Original Article

Diagnostic Utility of Cell Block and Conventional Cytology in Evaluation of Lymph Node Aspirates

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Abstract

Background: This study was conducted to assess the diagnostic utility of cell block and conventional cytology in the evaluation of lymph node aspirates.
Methods: This was a one-year prospective study approved by the ethical committee of the institution and was carried at a tertiary care hospital, Pt B.D. Sharma, PGIMS, Rohtak. This study included 46 patients attending the cytology outpatient department who were referred for fine needle aspiration from other clinical departments. FNAC was performed without anaesthesia, and the aspirated material was flushed on slides and then fixed immediately. The remaining materials were processed into cell blocks followed by H&E staining. The collected data was analysed using SPSS version 20 (IBM SPSS Statistics Inc., Chicago, Illinois, USA) Windows software program. A p-value <0.05 was taken as significant.
Results: The sensitivity, specificity, positive predictive value, negative predictive value and accuracy of the combined cytosmear and cell block technique for cytopathological diagnosis were 100%, 75.8%, 78.59%, 100% and 85.39% respectively. The combined use of cytosmear and cell block led to increased diagnostic efficiency.
Conclusion: The combined use of FNAC smear and cell block can be useful for establishing a more definitive cytopathologic diagnosis of lymphadenopathy. Compared with FNAC, it gives a more accurate diagnostic architecture and apparent histopathological features.

Keywords: Cell block; Cytosmear; Lymphadenopathy; FNAC; Histopathology

Introduction

Lymph nodes are the secondary organs of the immune system and filter lymph from almost all other organs of the human body [1]. The most common causes of lymphadenopathy are reactive processes, granuloma, and malignancies including metastases and lymphoproliferative disorder [2].

Fine needle aspiration cytology (FNAC) is used in the investigation of lymphadenopathy and offers a very quick preliminary diagnosis with minimal trauma to the patient at a considerably lower cost than surgical biopsy [3]. The role of FNAC in the diagnosis, to point out the exact type and possible source of metastatic malignancies in the lymph node, is well recognized and the diagnostic accuracy of FNAC is near about 90–95% in metastatic malignancy. However, FNAC sometimes does not yield information for a precise diagnosis, and the risk of false-negative and indeterminate diagnosis is always present. Inconclusive diagnosis on FNAC may be due to inadequate material, poor spreading, air-drying artifact and the presence of thick tissue fragments [4].

In order to overcome these problems, the cell block technique has been resorted to make the best use of the available material [5]. A Cell block is a condensed group of cells created from a fine needle aspirate material that is fixed and embedded in paraffin and multiple sections of the same material can be obtained and processed for routine stains such as H & E [6].

The benefit of the cell block technique is the recognition of the histologic pattern of diseases that sometimes cannot be reliably identified in smears [4]. The usefulness of cell blocks is further enhanced when the preserved tissue is used for microbiological, histochemical and immunohistochemical stains, which increase the diagnostic efficacy [7].

In this overview, this present study was undertaken to find out the spectrum of different clinically suspected lesions of lymph nodes by conventional cytology and cell block preparation and to assess the utility of cell blocks in increasing the accuracy of cytodiagnosis of fine needle aspirates of lymph nodes.

Materials and Methods

This was a one-year prospective study approved by the ethical committee of the institution and was carried at a tertiary care hospital, Pt B.D. Sharma, PGIMS, Rohtak. This study included 46 patients attending the cytology outpatient department which were referred for fine needle aspiration from other clinical departments. Patients of all ages and both genders were included. The cases with deep-seated lymph nodes, subcentimetric lymph nodes, patients with bleeding disorders and deranged coagulation profiles were excluded from the study.

For the purpose of data collection, a predesigned proforma was used to detail the clinical and epidemiological profile of the patient along with the findings of the aspirate and also the interpretation of conventional smear cytology and cell block histopathology. Informed consent was taken from each patient before doing the FNAC procedure. After taking a complete history, local and systemic examination of the patient was carried out. The lymph node was held in between two fingers, FNAC was performed using a 23-gauge needle attached to a 10ml disposable syringe under aseptic conditions. Smears were made, air-dried for Leishman stain or immediately alcohol-fixed in 95% ethyl alcohol for Papanicolaou stain wherever needed. After the preparation of smears, the material that remained in the needle hub and syringes was used for cell block preparation by the plasma-thromboplastin method. The conventional smears were stained with Romanowsky dye (Leishman stain) and Papanicolaou stain as per standard techniques.

