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RESEARCH ARTICLE

FINE NEEDLE ASPIRATION CYTOLOGY (FNAC) AS A DIAGNOSTIC TOOL IN CERVICAL LYMPHADENOPATHY IN PAEDIATRIC POPULATION

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ABSTRACT

Background: Lymphadenopathy (LAP) is a commonly encountered clinical problem in the pediatric population which has a multitude of causes. Cervical lymphadenopathy is the commonest form of peripheral lymphadenopathy and is a major concern amongst the parents. Fine needle aspiration cytology (FNAC) of lymph node has become an integral part of the initial diagnosis and management of patients with lymphadenopathy due to early availability of results, simplicity, and minimal trauma with less complication.

Materials and method: All children upto the age of 16 years presenting to the Department of Pediatric Surgery, Pt. B. D. Sharma, PGIMS Rohtak, Haryana, India with LAP of the neck and head were included in the study group. Lymph nodes that were enlarged more than 10 mm in the cervical, submental, and submandibular region, and 5 mm in the suboccipital, preauricular and postauricular region, were accepted as LAP. LAP that lasted less than 4 weeks was termed as acute LAP and 4 weeks or more as chronic LAP.

Results: Among all groups, 57.6% (n = 568) were girls, and the maximum number of cases were in 5-10 age group with mean age 7 years and female: male ratio of 1.35:1. 15.4% pre-cervical, 36.3% submandibular, 25.7% post cervical, 19.9% retroauricular and 02.7% supraclavicular. Patients were divided into two groups: patients with no malignancy (group 1; n=782), and patients with malignancy (group 2; n=204). Five hundred seventy three patients (58.1%) had acute LAP and 41.8% (n = 413) had chronic symptoms. Mean lymph node size was 27.5 ± 5.8 mm in group 1 and 29.2 ± 5.0 mm in group 2. The commonest cause of lymphadenopathy in children was reactive hyperplasia followed by tuberculosis

Conclusion: A thorough clinical history, examination (both local and systemic), routine and some special investigations should be considered to arrive at the diagnosis of paediatric cervical lymphadenopathy. FNAC is an accurate diagnostic technique in diagnosing various etiologies of lymphadenopathy. It provides a reliable, safe, rapid and economical method of investigating lymph node enlargement, the accuracy of which approaches that of other diagnostic procedures.

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INTRODUCTION

Lymphadenopathy (LAP) is a commonly encountered clinical problem in the paediatric population which has a multitude of causes. Cervical lymphadenopathy is the commonest form of peripheral lymphadenopathy and is a major concern amongst the parents. (Olu-eddo and Omoti, 2011) Lymph nodes react to a new antigen with hyperplasia, which is more pronounced in children. (Gosche and Vick, 2006; Leung and Robson, 2004) LAP is often caused by infectious diseases, but malignancies, autoimmune diseases, and chronic inflammatory processes may also be one of the reasons. Mostly self- limited acute upper respiratory viral infections in children may lead to LAP and it regresses spontaneously. Some infections may also cause chronic LAPs. Malignancies that present with LAP may be primary or metastasis. Malignant lymph nodes may enlarge in a rash or with a slow course. Hodgkin's lymphoma (HL) shows slow progress in lymph node size, but Non-Hodgkin's lymphoma (NHL) is abrupt. Some clues may be helpful to differentiate benign causes from malignant. Supraclavicular lymphadenopathy is mostly malignant; whereas LAP with concomitant maculopapulary rash is often benign. (Leung and Robson, 2004; Stutchfield and Tyrrell, 2011; Twist and Link, 2002) While a careful history and thorough physical examination can help identify the cause of lymphadenopathy, pathological examination is the definitive diagnostic test. Fine

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needle aspiration cytology (FNAC) of lymph node has become an integral part of the initial diagnosis and management of patients with lymphadenopathy due to early availability of results, simplicity, and minimal trauma with less number of complications. (Keith *et al*., 2007) It offers an accurate diagnosis and avoids the need of excisional biopsy in most of the cases and facilitates early initiation of therapy. (Howlett *et al*., 2007) The diagnosis of metastatic tumor to the lymph node on cytological smear is crucial and highly reliable. This would be the sole indication for searching the primary tumor, especially in cases of occult carcinoma. (Kollur and El Hag, 2003) However, in most of these cases, the primary tumor is clinically known and FNAC is used widely for the follow up of these patients. Most of metastatic carcinoma can be identified by their cytomorphological characteristics alone. However, there are certain instances where features of different tumors overlap and the precise diagnosis of the primary tumor remains obscure. (Al-Mulhim *et al*., 2004)

