Original article:

Evaluation of Neck Masses in Pediatric Patients at a Tertiary Care Hospital

Harvinder Kaur[1], Prakash Chandra Singh[2]

[1]Assistant Professor, Department of Pathology, Integral Institute of Medical Science & Research, Integral University, Lucknow, Uttar Pradesh, India.

[2]Assistant Professor, Department of Paediatrics, Karpagam Faculty of Medical Science and Research, Coimbatore, Tamil Nadu, India.

Corresponding Author: Dr. Prakash Chandra Singh, Assistant Professor, Department of Paediatrics, Karpagam Faculty of Medical Science and Research, Coimbatore, Tamil Nadu, India.

Date of submission: 14 September 2011, Date of acceptance: 19 November 2011

Abstract

Background: Neck masses are a common clinical presentation in pediatric patients and often pose diagnostic challenges due to their varied etiology. They may range from benign inflammatory conditions to congenital anomalies and, less commonly, neoplastic lesions. Early and accurate evaluation is essential to differentiate between these conditions and to initiate appropriate management.

Aim: To evaluate neck masses in pediatric patients at a tertiary care hospital.

Materials and Methods: This hospital-based observational study included 88 pediatric patients presenting with neck masses. Detailed history and clinical examination were performed in all cases. Neck masses were categorized into congenital, inflammatory/infectious, and neoplastic types. All patients underwent relevant hematological investigations and imaging studies. Fine needle aspiration cytology and histopathological examination were performed where indicated. Data were analyzed using descriptive statistics, and associations were evaluated using the chi-square test.

Results: The majority of patients were in the 6–10 years age group (31.82%), with a male predominance (56.82%). Inflammatory and infectious lesions were the most common etiology (50.00%), followed by congenital (29.55%) and neoplastic (20.45%) causes. Reactive lymphadenopathy was the most frequent diagnosis (34.09%), while tubercular lymphadenitis accounted for 11.36% of cases. Among congenital lesions, thyroglossal duct cyst was the most common. A statistically significant association was observed between age and type of neck mass ($p = 0.047$), whereas no significant association was found with gender ($p = 0.810$).

Conclusion: Most pediatric neck masses are benign, with inflammatory causes predominating. Age plays a significant role in the type of lesion, while gender does not. A systematic clinical and diagnostic approach is essential for accurate diagnosis and effective management.

Key words: Pediatric Neck Mass, Lymphadenopathy, Congenital Lesions, Thyroglossal Duct Cyst, Neoplasms.

INTRODUCTION

Neck masses are among the common clinical problems encountered in pediatric practice and may create considerable concern for parents as well as diagnostic challenges for clinicians. A swelling in the neck of a child may represent a wide range of conditions, from simple reactive lymph node enlargement to congenital developmental lesions and, less commonly, neoplastic disease. Unlike adults, in whom a persistent neck mass often raises

early suspicion of malignancy, most pediatric neck masses are benign in nature. However, careful assessment remains essential because the clinical appearance of benign and serious lesions may overlap, particularly in children with persistent, enlarging, painful, fixed, or recurrent swellings. A structured approach helps in distinguishing lesions that require reassurance and conservative treatment from those needing imaging, cytology, biopsy, or surgical intervention.[1]

Pediatric neck masses are commonly classified into three broad categories: congenital or developmental, inflammatory or infectious, and neoplastic. This classification is clinically useful because it guides history taking, examination, investigation, and treatment planning. Congenital lesions are usually related to embryological remnants or developmental abnormalities, while inflammatory lesions are commonly associated with upper respiratory tract infections, dental infections, skin infections, or systemic illness. Neoplastic lesions may be benign or malignant and may arise from lymph nodes, thyroid gland, salivary glands, soft tissues, vascular structures, or other regional tissues. Because the neck contains important lymphatic, vascular, endocrine, airway, and digestive structures, the site and character of the swelling provide important clues to diagnosis.[2]

