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Original Research Article

The Role of Fine Needle Aspiration Cytology in the Diagnosis of Deep-Seated Lesions in Sudanese Patients

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ABSTRACT

Study Design and Objective: This was a descriptive cross sectional hospital based study performed to assess the role of fine needle aspiration cytology in the diagnosis of mass lesions in deep-seated organs in Sudanese patients.
Material and Methods: During the period between April 2011 and March 2012, percutaneous fine needle aspiration, either blindly or under ultrasound guidance, was performed preoperatively on 73 patients attending Khartoum hospitals with lesions in deep-seated organs. The final diagnosis had been based on histological examination and clinical follow-up.
Results: The cytological diagnosis was positive for malignancy in 66 cases and negative in 7 cases. Histopathology and clinical follow up confirmed the cytological diagnosis in 52 and 12 cases, respectively. There were two false positive results and one false negative result. The overall diagnostic accuracy of the procedure was found to be 95.5 %.
Conclusion: Fine needle aspiration of deep-seated organs is an accurate, safe, quick and economic preoperative test that can save the patient a diagnostic laparotomy and provide dependable report to commence treatment by radiotherapy or chemotherapy.

Key Words: FNAC; liver; abdomen; retroperitoneum; pancreas; intrathoracic; pelvis.

INTRODUCTION

Having established its role as an effective preoperative diagnostic tool in superficial lesions, fine needle aspiration cytology (FNAC) is now extended to diagnose lesions of deep-seated organs.[1] In these sites, its role as a preoperative diagnostic method is even more important than superficial organs as it may save the patient a major operation like laparotomy or thoracotomy.[2] In some cases the technique may abolish the need for surgery when the lesion is inoperable or the treatment of choice is radiotherapy or chemotherapy.[2] Of deep-seated organs, the liver is one of the commonest sites that investigated by FNAC.[3-6] In addition to being an important site of primary tumors, it is one of the

common sites for secondaries. Moreover, it is one of the easiest organs to be examined by ultrasound, which can detect lesions as small as 0.5 cm in diameter.[7] The gastrointestinal tract (GIT) is also a common site of varieties of deep-seated lesions such as adenocarcinoma, carcinoid tumors and extranodal lymphomas.[8] The cytological diagnosis of GIT lesions is usually based on lavage (washing of the affected organ) or endoscopic brushing.[9] FNAC as a supplement to endoscopy has also been used in the diagnosis of GIT lesions. This is especially important in seriously ill patients who cannot stand major operations and in lesions which are not accessible by endoscopy.[10]

Tumors of the lung and mediastinum are one of the most common tumors especially in males, added to that the lungs are one of the commonest sites for secondaries.[11] The first line of elucidating the nature of these tumors is by sputum exfoliative cytology, bronchial brushing or washing, and endoscopic biopsies.[12] However, peripheral tumors which are not accessible by endoscopy, tumors that are not open to the bronchial tree, and tumors of the mediastinum, are some of the most important indications of FNAC.[12]

Mass lesions in kidneys,[13,14] adrenals,[15,16] pancreas,[17,18] and pelvis are also among targets which are accessible by FNAC. This is becoming more popular in assessing lesions that are detectable by ultrasound imaging, as masses in these sites continue to present a diagnostic challenge to the clinician because of the difficulty of differentiating them from chronic inflammatory lesions. In patients with unresectable neoplasms, microscopic documentation of the disease is important to give accurate prognostic information to the patient and to assess and compare treatment protocols.[1,2,5]

As such deep seated mass lesions are relatively common in Sudan, this study was planned to evaluate the role of FNAC in the preoperative diagnosis of lesions in deep-seated organs of Sudanese patients.

MATERIAL AND METHODS

During the period between April 2011 and March 2012, preoperative FNA biopsies were performed on 73 ultrasonically or radiologically detected lesions in deep-seated organs of the abdomen and thorax of Sudanese patients attended the departments of surgery at Khartoum hospitals. The patients included 47 adults and 26 children.

A disposable needle of 21 to 23 gauge, 3 to 6 inches length, 0.6 to 1.0 mm outer diameter, and with 10 to 50 ml glass or plastic syringe, was used for aspirating abdominal and retroperitoneal lesions. Palpable lesions were aspirated directly without the need for radiological control but deeper and smaller lesions required more precise localization by ultrasound. For abdominal and retroperitoneal lesions, the preferred and easiest approach was through the anterior abdominal wall, but a posterior or flank approach was selected whenever it provided a shorter needle path to the lesion. Intrathoracic lesions were aspirated by using a 27 gauge spinal-type needle; aspirates were done blindly depending only on surface anatomy of thoracic organs. [19]

Guidance by ultrasound was needed in 24 cases, and the procedure was done without guidance in the other 49 cases. FNA was performed without any routine fasting or premedication. Prothrombin time, PTT, and platelet counts or any other laboratory investigations were not evaluated routinely before the procedure. There were 34 aspirates from the liver, 15 aspirates from intestinal masses, 11 aspirates from lung and mediastinal masses, 10 aspirates from retroperitoneal masses, 2 aspirates from the

pancreas, and one aspirate from a pelvic mass.