Procedure for cell block preparation- Plasma-Thromboplastin clot method: Pooled fresh plasma obtained from Model Blood Bank, PGIMS Rohtak kept frozen and brought to room temperature and thromboplastin stored in a refrigerator at 2-8 °C and brought to room temperature was used. 2 drops of plasma were added to the FNAC sample and mixed. 4 drops of thromboplastin were added and mixed again until a clot formed for 15-30 seconds. The clotted material was then fixed in 10% neutral buffered formalin for a minimum of 6 hours. The resultant clot was then slid onto a premoistened filter paper, wrapped and placed carefully in a labelled tissue cassette. The sample was then processed as usual for histological processes and the sections were stained with haematoxylin and eosin and preserved for immunohistochemical staining [8].

Approval from the institutional ethics committee of the University of Health Sciences was obtained.

Interpretation of conventional smears versus cell block sections: After studying all the available clinical and radiological data, the conventional smears and the cell block sections were examined in detail. A comparison between the cellularity, morphological preservation, architectural presentation and background was performed on both the conventional smears and cell blocks. Cytological diagnosis was classified as follows: Reactive hyperplasia, Inflammatory (Tubercular), Suggestive of malignancy, Malignant

Immunohistochemical profile was assessed on cell block sections whenever required. The final diagnosis was made after combining morphological and immunohistochemical findings.

Statistical analysis A prospective study was carried out for 46 cases of lymphadenopathy. The collected data was analysed using SPSS version 20 (IBM SPSS Statistics Inc., Chicago, Illinois, USA) Windows software program. Descriptive statistics included computation of percentages, means and standard deviations. A p-value <0.05 was taken as significant.

Results

A total of 46 FNAC samples of peripheral lymph nodes were studied. The average age of the patient was 39.11 years $\pm$ 19.48 SD and the minimum and maximum ages were 5 and 78 years respectively. Male dominance was observed comprising 60.9% of the cases. On the basis of the distribution of cases as per site, 3 (6.5%) cases were axillary, 30 (65.2%) cervical, 4 (8.7%) inguinal, 3 (6.5%) postauricular, 3 (6.5%) submandibular and 3 (6.5%) supraclavicular in location. Further, cases were diagnosed based on cytosmears examination (Table 1).

According to cell block diagnosis, out of 46 cases, 43 cases (93.5%) were observed to be diagnostically adequate while 3 cases (6.5%) were observed to be diagnostically inadequate (Table 2). Ziehl-Neelsen staining with 20% H_2SO_4 was done for acid-fast bacilli (AFB) on cytological smears and cell blocks. Out of a total of 15 cases of granulomatous lymphadenitis, all cases were AFB positive on cytosmear while only 06 (40%) cases were AFB positive on cell block. In formalin-fixed tissues, bacilli walls may be altered, reducing their acid-fastness.

Distribution of cases as per cytological diagnosis on cytosmears and cell block were done (Table 3).

On clinicoradiological diagnosis, 27 cases were observed to be benign and 19 cases were observed to be malignant. While on cytosmears, 20 cases were benign and 26 cases were malignant. The difference was statistically significant (p-value-0.001). Keeping clinicoradiological diagnosis as the gold standard, the diagnostic efficiency of cytosmears was calculated. The sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV) and accuracy were 100%, 73.08%, 74.07%, 100% and 84.78% respectively. Further, cases were classified as benign and malignant on the basis of cytosmears and cell block (Table 4). The difference was statistically significant (p-value-0.001). Keeping cytosmear as the gold standard, the diagnostic efficiency of the cell block was evaluated. The sensitivity, specificity, PPV, NPV and accuracy were 95.24%, 72.0%, 94.74%, 82.61% respectively. The diagnostic efficiency of combined cytosmears and cell block was evaluated (Table 5). It was seen that there was an increase in diagnostic efficiency when cytosmear and cell block techniques were used for the diagnosis.

