

A Comprehensive Retrospective Analysis of Lymph Node Biopsies and Their Diagnostic Spectrum

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Abstract:

Background: Lymphadenopathy is among the diseases which are frequently seen due to many causative factors like infection, inflammation, reaction, and malignancy. Pathology of the disease remains the most reliable way of diagnosis of such diseases and differentiates whether the lesion is benign or malignant. Differential diagnosis of the lesions in lymph nodes gains importance.

Aim: To retrospectively evaluate the demographic profile, histopathological spectrum, microscopic findings, and clinical management patterns of lymph node biopsies.

Methodology: The present retrospective observational study was conducted on 180 patients' cases who were biopsied at Department of Pathology, Gouri Devi Institute of Medical Sciences & Hospital, Durgapur, West Bengal, India during the period of 1 year. The statistical analysis for demographic characters, site of lymph node involvement, histological diagnosis, special stains, treatment modalities were done with SPSS 27.0.

Results: The majority of the patients belonged to the age category of 21-40 years, accounting for 40.0%. Majority of the patients (56.7%) were males. Cervical lymph nodes were the most frequently seen organ in the patients and were seen in 55.6% of the patients. Reactive lymphadenitis, tuberculous lymphadenitis, metastasis, non-Hodgkin lymphoma, and Hodgkin lymphoma accounted for 35.0%, 25.0%, 20.0%, 10.0%, and 5.0%, respectively. Granuloma was seen in 27.8% of the patients, and caseous necrosis was seen in 22.2% of the patients. Ziehl-Neelsen stain was present in 16.7%, metastasis was present in 20.0%, and effacement was seen in 15.0% of the patients. Benign diseases underwent treatment through follow up and anti-tubercular therapy in 65.0% of the patients.

Conclusion: Reactive and tubercular lymphadenitis represented the common types of lymphadenitis encountered among patients. Histopathology will continue to be a vital part of the diagnosis of lymphadenopathy because histopathology is one of the most effective means of diagnosing and treating patients.

Keywords: Lymph node biopsy, Lymphadenopathy, Histopathology, Reactive lymphadenitis, Tuberculous lymphadenitis, Hodgkin lymphoma, non-Hodgkin lymphoma, Metastatic malignancy.

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Introduction

Lymphadenopathy, according to definition, refers to a state where there is enlargement of the lymph nodes, and it is a common problem that affects people irrespective of their age, and it can arise as a consequence of various causes, either benign or malignant [1]. Lymph nodes play an important role within the immune and lymphatic systems because of their function as filters of foreign materials present in the body. Lymphadenopathy may arise as a consequence of infections, inflammation, auto-immune disorders, granulomatous disorders, or even as a form of cancer. This is because lymphadenopathy usually has nonspecific symptoms [2]. Lymphadenopathy evaluation is an

exercise that has to be systematic and consists of examination, lab tests, imaging techniques, and histopathology [3]. The last two types of investigation allow acquiring a number of preliminary data; however, histopathology of the samples taken during the lymph node biopsy remains a reliable tool. It should be noted that histopathology of the lymph nodes presents a special chance to examine these nodes and their pathology, and to determine whether the problem is related to an infection, inflammation, malignancy or is simply reactive [4]. The diversity in lymph node disease extends across a range of conditions which can further be grouped to form benign and

malignant disease processes [5]. Some of the benign lymph node conditions include reactive lymphadenitis, granulomatous lymphadenitis, tuberculous lymphadenitis, etc [6]. There can also be malignant lymph node conditions like primary lymphoid malignancies like Hodgkin's and Non-Hodgkin's lymphoma and metastasis from other distant primary tumor sites. It is important to note that there are regional differences in the disease among different communities, depending on social and geographic differences [7].

Tuberculosis remains one of the commonest causes of granulomatous lymphadenitis in developing countries, particularly India [8]. The tuberculosis that infects the lymph glands is the most prevalent type of tuberculosis outside the lungs and it normally affects the cervical glands as a chronic disease. The presence of granulomas, caseation necrosis, and acid fast bacilli is critical to the diagnosis of tuberculosis [9]. However, despite significant progress in the fields of public health strategies and antitubercular medications, tuberculosis still constitutes an important cause of lymph node disorders in many parts of the world.