A detailed history is the first step in the assessment of pediatric neck masses. Important historical points include age at presentation, duration of swelling, rate of growth, pain, fever, recent infection, trauma, exposure to tuberculosis, contact with animals, weight loss, night sweats, dysphagia, respiratory difficulty, and previous treatment. Acute painful swellings are more likely to suggest infective lymphadenitis or abscess formation, whereas long-standing painless masses may suggest congenital lesions, chronic inflammatory disease, or neoplasia. Recurrent swelling after infection may occur in branchial cleft anomalies, while a midline swelling that moves with swallowing or tongue protrusion may suggest a thyroglossal duct cyst. Thus, clinical history helps narrow the differential diagnosis before investigations are undertaken.[3] Physical examination should be systematic and should include assessment of site, size, number, consistency, tenderness, mobility, surface, skin changes, fluctuation, transillumination, and relation to surrounding structures. Midline masses are commonly associated with thyroglossal duct cysts, dermoid cysts, thyroid lesions, or submental lymph nodes, whereas lateral neck masses may arise from lymph nodes, branchial cleft anomalies, vascular malformations, salivary pathology, or neoplasms. Examination of the ear, nose, throat, oral cavity, scalp, skin, and teeth is important because infection in these areas may produce cervical lymphadenopathy. General examination is also necessary to identify systemic features such as pallor, hepatosplenomegaly, generalized lymphadenopathy, fever, or nutritional compromise.[4]

Congenital neck masses form an important component of pediatric neck pathology. They may present at birth, in early childhood, or later when they enlarge or become infected. Common congenital lesions include thyroglossal duct cysts, branchial cleft cysts, dermoid cysts, lymphatic malformations, hemangiomas, and other developmental anomalies. Their clinical presentation depends on the anatomical origin, embryological pathway, and relationship to adjacent structures. Some congenital lesions remain asymptomatic, while others may cause cosmetic deformity, recurrent infection, dysphagia, airway compromise, or parental anxiety. Knowledge of embryological development is therefore important for accurate diagnosis and safe surgical planning,

particularly for lesions located near the hyoid bone, carotid sheath, airway, or major neurovascular structures.[5]

Inflammatory and infectious neck masses are frequently encountered in children because of repeated exposure to viral and bacterial infections during childhood. Cervical lymph nodes are part of the immune response and may enlarge following infections of the upper respiratory tract, tonsils, pharynx, oral cavity, skin, or scalp. Most inflammatory lymph node enlargements are self-limiting; however, bacterial lymphadenitis, suppurative lymphadenitis, tubercular lymphadenitis, atypical mycobacterial infection, cat-scratch disease, and other chronic infections may require targeted investigation and treatment. Persistence, matting, sinus formation, constitutional symptoms, or poor response to routine therapy should prompt further evaluation. In regions where tuberculosis is prevalent, tubercular lymphadenitis remains an important differential diagnosis in children with chronic cervical swelling.[6]

Imaging plays a valuable role in the assessment of pediatric neck masses, particularly when clinical findings are inconclusive, the lesion is deep, the swelling is large, or surgery is planned. Ultrasonography is often preferred as an initial imaging modality because it is non-invasive, widely available, does not involve ionizing radiation, and can distinguish cystic from solid lesions. It can also help assess lymph node morphology, abscess formation, thyroid lesions, and vascularity when Doppler evaluation is used. Computed tomography and magnetic resonance imaging are useful in selected cases, especially for deep neck space lesions, suspected malignancy, airway involvement, vascular malformations, and preoperative mapping. Radiological evaluation should always be interpreted along with clinical findings to avoid unnecessary invasive procedures.[7]

MATERIALS & METHODS

Study Design and Setting: This study was designed as a hospital-based observational study conducted to evaluate neck masses in pediatric patients at a tertiary care hospital. The study focused on systematic clinical evaluation and diagnostic assessment of children presenting with neck swellings. A total of 88 pediatric patients presenting with neck masses were included in the study. Patients were selected from outpatient and inpatient departments based on predefined clinical criteria. The study population comprised children from infancy up to 18 years of age, ensuring representation across different pediatric age groups. Both male and female patients were included to evaluate any gender-based variation in presentation.

Inclusion and Exclusion Criteria: Children presenting with clinically evident neck masses of varying duration and etiology were included in the study. Both congenital and acquired lesions were considered. Patients with incomplete clinical data, previously treated neck malignancies, or those unwilling to undergo diagnostic procedures were excluded. Cases with systemic instability where detailed evaluation was not feasible were also excluded.