Table 1: Distribution of Cases as per Diagnosis on Cytosmears

Cytosmear Diagnosis	Frequency	Percentage (%)
Lymphoproliferative disorder	7	15.2
Mets from Breast Carcinoma	1	2.2
Mets from poorly differentiated carcinoma (PDC)	14	30.4
Mets from possibly Adenocarcinoma	1	2.2
Mets from squamous cell carcinoma	1	2.2
Poorly differentiated carcinoma	1	2.2
Positive for malignancy	1	2.2
Reactive	5	10.9
Tubercular	15	32.6
Total	**46**	**100.0**

Table 2: Distribution of Cases as per Cell Block Diagnosis

Cell Block Diagnosis	Frequency	Percentage (%)
Inadequate	3	6.5
B-Non Hodgkin's Lymphoma	2	4.3
Granulomatous lymphadenitis	9	19.6
Hodgkin's Lymphoma	2	4.3
Mets from Adenocarcinoma lung	1	2.2
Mets from Adeno possibly from endometrial Carcinoma	1	2.2
Mets from Breast Carcinoma	1	2.2
Mets from Moderately differentiated squamous cell carcinoma	1	2.2
Mets from PDC	5	10.9
Mets from squamous cell carcinoma	9	19.6
Non Hodgkin's Lymphoma	2	4.3
Positive for malignancy with histiocytic component	1	2.2
Reactive	3	6.5
Tubercular	6	13.0
Total	**46**	**100.0**

Table 3: Distribution of Cases as per Cytological Diagnosis on Cytosmears and Cell Block

Diagnosis	Cytosmear	Cell block
Reactive hyperplasia	5 (10.8%)	3 (6.5%)
Tubercular	15 (32.6%)	15 (32.6%)
Malignant	26 (56.5%)	25 (54.3%)

Discussion

Diagnostic cytology is the science of interpretation of cells that are either exfoliated from epithelial surfaces or removed from various tissues. Fine needle aspiration cytology (FNAC) is widely used in the investigation of lymphadenopathy.

Table 4: Cross Tabulation of Cytosmear and Cell Block Diagnosis

	Cell block			
Cytosmear	**Benign**	**Malignant**	**Total**	**p-value**
Benign	20	0	20	0.001
Malignant	1	25	26	
Total	**21**	**25**	**46**	

Table 5: Diagnostic Efficiency of Combined Cytosmears and Cell Block

Statistic	**Value**
Sensitivity	100.00%
Specificity	75.8%
PPV	78.59%
NPV	100.00%
Accuracy	85.39%

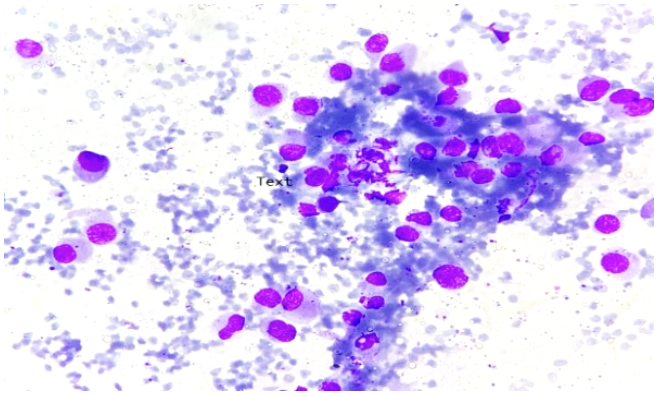

Figure 1: Conventional smear showing atypical cells in a case of carcinoma breast (Leishman stain; 400X)

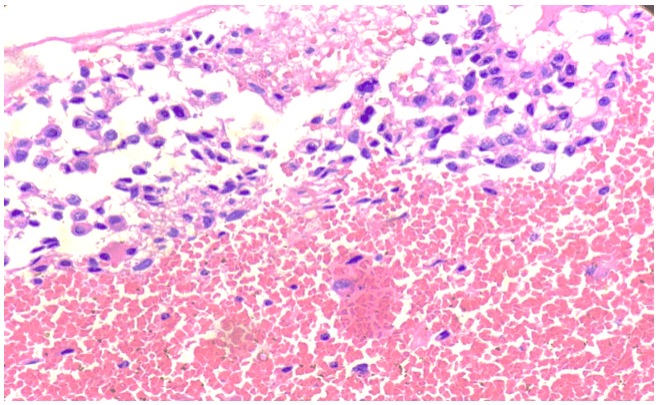

Figure 2: Cell block section showing atypical cells in a case of carcinoma breast with better architectural details (H&E; 400X)