There is one more very frequent cause of lymph nodes enlargement, which is called reactive lymphadenitis [10]. This condition takes place as a physiological reaction on any infection either localized or generalized. The features of reactive lymphadenitis are intact structure of nodes along with follicular and paracortical proliferation. Though this process does not threaten the patient's life, still it may simulate many severe diseases [11]. The distinction between reactive and neoplastic processes is rather necessary for both correct treatment and psychological well-being of patients.

The pathologies of lymph nodes contribute to an essential proportion of biopsies, causing morbidity and mortality [12]. Lymphoma may also be regarded as the primary form of cancer, which predominantly affects the lymphoid tissue. Lymphomas, in turn, can be classified according to the type of disease and immunological aspects as Hodgkin lymphoma and non-Hodgkin lymphoma. Furthermore, it is necessary to note that the metastasis in cases of breast cancer, lung cancer, gastrointestinal cancer, and head & neck cancer often occurs within the lymph nodes [13]. Thus, a correct diagnosis is crucial in cancer treatment and prognosis.

The rising problem of infections and cancers has made the use of the histopathology study of lymph nodes more important in current medical practice [14]. The analysis of retrospective data obtained from the analysis of biopsy samples offers essential information about the epidemiological features and diagnostic spectrum of lymph node pathology in certain groups of patients. This will allow doctors

to know the frequency of occurrence of certain types of diseases and pathological processes.

The current research project aims at carrying out a thorough retrospective investigation on lymph nodes biopsy specimens and associated diagnosis at a tertiary level teaching institution [15]. By analyzing histopathology reports within a span of one year, it is expected to establish the prevalence of different kinds of lymph node lesions in an attempt to develop more advanced means of diagnoses and treatment of lymphadenopathy cases.

Methodology

Study Design: The current study is a retrospective observational study that sought to examine the histopathology of lymph node biopsies in patients with lymphadenopathy and the distribution of their diagnosis. The study involved reviewing and analyzing previously collected data on both the clinical and pathological aspects of lymphadenopathy to determine the prevalence, nature, and demographic trends of different benign and malignant conditions of the lymph nodes. Retrospective studies were considered for this investigation to allow for an analysis of the available data from archived cases.

Study Area: This study was carried out at the Department of pathology, Gouri Devi Institute of Medical Sciences & Hospitals, Durgapur, West Bengal, India

Study Duration: This research was done during a period of one year.

Study Participants

Inclusion Criteria

- Patients irrespective of their age and sex who had lymph node biopsies conducted on them at the research center within the research period.
- Patients whose medical data was fully available in the archives in the department.
- Well-preserved lymph node biopsies which were good for histopathological analysis.
- Patients whose biopsies gave definite histopathological diagnoses.

Exclusion Criteria

- Biopsy samples inadequately or poorly preserved and not suitable for histopathology studies.
- Subjects with incomplete clinical and pathological data.
- Repeat biopsies on patients already diagnosed in order to avoid duplication of information.
- Biopsy samples showing inconclusive results due to technical difficulties in histopathology.

Sample Size: The research sample contained a total of 180 lymph nodes that met the inclusion criteria for the study. The sample was chosen to

represent all age groups, both genders, all lymph node areas (anatomical sites) and a wide variety of benign and malignant pathology commonly found in clinical practice.

Procedure: The patient records and histopathological reports of the cases were collected from the Department of Pathology and analyzed carefully. The parameters that were taken into account for data collection were demographic information, manner of presentation, site of lymph node involvement, and diagnosis based on the histopathology report. In preparation of histopathology slides, the process has been done based on a standard procedure that consists of fixation of the specimen in 10% neutral buffered formalin solution, after which paraffin is used to embed the specimen. Sectioning is done by using the microtome instrument, and Hematoxylin and Eosin (H&E) stains are done to complete the process. The special stain, such as Ziehl-Neelsen stain, was used where needed for the identification of granuloma and tuberculosis lesions.

Statistical Analysis: The obtained data were analyzed using the Statistical Package for Social

Sciences software (SPSS 27.0; IBM U.S). For descriptive statistics, mean and standard deviation were used for continuous data, whereas frequencies and percentages were used for categorical variables.