Ancillary techniques, such as immunocytochemistry, are used to overcome these difficulties and support the cytodiagnostic interpretation. (Haque and Talukder, 2003) FNAC is used mainly to assess the staging of primary lymphoid malignancies as well as to recognize the residual and recurrent lymphoid malignancies. However, the role of FNAC for the initial diagnosis and subclassification of primary lymphoid malignancy is still controversial and the cytological diagnosis of lymphoma on FNAC is still very often followed by tissue biopsy in most cases. (Jeffers *et al*., 1998) However, the latest World Health Organization (WHO) lymphoma classification is based not only on the architectural pattern, but also on cellular morphology, phenotype, and genotype of malignant lymphoid cells; and all of these can be assessed on cytology. Therefore, FNAC in combination with immunophenotypic and genotypic studies is gaining respect in providing an accurate diagnosis of malignant lymphoma in selected risk patients. Inspite of remarkable advances made in diagnostic procedures, the fine needle aspiration cytology is still occupying the significant role for diagnosing the etiology of cervical lymphadenopathy. (Troxell *et al*., 2005)

The purpose of this study was to evaluate the patients with cervical LAP in a general pediatric setting by FNAC and study the spectrum of diagnosis in patients presenting with significant lymphadenopathy. Here, we report our experience of 986 cases of lymphadenopathy diagnosed by FNAC.

MATERIALS AND METHODS

This prospective study was performed in children presenting to the Department of Pediatric Surgery, Pt. B. D. Sharma, PGIMS Rohtak, Haryana, India which is a tertiary care centre of North India. Informed consent was obtained from parents of all participants. The study comprised of FNAC of lymph nodes of 986 cases in pediatric age group between 0-16yrs with lymphadenopathy, who attended the OPD during the period between Jan 2015 to December 2016. On approach, detailed history, thorough examination and routine investigations were done. FNAC was carried out in all cases on significant lymph nodes. Fixed smears were stained with MAY-Grunwald Giemsa stain. Final smear was reported after correlating the clinical data and other investigations. Masses of thyroid, salivary glands, thyroglossal cyst, branchial cyst, dermoid cyst were excluded.

The study group and inclusion criteria

All children upto the age of 16 years with LAP of the neck and head were included in the study group. Lymph nodes that were enlarged more than 10 mm in the cervical, submental, and submandibular region, and 5 mm in the suboccipital, preauricular and postauricular region, were accepted as LAP. Any palpable lymph node in the supraclavicular region was accepted as LAP. (Stutchfield and Tyrrell, 2011; Alison, 2008) LAP that lasted less than 4 weeks was termed as acute LAP and 4 weeks or more as chronic LAP. Patients with any swelling other than lymph node, chronic disease, who were treated or diagnosed in another clinic, or had lymph node enlargement that did not fulfill our LAP criteria were not included in the study. An annexure form was used to collect the following information: age, sex, start date of symptoms, history of travel, animal contact, tuberculosis contact, immunization, B symptoms for lymphoma, medication causing LAP (e.g., phenytoin, allopurinol, valproic acid), dental symptoms and history of upper or low respiratory tract infections. LAP was classified depending on location, size, and existence of inflammation findings (redness on the skin, pain on palpation, tenderness and raised local temperature), relationship with peripheral tissue, like as fixed or not, and consistency. LAP was grouped depending on its consistency as soft, rubbery or hard. Other signs like arthritis, splenomegaly or rash were noted. B symptoms include: fever greater than 38.8C with no known cause, drenching night sweats, and unintentional weight loss of more than 10% of body weight over a period of 6 months or less. Presence of any of these was accepted as B symptom positive. Patients who left study for any reason before 8 weeks were excluded. Ethical committee approval was not taken as it was not necessary due to the nature and design of the study but the written informed consent was taken from the parents of all the patients included in the study.

Laboratory tests

Investigation of haemogram (CBC), C-reactive protein (CRP), ESR, LDH, serum uric acid level, and blood smear were routinely performed on all patients. Other diagnostic tests such as throat cultures, viral serological analysis, ultrasonography of LAP, tuberculin skin test, bone marrow aspiration, and excisional biopsy were undertaken if necessary. Patients were followed-up for 8 weeks after the diagnosis. If there was no suspicion of malignancy after the first-step evaluation, we treated patients with appropriate antibiotics against probable Gram-positive bacteria such as amoxicillin, amoxicillin–clavulanate, cefuroxime or ampicillin–sulbactam for 14 days and called them for a follow-up check afterwards. If there was no regression after two weeks, the patients underwent further examinations like tuberculin skin test, ultrasonography, chest radiography, and serology for EBV, CMV, Parvovirus B19, and Mycoplasma pneumonia. If there was still no suspicion for malignancy after re-evaluation, we followed-up the patient routinely. Uric acid, CRP, and LDH enzyme activities were measured.

