International Journal of Research in Medical Sciences
Bajantri SR et al. Int J Res Med Sci. 2022 Dec;10(12):2800-2804
www.msjonline.org
pISSN 2320-6071 | eISSN 2320-6012

DOI: https://dx.doi.org/10.18203/2320-6012.ijrms20223013

Original Research Article

Ultrasound guided fine needle aspiration cytology in deep seated lesions: an effective diagnostic tool

Supriya R. Bajantri[1], Dhara P. Mehta[2]*, Purva C. Shah[3], Ragini A. Patel[4]

[1]Dr. Lal Path Labs, Hubli, Karnataka, India
[2]Department of Pathology, GMERS Medical College and Hospital, Gotri, Vadodara, Gujarat, India
[3]Baroda Medical College and SSG Hospital, Vadodara, Gujarat, India
[4]Department of Pathology, GMERS Medical College and Hospital, Valsad, Gujarat, India

Received: 02 November 2022
Revised: 16 November 2022
Accepted: 17 November 2022

***Correspondence:**
Dr. Dhara P. Mehta,
E-mail: dharamehta0265@gmail.com

ABSTRACT

Background: Fine needle aspiration cytology (FNAC) is a diagnostic method used to assess various masses in the body with minimal invasion. FNAC alone has a lower yield as compared to biopsy for diagnosing deep-seated lesions. Radiological guidance improves the yield of FNAC. The aim of the study was to evaluate the diagnostic efficacy of Ultrasound (USG) guided FNAC in various deep-seated lesions in the body. We conducted a cross-sectional analytical study at the cytology section of pathology department of our hospital for indoor patients.
Methods: It was a retrospective study done over a period of five years, which included 334 aspirates suspected to be of inflammatory or neoplastic origin obtained from deep-seated lesions. After a thorough clinical and radiological evaluation, USG guided FNACs were performed. Experienced pathologists processed the smears, prepared thereby, for cytological evaluation and diagnosis.
Results: A total of 334 samples were collected using USG-guided FNAC. The most common site was lungs (36.5%) followed by liver (13.77%). The most common type were malignant lesions (57.19%) which were either primary malignancies or metastatic carcinomas. 29 samples were found to be acellular or had inadequate material, thus a diagnosis couldn't be made. Out of the various lung masses, non-small cell carcinoma was the most common (66.39%). The most common liver mass was metastatic carcinoma (54.35%).
Conclusions: USG guided FNAC is a relatively simple, safe, fast, minimally invasive and cost effective procedure, which provides quite a high rate of adequacy and diagnostic efficacy. It is useful for making a pre-operative diagnosis and guiding the choice of treatment.

Keywords: Cytological techniques, Image-guided FNAC, FNAC, Diagnosis, Pathology

INTRODUCTION

Fine needle aspiration cytology (FNAC) is a commonly used diagnostic tool to assess any mass in the body; either superficially palpable or deep seated. It is done by inserting a hollow needle of 23-25 gauge into the mass and sampling the cells. A smear slide is prepared and the cells are then stained for cytological evaluation. The technique is relatively painless, fast, safe, minimally invasive and cost effective. An accurate pathological diagnosis is always essential for the appropriate pre-operative staging and treatment of malignancy. Blady et al carried out aspiration cytology using imaging techniques in 1939.[1] In 1952, Lindblom and Edholm reported the guided needle puncture examination of renal cysts and tumors on Roentgen television.[2] In 1975, Holm et al and his team used percutaneous needle biopsy under Computed tomography (CT) scan and USG guidance.[3]

While performing FNAC, there is a chance that malignant cells may be missed since the sample collected is small. Also, the cells which are withdrawn may not be adequate for a definitive diagnosis. To overcome these limitations, the concept of image guided FNAC was introduced which uses the imaging techniques such as X-ray, USG, Magnetic resonance imaging (MRI) and CT scans to guide the insertion of needle and collection of sample from the exact said location with high accuracy. The guided FNAC procedures have revolutionized the approach to the diagnosis of deep-seated lesions using percutaneous, less invasive and quick techniques. Out of these, ultrasound is the most commonly used imaging technique.