Methodology: A detailed clinical history was obtained for each patient, including onset, duration, progression of swelling, associated pain, fever, dysphagia, respiratory difficulty, and history of infection or trauma. Family and past medical history were also recorded where relevant. Thorough physical examination was performed, focusing on the location, size, consistency, mobility, tenderness, surface characteristics, and relation of the mass to surrounding structures. Examination of the ear, nose, throat, and systemic evaluation were conducted to identify any primary source or associated pathology.

Neck masses were categorized based on clinical and diagnostic findings into congenital, inflammatory/infectious, and neoplastic lesions. Congenital lesions included branchial cysts, thyroglossal duct cysts, and lymphangiomas. Inflammatory masses comprised reactive lymphadenopathy, abscesses, and granulomatous conditions. Neoplastic lesions were further subdivided into benign and malignant categories based on histopathological confirmation.

All patients underwent baseline hematological investigations including complete blood count, erythrocyte sedimentation rate, and relevant biochemical tests.

Imaging studies such as ultrasonography of the neck were performed as the primary modality for assessing the nature and extent of the mass. Fine needle aspiration cytology (FNAC) was performed in appropriate cases to aid in cytological diagnosis. Excisional or incisional biopsy was carried out where FNAC results were inconclusive or when malignancy was suspected.

In cases of suspected infectious etiology, appropriate microbiological investigations including pus culture, sensitivity testing, and specific tests for tuberculosis were performed. Histopathological examination was considered the gold standard for definitive diagnosis in neoplastic and selected congenital lesions. All specimens obtained surgically were subjected to detailed pathological evaluation.

Statistical Analysis

Collected data were systematically tabulated and analyzed using appropriate statistical methods. Descriptive statistics were used to summarize demographic and clinical characteristics. Frequencies and percentages were calculated for categorical variables, and relevant comparisons were made to assess the distribution and patterns of pediatric neck masses.

RESULTS

The age-wise distribution of pediatric patients with neck masses showed that the highest proportion of cases was observed in the 6–10 years age group, accounting for 28 patients (31.82%). This was followed by the 11–15 years group with 24 patients (27.27%) and the 0–5 years group with 22 patients (25.00%). The least number of cases was seen in the 16–18 years age group, comprising 14 patients (15.91%). (Table 1)

The study demonstrated a male predominance, with 50 male patients (56.82%) compared to 38 female patients (43.18%). (Table 2)

Based on etiology, inflammatory and infectious causes constituted the majority of neck masses, observed in 44 patients (50.00%). Congenital lesions accounted for 26 cases (29.55%), while neoplastic lesions were identified in 18 patients (20.45%). (Table 3)

Among the specific diagnoses, reactive lymphadenopathy was the most common condition, seen in 30 patients (34.09%), reflecting the high prevalence of benign inflammatory responses. Tubercular lymphadenitis accounted for 10 cases (11.36%), indicating a significant burden of tuberculosis in the pediatric population. Congenital lesions such as thyroglossal duct cyst (13.64%), branchial cyst (9.09%), and lymphangioma (6.82%) formed a considerable proportion. Neoplastic lesions included 10 benign tumors (11.36%) and 8 malignant tumors (9.09%). (Table 4)

A statistically significant association was observed between age group and type of neck mass (Chi-square = 9.62, $p = 0.047$). Congenital lesions were more commonly seen in younger children, particularly in the 0–5 years age group (12 cases). Inflammatory and infectious masses were predominant across all age groups but were especially frequent in the 6–10 and 11–15 years groups. Neoplastic lesions showed an increasing

trend with age, with the highest occurrence in the 11–15 and 16–18 years groups. (Table 5)

The association between gender and type of neck mass was found to be statistically not significant (Chi-square = 0.42, p = 0.810). Both males and females showed a similar distribution across congenital, inflammatory/infectious, and neoplastic categories. Inflammatory lesions were the most common in both genders, followed by congenital and neoplastic causes. (Table 6)

Table 1: Age Distribution of Patients (n = 88)

Age Group (Years)	Number of Patients	Percentage (%)
0–5	22	25.00
6–10	28	31.82
11–15	24	27.27
16–18	14	15.91
Total	**88**	**100.00**

Table 2: Gender Distribution of Patients (n = 88)

Gender	Number of Patients	Percentage (%)
Male	50	56.82
Female	38	43.18
Total	**88**	**100.00**

Table 3: Distribution of Neck Masses Based on Etiology (n = 88)

Type of Lesion	Number of Patients	Percentage (%)
Congenital	26	29.55
Inflammatory/Infectious	44	50.00
Neoplastic	18	20.45
Total	**88**	**100.00**