Radiologic investigations

Bilateral submandibular, submental, postauricular and preauricular nodes, posterior cervical triangle, midjugular chain area and lower jugular chain area were checked. Long axis/short axis ratio of lymph node (L/S), echogenicity of hilum, vascular pattern were checked on ultrasonography of

the neck. If L/S was around 1 and there was deformation, irregular margins, and/or chaotic vascular patterns on echogenicity, these were defined as compatible with malignancy. (Steinkamp *et al*., 1994)

RESULTS

Nine hundred and eighty six (986) patients were enrolled in the study. Among all groups, 57.6% (n = 568) were girls, and the maximum number of cases were in 5-10 age group with mean age 7 years and female: male ratio of 1.35:1. (Table 1)

Table 1. Age and sex distribution of cases

Age (years)	BOYS	GIRLS	TOTAL	Percentage
0-1	65	108	173	17.5
1-5	160	156	316	32.0
5-10	145	215	360	36.5
10-14	48	89	137	14.0
Total	418	568	986	100

LAP was found in the following locations:

15.4% pre-cervical, 36.3% submandibular, 25.7% post cervical, 19.9% retroauricular and 02.7% supraclavicular. (Table 2)

Table 2. Anatomical distribution of Lymphadenopathy

Site	Unilateral	Bilateral	Total	Percentage
Precervical	127	25	152	15.4
Submandibular	345	13	358	36.3
Post cervical	165	89	254	25.7
Retro-auricular	148	48	196	19.9
Supraclavicular	24	02	26	2.7
Total	809	177	986	100

Patients were divided into two groups: patients with no malignancy (group 1; n=782), and patients with malignancy (group 2; n=204). Five hundred seventy three patients (58.1%) had acute LAP and 41.8% (n = 413) had chronic symptoms. Mean lymph node size was 27.5 ± 5.8 mm in group 1 and 29.2 ± 5.0 mm in group 2. Three hundred and five (30.9%) patients had a history of infection. The consistency of lymph nodes were 34.3% (n = 336) hard, 21.7% (n = 214) rubbery, and 45.2% (n = 446) generally soft. Lymph nodes in group 1 were mostly soft, whereas they were more frequently hard in group 2. B symptoms were found in 20 patients (2.1%). Existence of B symptoms was more common in group 2. (Table 3)

Table 3. Clinical features of group I and II

	Total	Group i	Group ii
Size			
<2 cm	584	565	19
>2 cm	402	217	185
Onset of symptoms			
<4 weeks	573	389	184
>4 weeks	413	393	20
H/o infection	305	293	12
Consistency			
Hard	336	142	194
Rubbery	214	201	13
Soft	446	439	07
B symptoms	20	04	16

The commonest cause of lymphadenopathy in children was reactive hyperplasia (Figure 1) followed by tuberculosis (Figure 2). (Table 4)

Table 4. Diagnosis on FNAC

	No. of cases (n=986)	Percentage (n=100%)
Infectious diseases		
Tubercular	199	20.1
Non tubercular	106	10.7
Noninfectious diseases		
Reactive hyperplasia	469	47.6
Kikuchi	04	0.4
Rosai- dorfmann	02	0.2
Kawasaki disease	01	0.1
Familial fever syndromes	01	0.1
Malignancies		
Hodgkin lymphoma	14	1.5
Non-hodgkin lymphoma	36	3.7
Acute leukemia		
Hemophagocytosis	150	15.2
	04	0.4

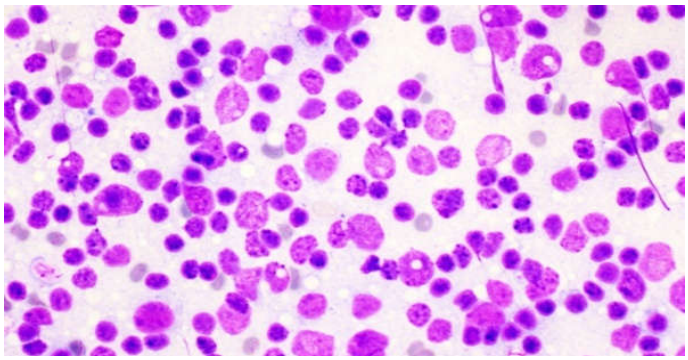

Figure 1. Reactive hyperplsia: lymphoid cells in various stages of maturation (leishman, 100x)

