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Original Article

Ultrasound guided percutaneous fine needle aspiration biopsy/automated needle core biopsy of abdominal lesions: Effect on management and cost effectiveness

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Abstract

Aims: This prospective study was designed to determine whether ultrasound (US)-guided percutaneous fine needle aspiration biopsy (PFNAB)/US-guided percutaneous needle core biopsy (PNCB) of abdominal lesions is efficacious in diagnosis, is helpful in treatment choice, to evaluate whether various other investigations can be avoided, especially invasive ones, its time (shortening hospitalization) and cost-effectiveness.

Materials and Methods: A total 159 US-guided PFNAB (67) and US-guided automated PNCB (92) of abdominal lesions were performed percutaneously in 150 patients; the youngest patient was a 3-month-old female and eldest was a 75-year-old female. The patient selection was irrespective of age, sex, or location of the abdominal lesion. These patients presented with abdominal mass/lesions, suspected malignancy, jaundice, and in some cases, however, biopsy was performed to determine the nature of indeterminate lesion (malignant / benign versus abscesses). They were 47 hepatobiliary, 6 pancreas, 24 gastrointestinal tract (GIT), 20 kidneys and urinary bladder, 20 prostate, 3 lymph nodes, 4 adrenals, 8 retroperitoneal, 13 ovaries, and 9 other types of lesions. We used free-hand technique (without biopsy attachment) in 129 cases, and transrectal and transvaginal with biopsy attachment was used in 30 cases.

Results: In 91.99% of cases, US-guided PFNAB/US-guided PNCB contributed significantly to diagnosis in which US-guided PFNAB/US-guided PNCB was the diagnostic test in 23.33% cases. It confirmed a highly suspected diagnosis in 64% patients, and indicated a specific diagnosis that was not suspected in the remaining 36%. In 57.33% cases, the results of US-guided PFNAB/US-guided PNCB, did not alter treatment choice but increased physician confidence in the choice. US-guided PFNAB/US-guided PNCB was responsible in avoiding 107 planned investigations, including 8 laparotomies, with no significant complications and decreasing length of stay and resulting in 20% cost savings.

Conclusions: Thus, the US-guided PFNAB/US-guided PNCB contributed significantly in diagnosis, and in most of the cases it did not change treatment choice but increased clinicians confidence in the choice. We can avoid the number of investigations, decrease morbidity and mortality, shorten hospitalization and cost by using these methods.

Key-words: Biopsy, cost-effectiveness, effect on diagnosis, effect on treatment, percutaneous fine needle aspiration biopsy, percutaneous needle core biopsy, ultrasound

Résumé

Objectifs: Cette étude prospective a été conçue afin de déterminer si l'échographie (US)-guidé percutanée fi ne aiguille biopsie d'aspiration (PFNAB) / biopsie guidée par U.S. percutanée aiguille (PNCB) des lésions abdominales est effi cacious en diagnostic, est utile dans le choix de traitement, d'évaluer si les divers autres enquêtes peuvent être évités, surtout envahissantes, son temps (raccourcissement hospitalisation) et la rentabilité.

Matériaux et procédés: Un total 159 - guidées, U.S. PFNAB (67) et U.S.-guidé automatisé PNCB (92) des lésions abdominales ont été réalisées par voie percutanée dans 150 patients ; le plus jeune patient était une femme âgée de 3 mois et l'aîné était un femme de 75 ans. La sélection des patients a été indépendamment de l'âge, le sexe ou l'emplacement de la lésion abdominale. Ces patients avec masse/lésions abdominales, soupçonnés de malignité, ictère et dans certains cas, cependant, a présenté biopsie a été effectuée afin de déterminer la nature de la lésion pour une période indéterminée (maligne / bénigne versus abcès). Ils étaient 47 hépatobiliaire, pancréas 6, 24 tractus gastro-intestinal (TIG), 20 reins et vessie, prostate 20, 3 lymphatiques nœuds, les glandes 4 surrénales, 8 rétropéritonéale, 13 ovaires et 9 autres types de lésions. Nous avons utilisé la technique de mains libres (sans attachement de biopsie) cas, 129, transrectale et transvaginale avec biopsie attachement a été utilisé dans 30 cas.

Résultats: Dans 91.99% des cas, guidée par l'U.S. de PNCB PFNAB/U.S.-guidé contribué signifi portée au diagnostic dans lequel USguided PNCB PFNAB/U.S.-guidé était le test diagnostique en cas de 23.33%. Il confi rmé un diagnostic très présumé en 64% des patients et a indiqué un diagnostic c précises qui n'était pas soupçonné de 36% restants. Dans des cas constatés%, les résultats de-guidées, U.S. PFNAB/U.S.-guidé PNCB, n'altère pas le traitement médecin choix mais une augmentation confi dence dans le choix. Guidée par l'U.S. PNCB PFNAB/U.S.-guidé était responsable, en évitant les enquêtes prévues 107, y compris 8 laparotomies, avec aucune signifi dévers complications et diminution de la durée du séjour et ce qui a entraîné des économies de coûts de 20%.

