing morbidity and preventing complications in pediatric patients with infective neck swellings.

Conclusion

The present study concludes that infective neck swellings are common in the pediatric age group, particularly among children aged 1–5 years and 6–10 years. A slight male predominance was observed. Neck swelling was the most frequent presenting complaint, followed by fever and local pain. Suppurative lymphadenopathy was the

commonest final diagnosis, while submandibular space infection was the most frequent deep neck space infection. Surgical intervention was required in a large proportion of deep neck infections, especially in submandibular infections and Ludwig's angina.

Early diagnosis, appropriate imaging, microbiological evaluation, rational antibiotic therapy, and timely surgical drainage are essential for achieving favorable outcomes and preventing complications.

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