Prior to aspiration, labeled glass slides were laid in readiness for the samples. The skin overlying the mass was cleaned with a suitable medical antiseptic. To avoid unnecessary tearing of small vessels and dilution of the sample with fluid and blood, topical or local anesthesia was not administered. In aspiration of the intrathoracic lesions, local anesthesia was used in all cases. In children who were already prepared for laparotomy, the procedure was done under general anesthesia immediately before the operation.

After localization of the target mass, the needle was introduced percutaneously into the lesion. Once the needle was within the mass, negative pressure was applied; the needle was then quickly moved in different directions several times during maximal aspiration to soften the lesion. When the material was within the needle, the negative pressure was released and the needle was withdrawn. Only one pass was made for each mass in all cases .The aspirated material was then ejected vigorously from the needle onto the slides and made as thin films or prepared as concentrated smears at the periphery of the slide. About 2-4 smears were prepared from each aspirate; these smears were fixed immediately while wet in 95 % ethanol for 10-15 minutes and then stained by hematoxylin and eosin method. Most of the aspirates required about 20-30 minutes to be stained and were reported within 30-45 minutes of obtaining the material. Results were compared with biopsy results or clinical follow-up findings. From the following equations, sensitivity, specificity, and overall diagnostic accuracy were calculated:

Sensitivity = (TP/TP+ FN) x 100%

Specificity = (TN/TN+ FP) x 100%

Overall Accuracy = (TP+ TN) / (TP+TN+FP+FN) x 100%

TP = True positive, TN = True negative, FP = False positive, FN = False negative.

RESULTS

A cytological diagnosis was made from the aspirated materials from various organs. The cytological diagnosis was then compared with the histopathological diagnosis whenever a biopsy was taken. In some advanced lesions, in which there no biopsy was taken, the cytological diagnosis, together with the clinical diagnosis, were considered as the final diagnosis. Malignant or benign diagnosis confirmed by histopathological examination and / or clinical follow-up were considered as true positive results (TP) or true negative results (TN), respectively.

The liver: the cytological diagnosis of the aspirated hepatic lesions (34) included 33 malignant lesions and one benign lesion (liver abscess). The cytological diagnosis of malignancy included 26 cases of secondaries and 7 cases of primary malignant lesions. Of the 26 metastatic lesions in the liver, the cytological diagnosis in 17 cases was confirmed by histopathology and in 3 cases by clinical follow-up in the department of radiotherapy, while in the remaining 6 cases follow-up was lost. The primaries of the confirmed metastatic lesions in the liver were 4 from colon, 3 from non-Hodgkin lymphoma (NHL), 2 from the lung, 1 from the pancreas, 1 from the breast, and 9 of unknown origin (anaplastic tumors). The primary malignant lesions of the liver included 3 cases of hepatocellular carcinoma (HCC), 2 cases of hepatoblastoma, one case of cholangiocarcinoma, and one case of myeloid metaplasia. The cases of HCC were confirmed by histopathology. Both cases of hepatoblastoma had been put on chemotherapy and were followed up for radiotherapy. The diagnosis of cholangiocarcinoma was confirmed by a tissue biopsy taken during laparoscopy. The

case of myeloid metaplasia had been confirmed by hematological analysis to be polycythemia Vera.

There had been no suspicious, inadequate, false positive or false negative cytological diagnosis in the aspirated hepatic lesions. The true positive cytological diagnoses were 27 cases and the true negative cytological diagnosis was only one case. Therefore, sensitivity, specificity, and overall diagnostic accuracy of FNAC in hepatic lesions were 100 %.

The GIT: the cytological diagnosis of the aspirated intestinal lesions included 14 cases of Non-Hodgkin Lymphoma (NHL) and one case of carcinoma of the colon. Of the NHL cases, 8 were of Burkitt's type and 6 were of large cell type. Of the 14 cases of NHL, the cytological diagnosis was confirmed by histopathology in 12 cases and the remaining 2 cases had been followed up for chemotherapy and radiotherapy. The cytological diagnosis of carcinoma of the colon had been confirmed by histological examination of a resected surgical specimen. There had been no benign, suspicious, inadequate, false negative or false positive cytological diagnosis in the aspirated intestinal lesions. All cytological diagnoses of intestinal lesions had been true positive. Therefore, sensitivity, specificity, and overall diagnostic accuracy of FNAC in intestinal lesions were 100 %.