Conclusions: Ainsi, la PNCB de PFNAB/U.S.-guidé U.S.-guidé contribué signifi cativement en diagnostic et dans la plupart des les cas ne change pas les cliniciens choix mais une augmentation de traitement confi dence dans le choix. Nous pouvons éviter les nombre d'enquêtes, diminution de la morbidité et mortalité, raccourcir d'hospitalisation et frais à l'aide de ces méthodes.

Mots clés: Biopsie, rentabilité, l'effet sur le diagnostic, l'effet sur le traitement, percutanée fi ne ponction à l'aiguille biopsie, biopsie aiguille percutanée, échographie

Introduction

Many studies have shown that the ultrasound (US)-guided PFNAB/US-guided PNCB of abdominal lesions is simple, relatively painless, reasonably safe, accurate, time saving, and a reliable method under ultrasound guidance to obtain specimen for specific cytological/histological diagnosis with less trauma, minimal discomfort, and with very low complication rate.[1-3] In its further course, to assess the clinical efficacy of ultrasound guided Percutaneous fine needle aspiration biopsy (PFNAB)/ Percutaneous needle core biopsy (PNCB) by automatic gun and its effect on diagnosis, treatment, investigation and cost effectiveness in abdominal lesions,[4] we undertook a prospective study of 150 patients.

Materials and Methods

During a 24-month period, a total 159 US-guided PFNAB (67) and US-guided automated PNCB (92) of abdominal lesions were performed percutaneously in 150 patients in the Department of radiology of Al Jedaani Hospital, Jeddah, Kingdom of Saudi Arabia [Table 1]. There were 47 hepatobiliary, 6 pancreas, 24 gastrointestinal tract (GIT), 20 kidneys and urinary bladder, 20 prostate, 3 lymph nodes, 4

Table 1: Showing distribution of lesions as per the site, type of biopsy used, and number of cases in which US-guided diagnosis was achieved.

Lesion	No. of cases	US-guided PFNAB	US-guided PFNAB diagnosis	US-guided PNCB	US-guided PNCB diagnosis	Total US-guided PFNAB/ PNCB diagnosis
Liver	43	12	10	31	28	38
Biliary tree	04	02	01	02	02	03
Spleen	06	06	05	00	00	05
Gastrointestinal tract	24	07	07	17	16	23
Pancreas	06	04	03	02	02	05
Lymph nodes	03	03	03	00	00	03
Renal	10	02	02	08	08	10
Urinary bladder	08	08	08	00	00	08
Adrenals	04	04	04	00	00	04
Retroperitoneum	08	01	01	07	05	06
Prostate	20	00	00	20	19	19
Ovaries	13	12	10	01	01	11
Miscellaneous	10	06	06	04	04	10
Total	159	67	60	92	85	145

PFNAB = Percutaneous fine needle aspiration biopsy, PNCB = Percutaneous needle core biopsy

adrenals, 8 retroperitoneal, 13 ovaries, and 9 others types of lesions [Table 1]. Patients were aged 3 months – 75 years (mean age: 46 years), and male to female ratio was 2.6:1. Fine needle aspiration or true cut needle biopsy technique was selected on many factors, including the size and site of the lesion, considering the nature of lesion like cystic, cystic with solid area, small size of lesion, and high vascularity of region, clinical condition, and the risk of complications.[5,6]

For US guidance we used standard USG machines (Aloka SSD-2000, and Alfa -7) equipped with 3.5 MHz electronic convex, and 5−10 MHz linear probes for free hand technique, and 5-7.5 MHz transvaginal and transrectal probes with biopsy attachment. For fine needle aspiration biopsy, 10-cm long spinal needles of 20−21 gauge, and 15, 20 cm Chiba needles of 20−22 gauges,[7] and 10, 15, 20, and 28-cm long Biopsy needles by Optimed (Germany) and Automated Biopsy Gun, also by Optimed (Germany) used.[8]

Free hand technique (without biopsy attachment) was used in 129 cases,[9,10] and transrectal and transvaginal with biopsy attachment was used in 30 cases. All specimens were sent to cytology / histology. All biopsies were performed by the same radiologist, and all the specimens were interpreted by the same pathologist.