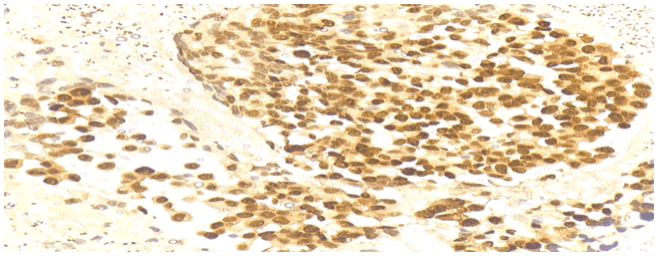

Figure 3: Cell block section: ER positive expression (IHC; 400X) (Clone: EP1 and positive control-Benign breast tissue)

FNAC is a simple, inexpensive, less traumatic, safe and fast diagnostic procedure with high accuracy. However, in certain situations, FNAC does not give sufficient information to render an accurate diagnosis and there is a chance of false-negative

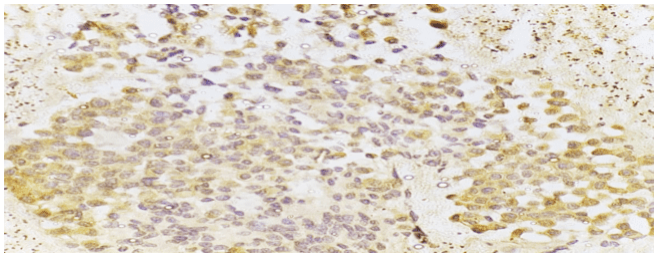

Figure 4: Cell block section: PR negative expression (IHC; 400X) (Clone: BSB2 and positive control- Benign breast tissue)

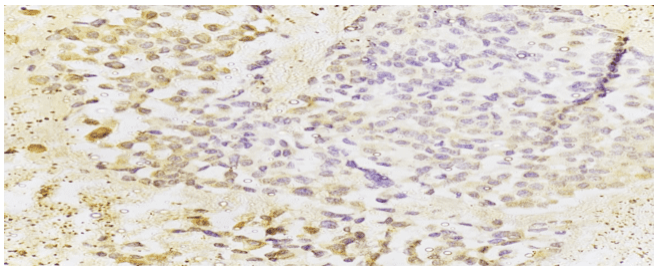

Figure 5: Cell block section: Her2/neu negative expression (IHC; 400X). (Clone: EP3 and positive control- Her2/neu positive gastric carcinoma)

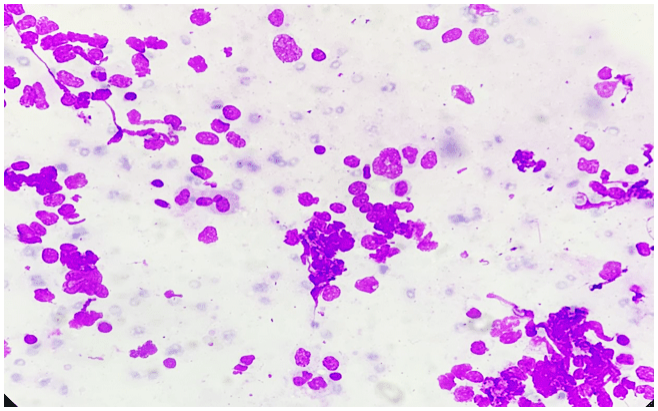

Figure 6: Conventional smear showing atypical lymphoid cells in a case of lymphoproliferative disorder (Leishman stain; 100X)

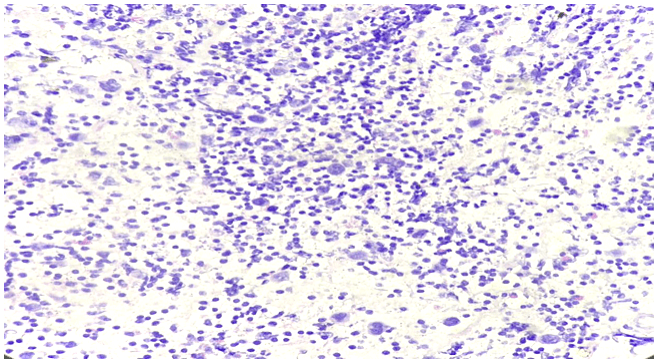

Figure 7: Cell block section showing atypical lymphoid cells (H&E; 100X)

and indeterminate results. This may be due to decreased cellularity or may be due to the lack of good morphological details. Drying and crushing artifacts can affect the interpretation of cell morphology. Cell block preparation obtained from residual material of the aspirate gives additional information and enhances the diagnostic accuracy [8].