The advantage with USG is that it is rapid, inexpensive, without radiation exposure, can be easily repeated when necessary and does not require injection of contrast medium.[4] But a disadvantage of USG is poor visibility of needle. A CT scan provides accurate localization and excellent needle visibility, but is time consuming, costly and risk of radiation exposure is present.[2]

The aim of the study was to evaluate the effectiveness of ultrasound-guided FNAC in diagnosis of patients with abnormal lumps in various parts of body, which helps to avoid unnecessary invasive diagnostic procedures and also guides the clinician for further approach to treatment.

METHODS

This study was a retrospective analysis of USG guided FNAC cases with clinically non-palpable/deep-seated lesions, performed in Cytology section of department of pathology of Baroda Medical College and SSG Hospital, Vadodara, India, a tertiary care center. The study was conducted over a period of 5 years, from January 2017 to December 2021.

A total of 334 aspirates suspected to be of inflammatory or neoplastic origin obtained from clinically non-palpable and radiologically deep-seated lesions from various compartments and organs of body including head and neck, lungs and mediastinum, liver, kidney, inguinal region, thyroid, abdomen, pancreas, prostate, breast, retroperitoneum, ovary, lymph nodes, testis and scrotum were included in the study. Patients with non-palpable or deep-seated swellings in the deeper viscera or deep compartments of the body were included for data collection while superficial, well-defined swellings, palpable swellings, pulsatile swellings, and swellings with body surface irregularities were excluded.

After a thorough clinical and radiological evaluation of all the patients, USG guided FNACs were performed jointly by pathologist and radiologist and the smears prepared thereby were further processed for cytological evaluation and diagnosis by experienced pathologists.

FNAC was performed as per standard procedure after taking the informed consent of patients. At first, the radiologist determined the anatomical location of the lesion and marked the puncture site. After sterilizing the marked the area upto 8-10 cm diameter, the puncture site was anesthetized with 5% xylocaine. We noted the depth of lesion and a 23-25 gauge needle was attached to a 10 cc syringe. We used a 26-gauge lumbar puncture needle in case of more deep lesions. As per the procedure, the needle is gently pushed inside under USG guidance and aseptic precautions following which, aspiration is done under negative pressure with numerous to and fro reciprocal movements. On an average, five to six needle passes are made in each case to obtain adequate material following which the suction is released and the needle removed. The aspirated material is expressed on a labelled glass slide and thin smears are made by opposition technique. Minimum six smears are made from each aspirate. Half of the slides were immersed for wet fixation in 70-90% alcohol for about 15-30 min, and the other half were air-dried without immediate fixation. Respective staining procedures are run over, depending upon the need. Commonly used stains are hematoxylin and eosin, Papanicolaou, Leishman, May-Grunwald Giemsa, acid-fast bacilli smear etc. Prepared slides were examined under the light microscope and were reported by experienced pathologists.

Statistical analysis was done using Microsoft excel sheets. Qualitative data was expressed in percentages and effectiveness of the diagnostic method was calculated with the results obtained.

RESULTS

Over a period of five years, a total of 334 Ultrasound guided FNAC were done. Out of them, 210 (62.87%) samples were collected from males and 124 (37.13%) patients were females. The youngest patient was 5 years of age, and oldest was 90 years of age. The mean age of the patients was 50.31 years. Amongst the various age groups, maximum number of cases were seen in 51-60 (22.75%) years age group; followed by 61-70 years age group (22.16%) (Figure 1).

Majority of lesions were diagnosed as malignant (57.19%, n=191). The FNAC sample was acellular in 9 cases (2.69%) and the results were unsatisfactory in about 43 cases (12.87%). (Figure 2). The various sites from which FNA was done included various anatomic regions and organs such as lung, liver, lymph node, abdominal lumps, ovary, kidney, thyroid, breast, mediastinum, retroperitoneum, testes, scrotum and neck masses. Lungs were the most common organ, constituting 36.53% of samples, followed by liver (13.77%) and lymph nodes (11.38%) (Table 1).