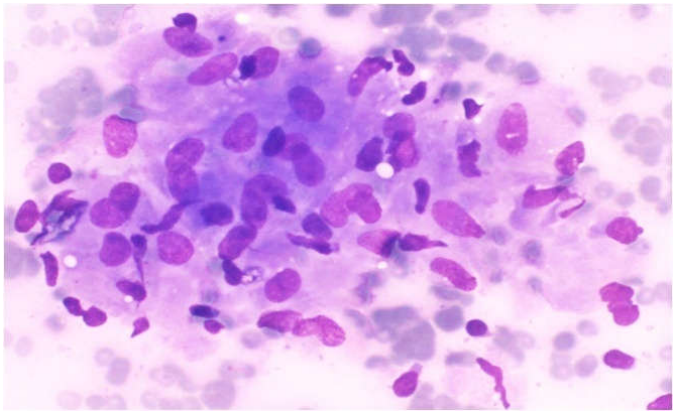

Figure 2. Tuberculosis: epitheloid cell granuloma (leishman, 400x)

Table 5. Cytomorphological features in tuberculosis lympadenitis correlating with afb positivity

Cytomorphological features	Cases	Afb positivity (%)
Granuloma without caseous necrosis	85	17
Granuloma with caseous necrosis	89	15
Caseous necrosis only	25	7.1
Total	199	39.1

Among the tubercular group, the predominant cytomorphological pattern was epithelioid cell granulomas with caseous necrosis (42.71%). Out of 199 cases, in 77 cases AFB was positive (39.1%) which was seen maximum in first

group with epitheloid cell granulomas (17%), followed by second group with epithelioid cell granulomas with caseous necrosis (15%) and least AFB positivity was seen in third group with caseous necrosis only (7.1%).

DISCUSSION

The diagnostic workup in children with persistent lymphadenopathy is difficult. Several studies have attempted to identify clinical patient characteristics, which may provide useful information to determine the etiology of lymphadenopathy in children. Still, a significant number of patients remains with persistent lymphadenopathy, in whom the etiology is unclear, and a possible malignancy must be ruled out. The current study shows that FNAC is a useful initial diagnostic tool in children with persistent peripheral lymphadenopathy to distinguish between benign and malignant disease. In patients with a history of previous malignancy, FNAC was an accurate diagnostic tool in monitoring recurrence. Fine needle aspiration cytology is a simple, safe, inexpensive and reliable investigative procedure. With the recent advances in ultrasound and CT scan technologies, deep-seated lesions can be aspirated using these procedures and it helps in preventing surgical intervention and staging of tumors along with diagnosis and prognosis of tumors in adjunct to Immunocytochemistry. FNAC of lymph nodes is one of the routinely used diagnostic procedures in patients presenting with lymphadenopathy. In experienced hands, the reliability and accuracy of FNAC is very high. This study was carried out primarily to evaluate the role and advantages of FNAC. In the present study, the age incidence among 986 cases has shown the age group between 5-10years (36.5%) to be more common. Next common age to present with lymphadenopathy was 1-5 years (32%). The least common age group with lymphadenopathy was 10-14 years (14%). Evidence of lympadenopathy was slightly higher in females (57.6%) than males. Similar to our study, Das Gupta *et al* showed among 180 cases, 111(61.7%) were female and 69(38.3%) were male, thus showing a female preponderance. (Anjali Das Gupta *et al*., 1994)