The cell block method was first introduced by Bahrenburg in 1896 which was later improved by Dr. F. S. Mandelbaum in 1900. Since then, cell blocks have been prepared from various specimens like urine, pleural, peritoneal, ascitic, pericardial, tissue scrapings and hemorrhagic aspirates [6].

Many studies have shown that cell block preparation has less cellular dispersion, better morphology, preserved tissue architecture, and facilitates better classification of tumors with the help of special stains and immunohistochemistry.

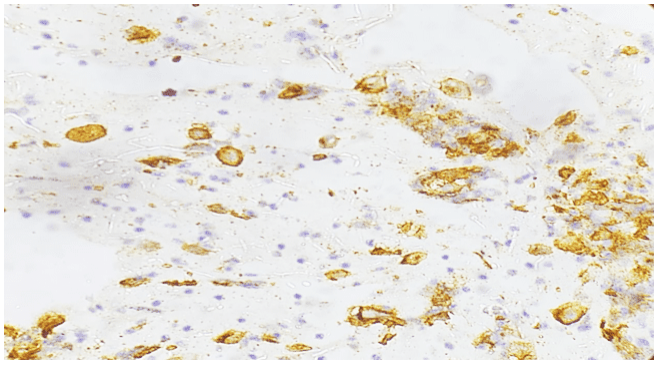

Figure 8: Cell block section showing positive expression of CD30 in a case of Hodgkin Lymphoma (IHC; 400X) (Clone: Ber-H2 and positive control-tonsillar tissue)

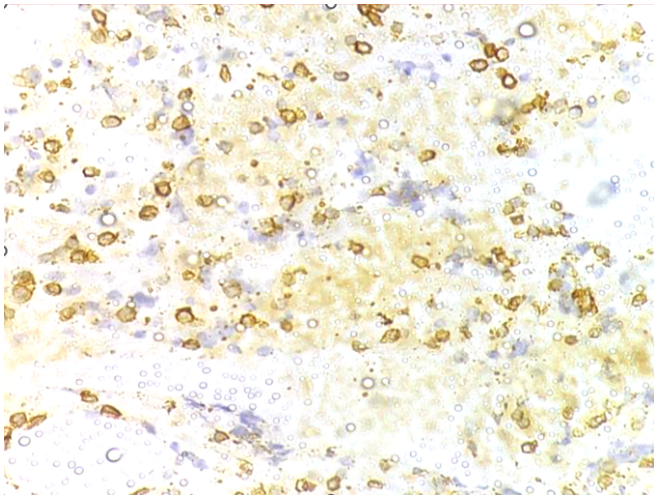

Figure 9: Cell block section showing positive expression of CD15 in a case of Hodgkin Lymphoma (IHC; 400X). (Clone: BY87 and positive control- tonsillar tissue)

However, high cost, increased processing time and delay in the diagnosis are the disadvantages of this technique.

This prospective study was conducted with the aim to assess the diagnostic utility of cell block and conventional cytology in the evaluation of lymph nodes aspirates. A total of 46 samples from palpably enlarged lymph nodes were studied.

Age and sex distribution: Experimental evidence indicates that lymph nodes in humans undergo alterations with age. The peak age of incidence in the present study was found to be in the age group of 40-50 years with a mean age of 39.11 $\pm$19.48 years. Our results were similar to the study conducted by Paul et al [9] (mean age: 39 years). There was an increased incidence in males with a male: female ratio of 3:2, which was comparable to a recent study by Bhunia et al [4].

Distribution of cases: In our study, we found malignant lesions to be much more common than non-malignant lesions. Among the metastatic malignant lesions, the most common was poorly differentiated carcinoma, followed by squamous cell carcinoma, adenocarcinoma and breast carcinoma. 7 cases were diagnosed as lymphoproliferative disorder. Among the non-malignant group, the majority of cases were of tuberculosis. The findings were comparable to recent studies done by Kamran et al [7] and Parate et al [10].