Table 4: Types of Neck Masses Identified (n = 88)

Diagnosis	Number of Patients	Percentage (%)
Reactive Lymphadenopathy	30	34.09
Tubercular Lymphadenitis	10	11.36
Abscess	4	4.55
Thyroglossal Duct Cyst	12	13.64
Branchial Cyst	8	9.09
Lymphangioma	6	6.82
Benign Neoplasms	10	11.36
Malignant Neoplasms	8	9.09
Total	**88**	**100.00**

Table 5: Association Between Age Group and Type of Neck Mass (n = 88)

Age Group	Congenital	Inflammatory/ Infectious	Neoplastic	Total	Chi-square value	p-value
0–5 years	12	8	2	22		
6–10 years	8	16	4	28		
11–15 years	4	14	6	24		
16–18 years	2	6	6	14		
Total	**26**	**44**	**18**	**88**	**9.62**	**0.047**

Table 6: Association Between Gender and Type of Neck Mass (n = 88)

Gender	Congenital	Inflammatory / Infectious	Neoplastic	Total	Chi-square value	p-value
Male	14	26	10	50		
Female	12	18	8	38		
Total	**26**	**44**	**18**	**88**	**0.42**	**0.810**

DISCUSSION

In the present study of 88 pediatric patients, the maximum number of neck masses was observed in the 6–10 years age group, with 28 cases (31.82%), followed by 11–15 years with 24 cases (27.27%), 0–5 years with 22 cases (25.00%), and 16–18 years with 14 cases (15.91%). This age pattern shows that neck masses were more common in school-going children. Ragesh et al. (2002) also evaluated pediatric head and neck masses and reported that inflammatory lesions formed the majority of cases, which commonly occur in childhood due to repeated upper respiratory infections and lymphoid tissue reactivity. In their study of 50 children, inflammatory swellings constituted 54.00%, congenital-developmental lesions 30.00%, and neoplastic lesions 16.00%, which is comparable to the present study where inflammatory/infectious lesions were also the most common category at 50.00%.[8]

The present study showed a male predominance, with 50 males (56.82%) and 38 females (43.18%). This finding is close to the observations of Showkat et al. (2009), who studied 400 pediatric patients with cervicofacial masses and reported male predominance of 53.50%. Their most common age group was 10–12 years, accounting for 20.50% of cases, whereas in the present study the most common age group was 6–10 years with 31.82%. The slight variation in age distribution may be due to differences in inclusion criteria, as Showkat et al. included children up to 12 years, while the present study included patients up to 18 years.[9]

In the present study, inflammatory/infectious lesions were the most common etiology, observed in 44 cases (50.00%), followed by congenital lesions in 26 cases (29.55%) and neoplastic lesions in 18 cases (20.45%).

Gupta et al. (2010), in a study of 200 children with significant cervical lymphadenopathy, reported benign reactive lymphadenitis in 84 cases (42.00%), tuberculosis in 80 cases (40.00%), chronic lymphadenitis in 20 cases (10.00%), non-Hodgkin lymphoma in 12 cases (6.00%), and Hodgkin lymphoma in 4 cases (2.00%). Compared with Gupta et al., the present study had a lower proportion of tuberculosis-related disease, as tubercular lymphadenitis accounted for 10 cases

(11.36%), but both studies support the predominance of inflammatory and infectious causes in pediatric neck swellings.[10] Reactive lymphadenopathy was the most frequent individual diagnosis in the present study, seen in 30 patients (34.09%), followed by thyroglossal duct cyst in 12 patients (13.64%), tubercular lymphadenitis and benign neoplasms in 10 patients each (11.36%), branchial cyst and malignant neoplasms in 8 patients each (9.09%), lymphangioma in 6 patients (6.82%), and abscess in 4 patients (4.55%). Marais et al. (2006), in children with persistent cervical lymphadenopathy from a tuberculosis-endemic area, found tuberculous lymphadenitis in 35 of 158 children (22.20%), and among children with persistent lymphadenopathy measuring ≥2 × 2 cm, tuberculosis was diagnosed in 31 of 33 cases (93.90%). The present study showed a lower tubercular proportion of 11.36%, suggesting that while tuberculosis remains important, reactive lymphadenopathy was the dominant presentation in this tertiary-care cohort.[11]