In the current study, the size of benign nodes was mostly equal to or less than 2 cm in 72.2% of all benign cases, whereas malignant nodes were over 2 cm in 90.6% of all malignant cases. The most common cytological diagnosis was reactive hyperplasia (47.6%) in present study. Similar findings were observed by Lakhey *et al*. (Lakhey *et al*., 2009) while Pandav *et al*, Kochhar *et al* and Ruchi *et al* documented tuberculous lymphadenitis as one of the most common type of lymphadenopathy in developing countries. (Pandav *et al*., 2012; Kochhar *et al*., 2012; Ruchi Khajuria *et al*., 2006) The high rate is due to low socio-economic status, illiteracy, incomplete treatment, resistance and increased incidence of HIV infection. This difference may be due to different study population. Moreover, this etiological variation of patients of cervical lymphadenopathy may be due to variation in socioeconomic and nutritional status in different geographical locations of the world. Predominant cytomorphological pattern was epithelioid cell granulomas with caseous necrosis (42.71%) in present study, which was comparable to findings of Pandav *et al* (45.8%), Lakhey *et al* (46.7%) and Goswami *et al* (50%). (Lakhey *et al*., 2009; Pandav *et al*., 2012; Goswami *et al*., 2012) However, Paliwal *et al* found necrosis without granulomas (69.3%) as the most predominant cytomorphological pattern. (Paliwal Nidhi *et al*., 2011) In the present study, AFB positivity was maximum with granulomas without caseous necrosis pattern (17%) followed by epithelioid cell granulomas with necrosis pattern (15%). So our findings were comparable to findings of Lakhey *et al*, Goswami *et al* and Paliwal *et al*. (Lakhey *et al*., 2009; Goswami *et al*., 2012; Paliwal Nidhi *et al*., 2011) Patients who had malignant LAP in our study mostly had hard or rubbery lymph nodes, and B symptoms, which is in agreement with similar studies. (Kumral *et al*., 2002) Lymphoma was the most common of the malignant causes, which was consistent with previous studies. (Ahuja and Ying, 2000; Tekul *et al*., 1997) The strengths of our study were that this was prospective cohort study with a high number of patients, mainly with cervicofacial LAP for which every effort was made to discover the specific etiologies and define the malignancy types. FNAC has several important advantages compared to a surgical biopsy; it can be performed in the outpatient department, is a simple and rapid procedure, does not require general anesthesia, has a low morbidity, is cost effective, and it will not induce a scar. Of course, FNAC is an operator-dependant procedure, which for optimal results requires both an experienced cytologist to perform and assess FNAC and good communication between the clinician and the cytologist. Another important limitation of FNAC is the small sample size, which does not render sufficient material for marker studies, i.e. in the pathologic characterization of malignant lymphomas. From the results of this study and those from the literature, FNAC is recommended as the initial diagnostic tool in children with persistent or suspicious peripheral lymphadenopathy. It has proven to be a rapid, simple, and accurate diagnostic tool with low morbidity. Keeping the limitations of FNAC in mind, a surgical biopsy is still obligatory in any doubtful case. Thus, FNAC may have a triage function in the selection of those patients who can undergo clinical follow-up and those requiring a surgical biopsy.

Conclusion

In conclusion, a thorough clinical history, examination (both local and systemic), routine and some special investigations should be considered to arrive at the diagnosis of paediatric cervical lymphadenopathy. Lymph nodes which are not considered to be malignant and where there is no infectious cause found clinically, treatment with a conservative approach should be the first step by the clinician. At the same time we recommend FNAC as an important diagnostic procedure in children with cervical lymphadenopathy. FNAC is an accurate diagnostic technique in diagnosing various etiologies of lymphadenopathies. It provides a reliable, safe, rapid and economical method of investigating lymph node enlargement, the accuracy of which approaches that of other diagnostic procedures. Most of lymphadenopathies are due to non neoplastic conditions. It may replace unnecessary surgical procedures in many cases and helps the clinician to reach to a firm diagnosis. Speedy cytological diagnosis helps the clinician to further plan the treatment. A team work with close cooperation between different specialities is very important for proper diagnosis and management of paediatric cervical lymphadenopathy.

REFERENCES

Ahuja, A.T. and M. Ying, 2000. Grey scale sonography in assessment of cervical lymphadenopathy: review of

sonographic appearances and features that may help a beginner, *Br. J. Oral Maxillofac. Surg*., 38; 451–459.

Alison, M.F. 2008. Evaluation and management of lymphadenopathy in children, *Pediatr. Rev*., 29;53–60.

Al-Mulhim AS, Al-Ghamdi AM, Al-Marzooq HM, Mohammad HA, Gharib IA. 2004. The role of fine needle aspiration cytology and imprint cytology in cervical lymphadenopathy. *Saudi Med J*., 25:862–5.

Anjali Das Gupta *et al*. 1994. Fine needle aspiration cytology of cervical lymphadenopathy with special preference to TB *JIMA*, Feb 92-2.

Gosche, J.R. and L. Vick, 2006. Acute, subacute, and chronic cervical lymphadenitis in children, *Semin. Pediatr. Surg*., 15; 99–106.