Malignant lesions diagnosed by FNAC were squamous cell carcinoma of lung, non-small cell lung carcinoma (Figure 3), adenocarcinoma of various organs, sarcoma, neuroendocrine carcinoma, non-Hodgkin's lymphoma, germ cell tumor, gastrointestinal stromal tumor, small cell carcinoma, large cell carcinoma, hepatocellular

carcinoma, metastases in liver (Figure 4), serous cystadenocarcinoma, renal cell carcinoma, seminoma and various surface epithelial carcinomas of ovary. In the cytological diagnosis of the lung masses, which were most common in our study, the most common type of lung malignancy was non-small cell lung cancer (66.39%, n=81). Among the subtypes, squamous cell carcinoma (39.50%, n=32) was the commonest form (Table 2).

Among the hepatic lesions (n=46), the most common cytological diagnosis was metastatic carcinoma which comprised 54.35% (n=25) lesions followed by hepatocellular carcinoma and adenocarcinoma, both of which were found in 13.04% (n=6) patients (Table 3). Among the benign lesions, majority were found in thyroid (37.74%, n=20) followed by benign breast lumps (20.75, n=11). Non-neoplastic lesions included abscess, tuberculous inflammation and reactive lymphadenitis.

Table 1: Site-wise frequency of USG-guided FNAC of deep-seated lesions.

Site of FNAC	n	%
Submandibular gland	9	2.69
Liver	46	13.77
Lungs	122	36.53
Abdomen	20	5.99
Renal	5	1.50
Lymph nodes	38	11.38
Ovary	10	2.99
Thyroid	29	8.68
Breast	19	5.69
Neck	18	5.39
Retroperitoneum	3	0.90
Back	3	0.90
Testes and scrotum	6	1.80
Mediastinum	6	1.80

Table 2: Cytological diagnosis of deep-seated lung mass lesions using USG-guided FNAC.

Cytological diagnosis	n	%
Submandibular gland	9	2.69
Liver	46	13.77
Lungs	122	36.53
Abdomen	20	5.99
Renal	5	1.50
Lymph nodes	38	11.38
Ovary	10	2.99
Thyroid	29	8.68
Breast	19	5.69
Neck	18	5.39
Retroperitoneum	3	0.90
Back	3	0.90
Testes and scrotum	6	1.80
Mediastinum	6	1.80

Table 3: Cytological diagnosis of deep-seated liver mass lesions using USG-guided FNAC.

Cytological diagnosis	n	%
Metastatic carcinoma	25	54.35
Hepatocellular carcinoma	6	13.04
Adenocarcinoma	6	13.04
Neuroendocrine tumor	5	10.87
Inconclusive	4	8.70
Metastatic carcinoma	25	54.35

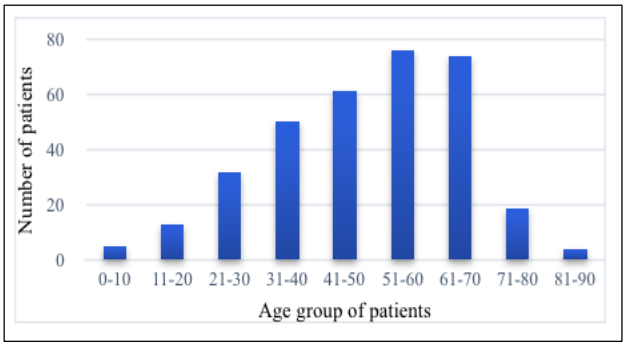

Figure 1: Age-wise distribution of study subjects.