Table 6: Comparison of Findings with Other Studies

	Cytosmear		Cell Block	
Study	**Benign**	**Malignant**	**Benign**	**Malignant**
Meshram et al[11]	50%	50%	50%	41.6%
Parate et al[10]	17.4%	78.3%	17.4%	78.3%
Present study	43.5%	56.5%	45.6%	54.4%

Efficacy of cell block: In our study, the diagnostic category of cell blocks was based on the amount of obscuring background material, cellularity, extent of cellular degeneration and retention of architectural details. Out of 46 cases, 43 cases (93.5%) were observed to be diagnostically adequate while 3 cases (6.5%) were inadequate. When we used combined cytosmear and

cell block, we observed an increase in diagnostic accuracy. The sensitivity, specificity, PPV, NPV and accuracy of combined techniques were 100%, 75.8%, 75.59%, 100% and 85.39% respectively. Similar findings were observed by Barsagade et al [6], Meshram et al [11] and Parate et al [10] in their study.

Conclusion

The cell block technique is a sensitive and specific tool in diagnostic cytology. The combination of cell block and conventional cytology smears reduces the inadequacy of FNAC. The cell block preparation increases the cellular yield of FNA by capturing any small fragments in hemorrhagic aspirates. The architectural pattern of tissue is preserved in Cell block preparation and there is less cellular dispersion. Special stains & Immunohistochemistry can be performed on serial sections. This can help to subtype certain tumors & metastases. Based on this, open biopsies can be avoided. Besides IHC, we can preserve cell blocks for other ancillary studies also.

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Conflicts of Interest: There are no conflicts of interest in this study.

References

1. Kocjan G. Fine needle aspiration cytology: Diagnostic Principles and Dilemmas. Verlag Berlin Heidelberg, Germany: Springer. 2006.
2. Alrajjal A, Choudhury M, Yang J, Gabali A. Cell-blocks and hematolymphoid lesions. Cytojournal. 2021;18:7.
3. Singh P, Gupta A, Awasthi N, Singhal A, Gupta G. Efficacy of cell block immunocytochemistry in the diagnostic workup of Non Hodgkin lymphoma-experience from a tertiary care hospital in North India. Indian J Pathol Oncol. 2018;5(2):216-20.
4. Bhunia C, Chatterjee S, Kundu D, Bhattacherjee S. Comparative evaluation of cell block histopathology and conventional smear cytology in FNAC of clinically suspected cervical lymph node malignancy. Med J Babylon. 2022;19(1):94-8.
5. Basnet S, Talwar OP. Role of cell block preparation in neoplastic lesions. J Pathol Nepal. 2012;2:272-6.
6. Barsagade AK, Umap P, Deshpande A, Male P, Dhadas A, Jungare A, et al. Diagnostic Utility of Cell Block Preparation of Fine Needle Aspiration Material. Sch. J. App. Med. Sci. 2017; 5(12D): 5031-7.
7. Kamran M, Baloch F, Shah W. Comparison of cell blocks and smear examination with fine needle aspirats in the diagnosis of superficial palpable head and neck lesions. Khyber Med Univ J. 2021;13(4):244-50.
8. Sukumaran R, Nayak N, Katoor J, Nair S, Anila KR, Venugopal M. Cytomorphological Spectrum of Ultrasound Guided Fine Needle Aspiration Cytology of Liver Lesions, and the Role of Cell Block Preparation and Immunohistochemistry in the Diagnosis: An Analysis of 638 Consecutive Aspirations. JMSCR. 2018;6(4):875-81.
9. Paul T, Gautam U, Rajwanshi A, Das A, Trehan A, Malhotra P, et al. Flow cytometric immunophenotyping and cell block immunocytochemistry in the diagnosis of primary Non-Hodgkin Lymphoma by fine-needle aspiration: Experience from a tertiary care center. J Cytol. 2014;31(3):123-30.
10. Parate SN, Pawar PS, Kakade A. Role of cell block preparation in cytopathological diagnosis. IJCMR. 2019;6(7):G26-31.
11. Meshram P, Lonkar K, Kulkarni A, Bindu R. Significance of study of fine needle aspiration cytology and cell block preparation in neck swelling and breast lesions. Int J Recent Sci Res. 2018; 9(2):24543-52.