Goswami H.M., Parikh U.R., Barot H.P., Vaghela G.M., Yadav K.S., Vegad M.M. And Gazali Z.A. 2012. Efficacy Of Fine Needle Aspiration Cytology, Ziehl-Neelsen (Z-N) Stain And Culture (Bactec) In Diagnosis Of Tuberculosis Lymphadenitis; *International Journal of Microbiology Research*, 4(7):275-278.

Haque MA, Talukder SI. 2003. Evaluation of fine needle aspiration cytology of lymph node in Mymensingh. *Mymensingh Med J*., 12(1):33–5.

Howlett DC, Harper B, Quante M, Berresford A, Morley M, Grant J. 2007. Diagnostic adequacy and accuracy of fine needle aspiration cytology in neck lump assessment: results from a regional cancer network over a one year period. *J Laryngol Otol*., 121(6):571–9.

Jeffers MD, Milton J, Herriot R, McKean M. 1998. Fine needle aspiration cytology in the investigation on Non Hodgkin' lymphoma. *J Clin Pathol*., 3:189–96.

Keith VE, Harsharan SK, Jerald GZ. 2007. Fine needle aspiration biopsy of lymph nodes in the modern era: reactive lymphadenopathies. *Pathol Case Rev*., 12(1):27–35.

Kochhar, A.K., G. Duggal, K. Singh, S.K. Kochhar, 2012. Spectrum Of Cytological Findings In Patients With Lymphadenopathy In Rural Population Of Southern Haryana, India - Experience In A Tertiary Care Hospital. *The Internet Journal of Pathology*, 13(2):7-11.

Kollur SM, El Hag IB. 2003. Fine needle aspiration cytology of metastatic nasopharyngeal carcinoma in cervical lymph nodes: comparison with metastatic squamous cell carcinoma and Hodgkin' and Non Hodgkin' lymphoma. *Diagn Cytopathol*., 28:18–22

Kumral, A., N. Olgun, K.M. Uysal, F. Corapcioglu, H. Oren, F. Sarialioglu, 2002. Assessment of pheripheral lymphadenopathies experience at a pediatric hematology oncology department in Turkey, *Pediatr. Hematol. Oncol*., 19; 211–218.

Lakhey M, Bhatta CP, Mishra S. 2009. Diagnosis of Tubercular Lymphadenopathy by Fine Needle Aspiration Cytology, Acid-Fast Staining and Mantoux Test: *J Nepal Med Assoc*., 48(175):230-33.

Leung, A.K.C. and W.L.M. Robson, 2004. Childhood cervical lymphadenopathy*, J. Pediatr.Health Care*, 18;3–7.

Olu-eddo AN, Omoti CE. 2011. Diagnostic evaluation of primary cervical adenopathies in a developing country. *Pan Afr Med J*., 10:52.

Paliwal Nidhi, Thakur Sapna, Mullick Shalini and Gupta Kumud, 2011. FNAC In Tuberculous Lymphadenitis: Experience From A Tertiary Level Referral Centre; *Indian J Tuberculosis*, 58:102-107.

Pandav, A. B., P. P. Patil, D. N.Lanjewar, 2012. Cervical lymphadenopathy – Diagnosis by F.N.A.C., A study of 219 cases: *Asian J Med Res*., 1(3):79-83.

Ruchi Khajuria, K. C. Goswami, K. Singh, V. K. Dubey, 2006. Pattern of Lymphadenopathy on Fine Needle Aspiration Cytology in Jammu:J K Science, 8:157-159.

Steinkamp, H.J., J. Maurer, M. Cornehl, D. Knobber, H. Hettwer, R. Felix, 1994. Recurrent cervical lymphadenopathy: differential diagnosis with color-duplex sonography, *Eur. Arch. Otorhinolaryngol*., 251;404–409.

Stutchfield, C.J. and J. Tyrrell, 2011. Evaluation of lymphadenopathy in children, *Paediatr. Child Health*, 22 (3) 98–102.

Tekul, H., S. Oztop, N. Cetingul, S. Soydan, G. Nisli, 1997. A prospective study of pheripheral lymphadenopathy in childhood, *J. Trop. Pediatr*., 43;117–118.

Troxell ML, Charles DB, Athena MC, Yasodha N. 2005. Cytologic diagnosis of Burkitt lymphoma: role of ancillary techniques. *Cancer Cytopathol*., 105:310–8.

Twist, C.J. and M.P. Link, 2002. Assessment of lymphadenopathy in children, *Clin. Pediatr*., 49;1009–1025.

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