Intrathoracic lesions: the cytological diagnosis of the aspirated intrathoracic lesions included 9 malignant lesions and 2 benign lesions. Malignant diagnoses included 3 cases of secondaries, 3 cases of adenocarcinoma, one case of squamous cell carcinoma, one case of NHL, and one case of thymic tumor. Secondary malignant tumors were of unknown origin in 2 cases and of renal cell carcinoma origins in one case. All positive cases of secondaries were confirmed by histopathological examination. There were 7 true positive diagnoses, 2 true negative, 2 false positive, and no false negative results. Therefore, sensitivity, specificity, and overall accuracy of FNAC in intrathoracic lesions were 100 %, 50 %, and 81.8 %, respectively.

Retroperitoneal lesions: the cytological diagnosis of the aspirated lesions in this region included 4 cases of Wilm's tumor, 3 cases of neuroblastoma, one case pheochromocytoma, one benign lesion, and in one case the aspirate was negative for malignancy. The cytological diagnosis was compared with the histological diagnosis in all cases. There had been 8 true positive results, one true negative result, and one false negative result. There were no false positive results. Therefore, sensitivity, specificity, and overall accuracy of FNAC in retroperitoneal lesions were 88.9 %, 100 %, and 90 % respectively.

Other aspirated sites: there were two aspirates from pancreatic masses and one aspirate from a pelvic abscess. The cytological diagnoses of the pancreatic lesions were carcinoma of the head of the pancreas and a pseudocyst: both were confirmed by clinical follow up.

Diagnostic accuracy of FNAC of deep-seated organs: of the 73 aspirated lesions in various deep-seated sites, there had been 58 true positive results, 6 true negative results, 2 false positive results, and one false negative result. Therefore, the sensitivity, specificity, and the overall diagnostic accuracy of FNAC of lesions in deep-seated organs were 98.3 %, 75 %, and 95.5 % respectively.

A comparison between sensitivity, specificity, and overall accuracy of FNAC in various sites is shown in table (1).

Table (1): Comparison between sensitivity, specificity, and overall diagnostic accuracy in various sites.

Site	No. of cases	TP	TN	FP	FN	Sensitivity	Specificity	Accuracy
Abdomen	62	51	3	0	1	98.1 %	100 %	98.2 %
Liver	34	27	1	0	0	100 %	100 %	100 %
GIT	15	15	0	0	0	100 %	100 %	100 %
Renal / Suprarenal	10	8	1	0	1	88.9 %	100 %	90 %
Thorax	11	7	2	2	0	100 %	50 %	81.8 %
All sites	73	58	5	2	1	98.3 %	75 %	95.5 %

Note: Abdomen included liver, GIT, renal / suprarenal, pancreas, and pelvis

A comparison between the cytological and histological diagnosis of all the aspirated lesions in deep-seated organs is shown in table (2).

Table (2): Comparison between the cytological and histological diagnosis in all the aspirated lesions.

Site	No. of cases	+ve cytology	-ve cytology	+ve biopsy	-ve biopsy	Inadequate
Liver	34	33	1	22	1	0
GIT	15	15	0	13	0	0
Thorax	11	9	2	7	4	0
Renal / Suprarenal	10	8	1	9	1	1
Pancreas	2	1	1	0	0	0
Pelvic mass	1	0	1	0	1	0
Total	73	66	6	51	7	1

DISCUSSION

The cytological diagnosis of malignant hepatic lesions (33/34) was consistent with the histological diagnosis in all the cases which had tissue biopsies examined (22/33). In 5 cases the lesions were too advanced and inoperable; therefore tissue biopsies were not obtained. In these cases, the cytological diagnosis was confirmed by the subsequent clinical deterioration of the patient's condition. Some of these patients had widespread metastases and died within 6 months after diagnosis, while others had been still on chemotherapy and radiotherapy. In the remaining 6 cases the follow-up was lost; although the cytological features had been clearly malignant, yet they were excluded from this study. The sensitivity, specificity, and diagnostic accuracy of FNAC of the liver in this study are compatible with several other studies performed on lesions of the liver (Table 3).

Table (3): Other studies performed on lesions of the liver compared with the present study.