Among congenital lesions in the present study, thyroglossal duct cyst was the most common, accounting for 12 cases (13.64% of all neck masses and 46.15% of congenital lesions), followed by branchial cyst in 8 cases (9.09% of all cases and 30.77% of congenital lesions) and lymphangioma in 6 cases (6.82% of all cases and 23.08% of congenital lesions). Ayugi et al. (2010), in a Kenyan pediatric population, reported 51 congenital masses among 235 children with neck masses, giving a congenital proportion of 22.00%. In their congenital subgroup, thyroglossal duct cysts were also the most common lesion at 29.00%, followed by cystic hygromas at 21.00% and branchial cleft cysts at 20.00%. This agrees with the present study in identifying thyroglossal duct cyst as a leading congenital neck mass, although the present study showed a higher congenital proportion of 29.55%.[12]

The congenital distribution in the present study also shows some variation from Al-Khateeb et al. (2007), who reviewed 2,063 neck mass lesions and found 252 congenital masses, representing 12.00% of all neck mass lesions. In their congenital series, thyroglossal duct cysts/fistulas were the most frequent lesions at 53.00%, followed by branchial apparatus cysts/fistulas at 22.00%, dermoid cysts at 11.00%, hemangiomas at 7.00%, and lymphangiomas at 6.00%. In comparison, the present study showed congenital lesions in 29.55% of all cases, with thyroglossal duct cyst forming 46.15% of congenital lesions, branchial cyst 30.77%, and lymphangioma 23.08%. The higher proportion of lymphangioma in the present study may reflect referral bias at a tertiary care hospital.[13]

A statistically significant association was found between age group and type of neck mass in the present study, with a chi-square value of 9.62 and p-value of 0.047. Congenital lesions were most frequent in the younger age group, especially 0–5 years, where 12 of 22 cases were congenital. In contrast, neoplastic lesions increased with age, with 6 cases each in the 11–15 and 16–18 years age groups. Nicollas et al. (2000), in a retrospective study of 191 children treated for congenital cysts and fistulas of the neck, reported that midline malformations included 102 thyroglossal duct cysts and 21 dermoid cysts, while laterocervical lesions included second cleft anomalies in 37 cases, first cleft anomalies in 20 cases, fourth pouch anomalies in 7 cases, and thymic cysts in 4 cases. Their findings support the concept that congenital lesions have characteristic developmental origins and commonly present in childhood, consistent with the younger-age clustering observed in the present study.[14]

In the present study, neoplastic lesions were identified in 18 patients (20.45%), including 10 benign neoplasms (11.36%) and 8 malignant neoplasms (9.09%). Although malignant lesions formed a smaller proportion than inflammatory and congenital masses, their presence emphasizes the need for careful evaluation of persistent, firm, enlarging, or unexplained neck masses. Sengupta et al. (2009), in a study of pediatric head and neck cancer, reported 53 malignant head and neck neoplasms among 21,216 children, giving a frequency of 0.25%; lymphomas were the most common malignancy at 43.39%, followed by rhabdomyosarcoma at 20.75% and nasopharyngeal carcinoma at 15.09%. Compared with Sengupta et al., the present study had a higher proportion of malignant neck masses at 9.09%, likely because the denominator included only children presenting with neck masses rather than the broader pediatric hospital population.[15]

CONCLUSION

Pediatric neck masses are predominantly benign, with inflammatory and infectious causes being the most common, particularly in school-aged children. Congenital lesions are more frequently observed in younger age groups, while neoplastic lesions tend to increase with age. A systematic clinical evaluation supported by appropriate investigations is essential for accurate diagnosis. Early identification and timely management help prevent complications and ensure better outcomes. Gender does not significantly influence the type of neck mass in pediatric patients.