Chi-squared tests and independent t-tests were conducted to determine correlations between demographic variables and histopathological results, where applicable. Age group, gender, and location-specific distribution of benign and malignant lesions were also assessed.

Result

Table 1 shows the demographic features of 180 study participants, who had undergone lymph node biopsy. Majority age group for the study patients were 21-40 years (72; 40.0%) and a good chunk was between 41-60 years (50; 27.8%). Male patients (102; 56.7%) outweighed female patients (78; 43.3%). The most commonly biopsied sites were the cervical lymph nodes (100; 55.6%), then axillary (32; 17.8%), inguinal (25; 13.9%), supraclavicular (15; 8.3%) and others (8; 4.4%) nodes.

Table 1: Demographic Characteristics of Study Participants

Parameter	Category	Frequency (n)	Percentage (%)
Age (years)	0-20	30	16.7
	21-40	72	40.0
	41-60	50	27.8
	>60	28	15.5
Gender	Male	102	56.7
	Female	78	43.3
Site of Lymph Node	Cervical	100	55.6
	Axillary	32	17.8
	Inguinal	25	13.9
	Supraclavicular	15	8.3
	Others	8	4.4

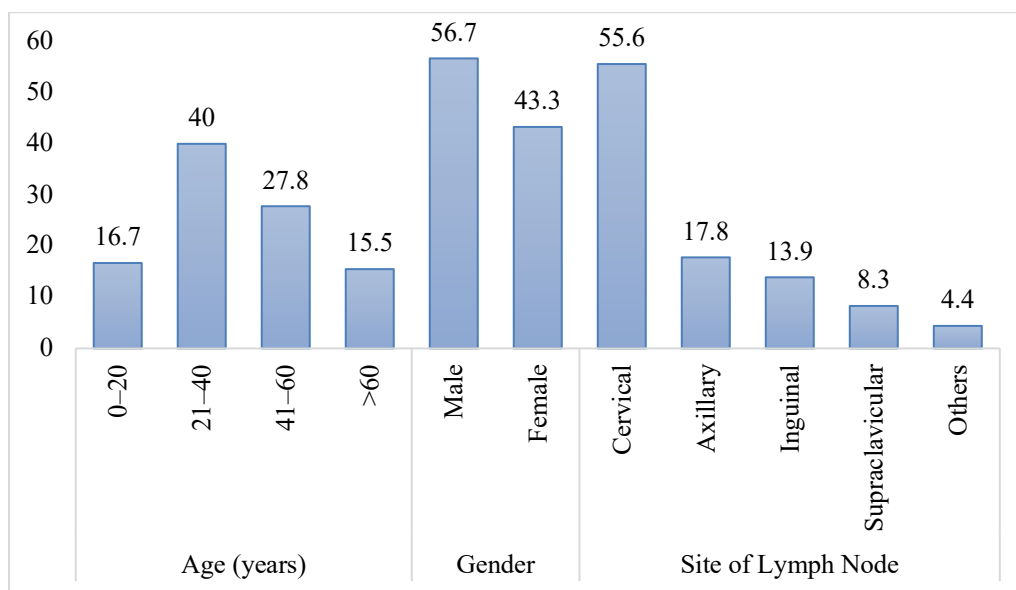


Figure 1: Visual Representation of Demographic Characteristics of Study Participants

The results revealed that there is a high prevalence of lesions in lymph nodes in young and middle-aged individuals, especially within the age group of 21-40 years old. It can be seen that males have been found in relatively greater numbers than females. In addition, it has been noted that the majority of cases had cervical lymph nodes involved, which may reflect the fact that there could be various problems associated with the head and neck region such as infections or malignancy. Table 2 highlights the type of histopathological

presentation observed in the lymph node biopsies of the 180 patients involved in this research. The frequentist histopathological finding that was present in all patients was reactive lymphadenitis (n=63, 35.0%). This was followed by tuberculous lymphadenitis which was present in 45 cases (25.0%) and then by metastatic carcinomas in 36 cases (20.0%) and non-Hodgkins's lymphoma in 18 cases (10.0%). Other types of lesions were found in 9 (5.0%) patients.