Author	No. of patients	Guidance	Needle	Sensitivity	Specificity
W.B.Schwerk 1981 [20]	60	U/S	20-25G spinal	92.2 %	88.9 %
M.Tasutal et al 1984 [21]	41	U/S	22G	100 %	95.7 %
Sania Noguchi et al 1986 [22]	84	Blindly	22G	100 %	100 %
Steven R. Axe et al 1986 [23]	59	U/S	20G 22G	78.7 %	100 %
Christian Prior et al 1988 [24]	36	U/S	22G Chiba	85.7 %	100 %
Angeles A. et al 1994 [25]	114	U/S, CT	21-22 G	96.2 %	93.1 %
Herzzenyi et al 1995 [26]	226	U/S	21-22 G	93 %	100 %
Present study	34	Blindly ,U/S	21-22G	100 %	100 %

Prothrombin time, PTT, and platelet counts were not checked routinely before FNA of the liver in this study. Nevertheless, no significant complications had been noted and no bleeding or other complications had occurred. This reflects the safety of the technique and indicates that evaluation of such laboratory data is not obligatory before performing FNAC of the liver.

In addition to its role in differentiating benign from malignant lesions, FNAC can help in predicting the site of primary tumors in patients with metastases. In 26 cases, the origins of the metastatic lesions in the liver were suggested, in 20 of them the diagnosis was confirmed by histopathology and / or clinical follow-up. In 9 cases, the final diagnosis was "metastases of unknown origin" and that was due to the undifferentiated nature of the lesions. In such cases, diagnosis of primary sites becomes possible with the use of cell markers. Although such achievement seems to be of little importance in patients with secondaries in the liver, however, it is of importance in assessment of prognosis and provides a rational treatment of some cases like prostatic cancer or papillary carcinoma of the thyroid.

Although the number of patients with GIT aspirations was small (15 cases), the results obtained indicate that percutaneous FNA of GIT masses is a useful method for the diagnosis of neoplastic lesions. These results are compatible with several other studies (Table 4).

Table (4): Some other studies on GIT lesions compared with the present study.

Author	No. of patients	Guidance	Needle	Sensitivity	Specificity
S.Torp-pedersen et al 1984 [27]	78	U/S	23G	67 %	100 %
Luigi solbiat et al 1986 [28]	24	U/S	22G	100 %	100 %
L.L. Cafferty et al 1990 [29]	192	U/S, CT, Fluor	18-22G	66 %	99 %
Dilip K. Das C.S. Pant 1994 [30]	78	Blindly U/S	22G	100 %	100 %
Present study	15	Blindly	21G 22G	100 %	100 %

The lack of specificity (50%) in intrathoracic lesions can be attributed to the weak experience in this field. Nevertheless in experienced hands this technique has proved to be accurate, easy and safe (Table 5). It can save the patient unnecessary thoracotomy, as such lesions may be inoperable and their cytological diagnosis is enough to start radiotherapy or chemotherapy.

Table (5): Some other studies on intrathoracic lesions as compared with the present study.

Author	No. of patients	Guidance	Needle	Sensitivity	Specificity
John H. Crosby et al 1985 [31]	180	CT, U/S Fluro.	0-9 OD	82 %	100 %
Nagi F. Khouri et al 1985 [32]	650	CT Scan	Turner's	94.7 %	96 %
John H. Stanley et al 1987 [33]	458	CT Fluor.	22-23G chiba	96.6 %	96.6 %
R. W. Simpson et al 1988 [34]	233	Fluor.	18 G spinal	82 %	100 %
James V.Lovett et al 1988 [35]	79	Fluor.	22, 23, 25 G	90 %	100 %
Alfred BÖcking et al 1995 [36]	482	CT Scan	22G spinal	98.4 %	95.3 %
Present study	11	Blindly	27G spinal	100 %	50 %

Although the number of the aspirated retroperitoneal lesions in this study was too small for comparison with other studies (10 cases), nevertheless, the results seem to be encouraging.

Pancreatic carcinoma continues to present a diagnostic challenge to the clinician because of the difficulty of differentiating it from chronic pancreatitis. The pancreatic cases in this series had been too small for any analysis or comparison.

The results of FNAC can be improved by using a guide of ultrasound. In this study, guided aspirations had been more successful as compared with unguided ones (Table 6). This is especially important in small and deep lesions which are not palpable by the aspirating pathologist. Added to that, guided aspiration is safer, as one can avoid penetrating certain structures such as distended gallbladder, or penetrating a major blood vessel.

Table (6): Comparison between U/S guided and unguided FNA biopsies.

	No. of cases	TP	TN	FP	FN	Sensitivity	Specificity	Accuracy
Guided FNA	17	17	0	0	0	100 %	100 %	100 %
Unguided FNA	49	41	5	2	1	97.7 %	71.4 %	94 %

CONCLUSIONS

It can be concluded from this study that FNAC of deep-seated organs, especially when guided by ultrasound, is an accurate, safe, quick and economic preoperative test. It is useful in differentiating neoplastic from nonneoplastic lesions and benign from malignant lesions. It can save the patient a diagnostic laparotomy and provide dependable report to commence treatment by radiotherapy or chemotherapy. Finally, it can help to predict the primary lesion of an aspirated metastatic lesion.

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