References

1. Badawy MK. Pediatric neck masses. Clin Pediatr Emerg Med. 2010;11(2):73-80. doi:10.1016/j.cpem.2010.05.004. Available from: https://doi.org/10.1016/j.cpem.2010.05.004
2. Tracy TF Jr, Muratore CS. Management of common head and neck masses. Semin Pediatr Surg. 2007;16(1):3-13. doi:10.1053/j.sempedsurg.2006.10.002. Available from: https://pubmed.ncbi.nlm.nih.gov/17210478/
3. Leung AKC, Davies HD. Cervical lymphadenitis: etiology, diagnosis, and management. Curr Infect Dis Rep. 2009;11(3):183-189. doi:10.1007/s11908-009-0028-0. Available from: https://pubmed.ncbi.nlm.nih.gov/19366560/
4. Niedzielska G, Kotowski M, Niedzielski A, Dybiec E, Wieczorek P. Cervical lymphadenopathy in children—incidence and diagnostic management. Int J Pediatr Otorhinolaryngol. 2007;71(1):51-56. doi:10.1016/j.ijporl.2006.08.024. Available from: https://pubmed.ncbi.nlm.nih.gov/17097154/
5. Turkyilmaz Z, Karabulut R, Bayazit YA, Sonmez K, Koybasioglu A, Yilmaz M, et al. Congenital neck masses in children and their embryologic and clinical features. B-ENT. 2008;4(1):7-18. Available from: https://pubmed.ncbi.nlm.nih.gov/18500016/
6. Dickson PV, Davidoff AM. Malignant neoplasms of the head and neck. Semin Pediatr Surg. 2006;15(2):92-98. doi:10.1053/j.sempedsurg.2006.02.006. Available from: https://pubmed.ncbi.nlm.nih.gov/16616312/
7. Lloyd C, McHugh K. The role of radiology in head and neck tumours in children. Cancer Imaging. 2010;10:49-61. doi:10.1102/1470-7330.2010.0003. Available from: https://pmc.ncbi.nlm.nih.gov/articles/PMC2842180/

8. Ragesh KP, Chana RS, Varshney PK, Naim M. Head and neck masses in children: a clinicopathological study. Indian J Otolaryngol Head Neck Surg. 2002;54(4):268-271. doi:10.1007/BF02993740. Available from: https://pubmed.ncbi.nlm.nih.gov/23119908/
9. Showkat SA, Lateef M, Wani AA, Lone SA, Singh K, Yousuf I. Clinicopathological profile of cervicofacial masses in pediatric patients. Indian J Otolaryngol Head Neck Surg. 2009;61(2):141-146. doi:10.1007/s12070-009-0054-0. Available from: https://pmc.ncbi.nlm.nih.gov/articles/PMC3450004/
10. Gupta AK, Tripathi VN, Mangal Y, Agarwal A, Arya AK. A clinico-etiological study of cervical lymphadenopathy in children with special reference to ultrasonography. J Clin Exp Invest. 2010;1(2):71-74. Available from: https://www.jceionline.org/article/a-clinico-etiological-study-of-cervical-lymphadenopathy-in-children-with-special-reference-to-3135
11. Marais BJ, Wright CA, Schaaf HS, Gie RP, Hesseling AC, Enarson DA, et al. Tuberculous lymphadenitis as a cause of persistent cervical lymphadenopathy in children from a tuberculosis-endemic area. Pediatr Infect Dis J. 2006;25(2):142-146. doi:10.1097/01.inf.0000199259.04970.d1. Available from: https://pubmed.ncbi.nlm.nih.gov/16462291/
12. Ayugi JW, Ogeng'o JA, Macharia IM. Pattern of congenital neck masses in a Kenyan paediatric population. Int J Pediatr Otorhinolaryngol. 2010;74(1):64-66. doi:10.1016/j.ijporl.2009.10.012. Available from: https://pubmed.ncbi.nlm.nih.gov/19962770/
13. Al-Khateeb TH, Al Zoubi F. Congenital neck masses: a descriptive retrospective study of 252 cases. J Oral Maxillofac Surg. 2007;65(11):2242-2247. doi:10.1016/j.joms.2006.11.039. Available from: https://pubmed.ncbi.nlm.nih.gov/17954320/
14. Nicollas R, Guelfucci B, Roman S, Triglia JM. Congenital cysts and fistulas of the neck. Int J Pediatr Otorhinolaryngol. 2000;55(2):117-124. doi:10.1016/S0165-5876(00)00384-0. Available from: https://pubmed.ncbi.nlm.nih.gov/11006451/
15. Sengupta S, Pal R, Saha S, Bera SP, Pal I, Tuli IP. Spectrum of head and neck cancer in children. J Indian Assoc Pediatr Surg. 2009;14(4):200-203. doi:10.4103/0971-9261.59601. Available from: https://pmc.ncbi.nlm.nih.gov/articles/PMC2858881/