Table 2: Histopathological Spectrum of Lymph Node Biopsies

Diagnosis	Frequency (n)	Percentage (%)
Reactive lymphadenitis	63	35.0
Tuberculous lymphadenitis	45	25.0
Metastatic malignancy	36	20.0
Non-Hodgkin lymphoma	18	10.0
Hodgkin lymphoma	9	5.0
Other lesions	9	5.0

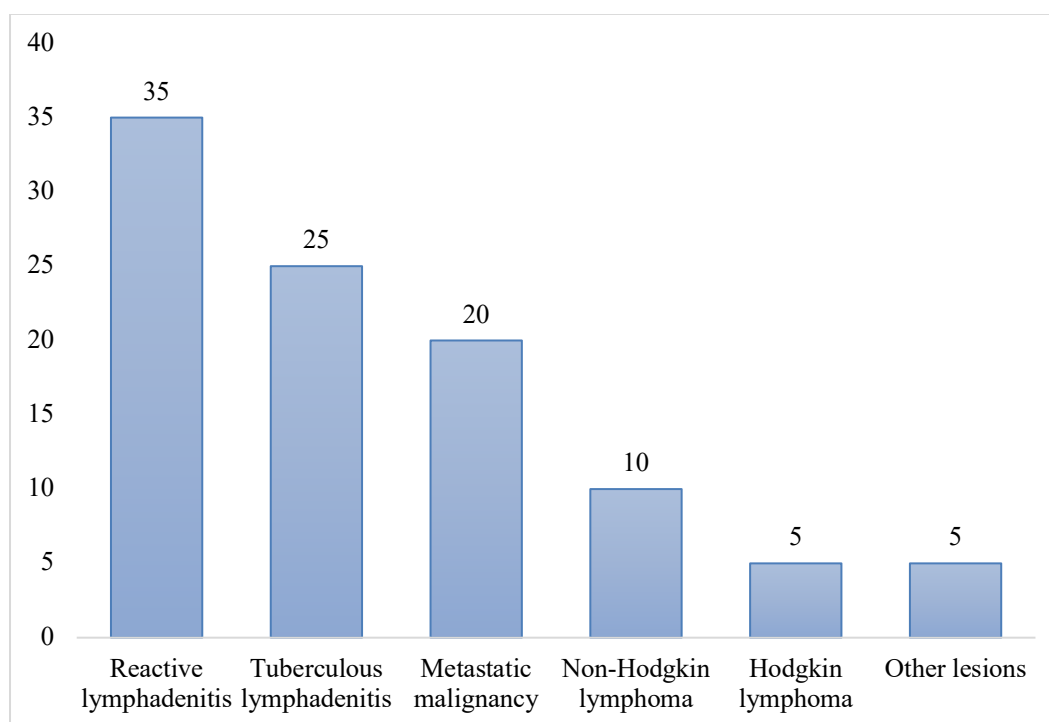


Figure 2: Visual Representation of Histopathological Spectrum of Lymph Node Biopsies

Based on the results obtained, it can be concluded that the most frequently encountered type of lesion was benign inflammatory lesions, especially reactive and tuberculous lymphadenitis.

Nonetheless, there was a significant number of cases that presented as malignant, with metastatic malignancies being more prevalent than primary lymphomas.

This is an indication of the persistent problem posed by infectious and inflammatory illnesses, as well as the need for histopathology in diagnosing lymphadenopathy. Table 3 describes the results