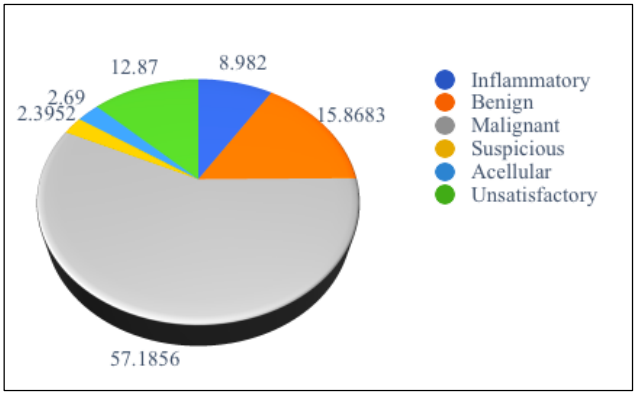

Figure 2: Distribution of the various types of lesions observed.

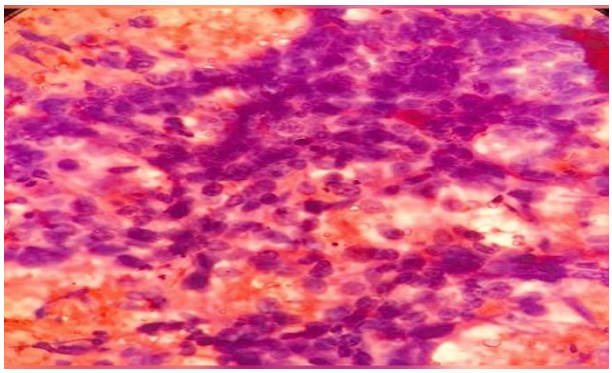

Figure 3: Non-small cell carcinoma lung- light microscopic image of a Hematoxylin and eosin stained smear of poorly-differentiated squamous cell carcinoma visualized under oil immersion (at 100X).

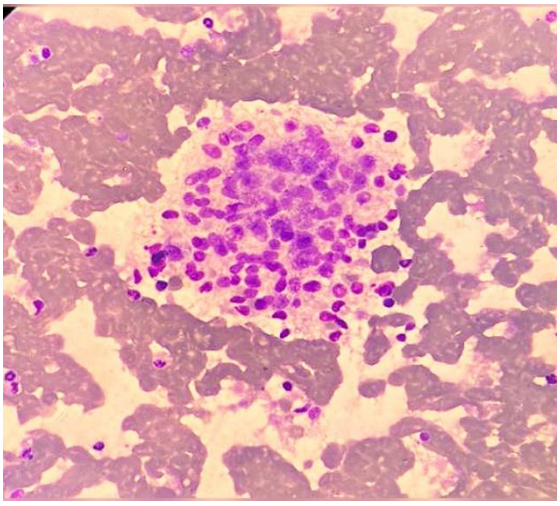

Figure 4: Liver metastasis- light microscopic image of a Giemsa stained smear of liver metastasis, which was more common than liver primary, as visualized through a high power objective (at 40X).

DISCUSSION

In the last few decades, FNAC has emerged as one of the first-line diagnostic tool to evaluate various deep seated lesions. The technique being quite accurate and less complicated, is highly employed in clinical practice to analyse various palpable as well as non-palpable, superficial as well as deep lesions. USG guided aspirations increase the diagnostic efficacy of FNAC without adding any extra risk to the procedure.

The male:female ratio was found to be 1.7:1 in our study. Similar findings of male preponderance have been observed in studies done by Krishna et al, Zawar et al and Sobha et al.[2,5,6] However, studies done by Shamshad et al and Sidhalingareddy et al showed female predominance.[7,8] The most common age group belonged to 51-60 years of age followed by 61-70 years. The study findings are similar to Shamshad et al, Sidhalingareddy et al and Zawar MP et al.[6-8]

The diagnostic efficacy of USG guided FNAC was found to be 85%. This is similar to the findings observed in various studies carried out by Nautiyal et al, Sobha et al and Sidhalingareddy et al.[2,8,9] The most common type of lesion that was diagnosed was malignant (57%) which is the case with all the studies carried out similarly.