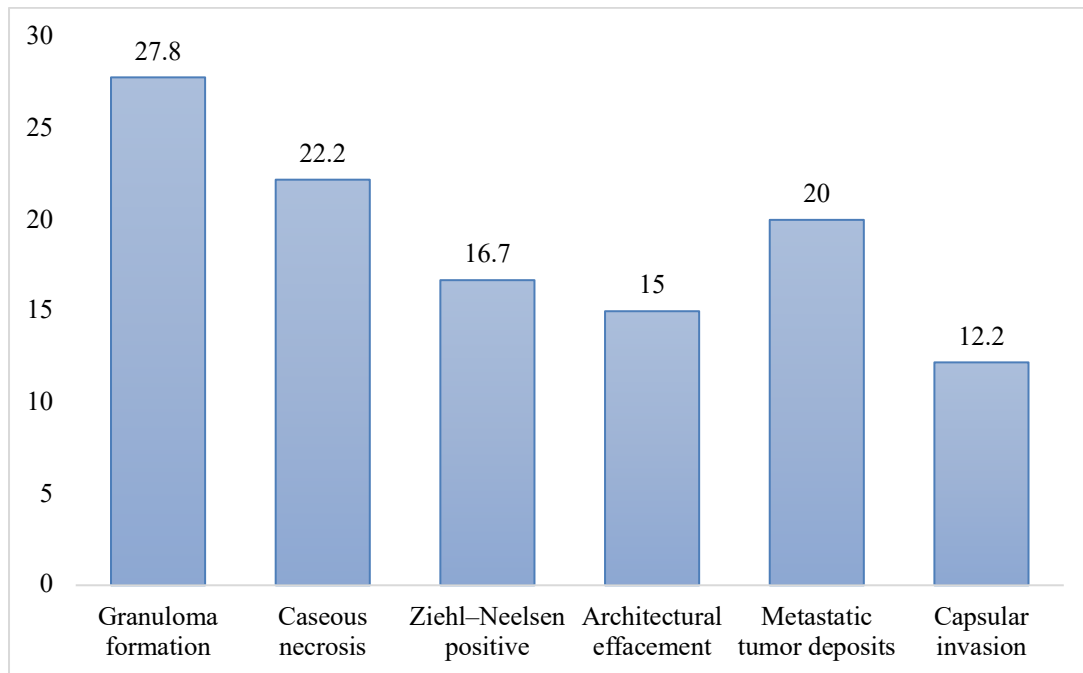
from histopathological studies and special stains performed on 180 lymph node biopsy samples. Granulomatous reaction is the most frequent histological finding seen in 50 cases (27.8%), while caseous necrosis is found in 40 cases (22.2%).

Metastasis was observed in 36 cases (20%), and positivity on Ziehl Neelsen stain for acid-fast bacilli was recorded in 30 cases (16.7%) samples.

Architectural disruption, suggesting lymphoproliferative disease, was seen in 27 (15%) samples, whereas capsular invasion was found in 22 (12.2%) samples.

Table 3: Histopathological and Special Staining Findings

Finding	Frequency (n)	Percentage (%)
Granuloma formation	50	27.8
Caseous necrosis	40	22.2
Ziehl–Neelsen positive	30	16.7
Architectural effacement	27	15.0
Metastatic tumor deposits	36	20.0
Capsular invasion	22	12.2

**Figure 3: Visual Representation of Histopathological and Special Staining Findings**

The findings indicate that there is a high occurrence of granulomatous and tuberculous pathologies, as evidenced by high levels of granulomas, caseous necrosis, and positivity of Ziehl–Neelsen stain. The high occurrences of metastasis and capsular invasion indicate that there is a high occurrence of malignant lymphadenopathy. Furthermore, the architectural effacement seen in many samples confirms the existence of malignancy among the sampled population. Overall, these results show the varied pathology associated with lymph nodes and highlight the need for histopathology to diagnose lymph node pathology. Table 4 provides the

proportion of benign and malignant lymph node lesions, together with the respective approaches to managing them in the 180 subjects involved in the current study. Most of the cases involved benign lesions, representing 117 people (65.0%). The proportion of patients with malignant lesions was 63 people (35.0%). Among benign lesions conservative follow-up recommended in 72 persons (40.0%) while Antitubercular treatment started in 45 persons (25.0%). Among malignant lesions chemotherapy recommended in 27 patients (15.0%) surgery +adjuvant treatment to 22 patients (12.2%) chemotherapy + surgery to 14 patients (7.8%).

Table 4: Distribution of Lesions and Clinical Management

Category	Frequency (n)	Percentage (%)
Benign lesions	117	65.0
Conservative follow-up	72	40.0
Anti-tubercular therapy	45	25.0
Malignant lesions	63	35.0
Chemotherapy	27	15.0
Surgery with adjuvant therapy	22	12.2
Combined multimodal treatment	14	7.8

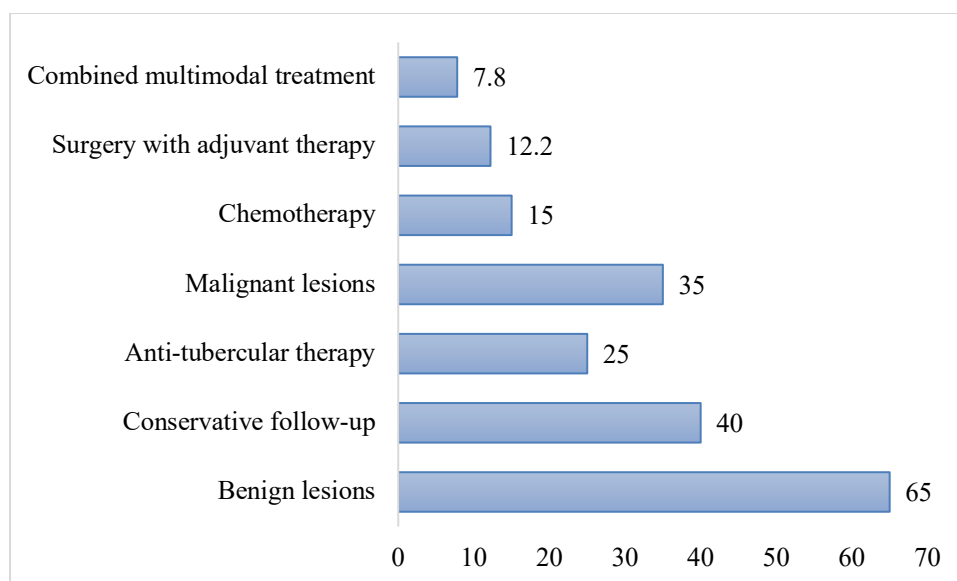


Figure 4: Visual Representation of Distribution of Lesions and Clinical Management

From the results obtained, it is evident that the rate of benign lymph node diseases was higher compared to malignancies in this case. The conservative management and anti-tubercular therapy were the most commonly used management strategies for benign diseases, attributed to the high rate of reactive and tuberculous lymphadenitis cases. Malignant lymph node diseases, on the other hand, demanded more drastic measures such as chemotherapy and surgery among others.

Discussion

The current retrospective study described the histopathology range of lymph nodes in biopsy samples from a tertiary care hospital. Most patients had ages between 21 and 40 years, with male patients being predominant (Cordesmeier et al., 2017) [16]. Lymph nodes of the cervix were found to be the most common site, probably because infections and inflammation diseases are frequently observed in the neck and head regions. This is supported by previous researches that described cervical lymphadenopathy as the most common indication for performing lymph node biopsy (Lenaerts et al., 2021) [17].

Reactive lymphadenitis was the most common diagnosis made based on histopathology, while tuberculous lymphadenitis came next, suggesting that benign inflammatory lesions were predominant in this patient group (Sekiguchi et al., 2016) [18]. Granulomatous reaction, caseation necrosis, and positive staining using Ziehl–Neelsen stain indicate that the problem of tuberculous lymphadenitis is quite prevalent in this community. This observation has been documented in many studies conducted in other parts of India (Oguntunde et al., 2019) [19].

The percentage of malignant lesions occurred in 35% of total cases, and there was a higher

incidence of metastatic cancers than lymphomas. The benign tumors were handled by anti-tuberculosis treatment, while cancerous lesions required chemotherapy or surgery (Hawaladar et al., 2017) [20]. These findings indicate that the performance of histopathology study is a critical diagnostic process.

Conclusion

This paper highlights the role of histopathology in the evaluation of patients presenting with lymphadenopathy. The largest number of lymph node biopsies was performed on young and middle-aged adults, mostly men, while the most common affected areas included cervical lymph nodes. Among the histopathological results, the authors found reactive lymphadenitis to be the leading type, followed by tuberculous lymphadenitis, thus proving that inflammation and infection are still the most common causes of lymphadenopathy. Granuloma formation, caseous necrosis, and Ziehl–Neelsen staining positivity confirm the high frequency of tuberculous lymphadenitis among patients. While the majority of pathologies are benign, many lymphadenopathies are proven to be of malignant origin, namely metastatic cancers and lymphomas, which indicates the necessity of histopathological analysis. As for the management methods, conservative observation, anti-tuberculosis treatment, surgery, and chemotherapy were used for benign and malignant lesions, respectively. Overall, despite its limitations, lymph node biopsy can still be considered an essential method for diagnosing lymph node lesions.

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