The adequacy rates of the samples collected during the study was 85%, and out of these 92.46% were definitely diagnosed. 9 cases were acellular, and in 43 cases, no opinion could be made due to inadequate sample. Adequacy depended on the size, location, consistency of lesion, histological tumor type, vascularity and amount of necrosis present. The material aspirated was usually adequate in malignant lesion, in comparison to benign and non-neoplastic lesions. This suggests that guided FNAC should routinely be done in deep seated lesions due to high adequacy rate and very low complication rate.[10] Various studies have concluded that ultrasound-guided FNAC is more sensitive and advantageous than needle core biopsy in the diagnosis of radiologically detected abdominal lesions and pulmonary lesions.[11-14]

Among the organs involved, majority of cases belonged to lung (n=122). The aspirates were adequate in 89.34% (n=109) samples from which a definitive diagnosis could be made. Squamous cell carcinoma was the most common type of lung cancer diagnosed (26.23%, n=32) followed by poorly differentiated non-small cell lung carcinoma (20.49%, n=25). The findings are similar to the study done by Jha et al in which they found squamous cell carcinoma to be the most common type of lung cancer.[15] Among the abdominal masses, liver was the most common organ affected. This is similar to the findings of studies conducted by Adhikari et al and Sheikh et al.[10,16] The most common cytological diagnosis was metastatic carcinoma which comprised 54.35% (n=25) lesions followed by hepatocellular carcinoma and adenocarcinoma, both of which were found in 13.04% (n=6) patients.

From the FNAC obtained from lymph nodes, majority were inflammatory changes (65.79%, n=25) of either tuberculous origin (64%, n=16) or reactive lymphadenitis (36%, n=9) which is similar to findings observed in the study of Adhikari et al.[10] Among the ovarian lesions, 70% were diagnosed as malignant; which is similar to the observations made in a study done by Pranabdey et al.[17] Among the thyroid lesions, majority were benign (68.97%, n=20). The most common cytological diagnosis with breast lesions also happened to be benign lesions (57.89%, n=11) out of which, fibroadenoma was commonest (81.81%, n=9). Mass lesions of neck, colon, pancreas, back, testes, scrotum, kidney, retroperitoneum etc were also aspirated. Thus, any deep-seated mass lesion can be aspirated using ultrasound guidance which can then be utilized for cytological diagnosis correlating with clinico-radiological features.

Limitations

In our study, the results of FNAC were unsatisfactory in about 43 cases (12.87%). This might in part be because our study was conducted in a resource-poor setting with not the best-in-class quality of imaging equipment used for a USG guided FNAC. Hence, the efficacy of this method of diagnosis would be even better with a resource-rich setting. Another limitation of our study was that we did not include the histology-cytology correlation of image guided FNAC results with the biopsy results, to study the accuracy of this method of diagnosis, as that was not in the scope and objective of our study.

CONCLUSION

Imaging techniques can be used to precisely visualize deep seated mass lesions and image guided FNAC can yield effective and relatively accurate results, which plays an

important role in diagnosing the various deep-seated as well as superficially palpable lesions with variable areas within; in addition to being relatively simple, safe, fast, minimally invasive and cost effective procedure. It can also help in typing of various tumors and differentiating between benign and malignant lesions. Thus, it can be regarded as the investigation of choice for rapid confirmation and morphological evaluation of doubtful lesions with sufficient diagnostic reliability, that can guide a clinician's approach for making a pre-operative diagnosis and the choice of treatment, especially with resource-poor tertiary care set-ups like our's.

Recommendations

We recommend that future studies that compare the results of image-guided FNAC with tissue biopsy should be performed to additionally analyse the diagnostic accuracy of this method over and above the effectiveness, for pre-operative diagnosis of deep-seated lesions.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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Cite this article as: Bajantri SR, Mehta DP, Shah PC, Patel RA. Ultrasound guided fine needle aspiration cytology in deep seated lesions: an effective diagnostic tool. Int J Res Med Sci 2022;10:2800-4.