Relative contraindications included abnormal bowel dilatation, bleeding tendencies, and unco-operative patients.[11,12] Ascitis and obstructive jaundice were not regarded as contraindications, which was in accordance with the studies by Murphy *et al*. Suspected ecchinococcal cysts, pheochromocytomas, and hemangiomas were not biopsied in our series though there have been reports of successful aspiration biopsies.[13,14]

The attending clinicians were asked to complete two questionnaires the first before US-guided PFNAB/US-guided PNCB, and the second after the results of US-guided PFNAB/US-guided PNCB and final diagnosis is known.[4]

In the prebiopsy questionnaire, clinicians cited: (1). The investigations already performed and those might be done if US-guided PFNAB/US-guided PNCB were not available. (2) The treatment planned with the existing information.[4]

In the postbiopsy questionnaires, clinician indicated: (1). A type from 1 to 4 of the effect of US-guided PFNAB/US-guided PNCB on final diagnosis. (2). A type from 1 to 4 of the effect of US-guided PFNAB/US-guided PNCB on treatment. (3). Investigations avoided after US-guided PFNAB/US-guided PNCB. (4). Investigations performed after US-guided PFNAB/US-guided PNCB. (5). Total period of hospital stay.[4]

Results

Out of the total 159 cases, US-guided fine needle aspiration (PFNAB) with preparation of slide smears were done in 67 cases, and in 60 cases diagnosis was made, which was confirmed by postoperative histopathology. In rest of the seven cases, US-guided fine needle aspiration was not helpful due to small size of lesion in liver and biliary tree lesions, needle was not penetrated due to fibrous/hard lesion in pancreas, and gross bloody aspirate in spleen fine needle aspirate, and very small nodule in ovary showing scanty/inadequate specimen by cytological examination [Table 1].

In the rest 92 cases, US-guided PNCB and histopathological examination was done and diagnosis was obtained in 85 cases. In rest 7 cases, it did not help in diagnosis because of small-sized lesions and inadequate specimen in liver and prostate, fibrous/hard lesions in retroperitoneum, and mobility of lesions in GIT [Table 1].

The effects mentioned above of US-guided PFNAB/PNCB on the final diagnosis was obtained by comparing highly probable diagnosis before US guided PFNAB/PNCB with the results of US guided PFNAB/PNCB.

The effects mentioned above of US-guided FNAB/NCB on final treatment was obtained by comparing treatment planned with the existing information before US-guided FNAB/NCB with the existing information before US-guided FNAB/NCB with the result of US-guided FNAB/NCB.

The number of procedures that were not done because of results from US-guided FNAB/NCB was estimated by comparing the investigations planned before US-guided FNAB/NCB with those actually performed after biopsy.

Certain procedures mentioned above that were not planned before biopsy were performed afterwards with US-guided FNAB/NCB or to search for primary lesion if a diagnosis of metastasis was obtained or as a part of evaluation before surgery (e.g. If the diagnosis of ovarian malignancy is made after biopsy, Intravenous urography is needed to evaluate ureteric involvement before surgery or computed tomography scan if patient can afford).

Discussion

The real time B-mode US is relatively safe, less expensive, without radiation, non-invasive, and provides guidance in multiple axial, longitudinal and oblique planes of section and efficiently guides the needle for US-guided PFNAB/US-guided PNCB to obtain specimen for cytological/histological diagnosis.[10,12] The routine sector transducer can be used, without biopsy attachment (free hand technique) to have free movements and for time savings.

Although various studies had proved that US-guided PFNAB/US-guided PNCB as a highly accurate method in diagnosis of malignancy, with a sensitivity of 78%-93.4% and a specificity of 100%[2,4,8,15] (Our study show overall accuracy of 91.19%, sensitivity 92.18%, and specificity 100%) [Table 2] but this does not means, however, it is clinically efficacious, necessary or even useful to patient. We undertook this study to evaluate the effect of PFNAB/PNCB with automatic gun on diagnostic workup, therapeutic choice, and cost-effectiveness.

In 150 patients, we performed 159 percutaneous biopsies (67 US-guided PFNAB and 92 US-guided PNCB). Fine needle aspiration or true cut needle biopsy technique was selected on many factors, including the size and site of the lesion, considering the nature of lesion like cystic, cystic with solid area, small size of lesion, and high vascularity of region, clinical condition and the risk of complications.[5,6]

We did not have any major complication, except pain, small hematoma, minimal bleeding from local site, and two cases of hematuria after FNAB of bladder lesion.

The clinician send the patient with answer to prebiopsy questionnaire, with highly probable diagnosis made by clinical examination, roentgenologic, US, biochemical, haematological, and other investigations performed and investigations to be done, if ultrasound guided biopsy facility would not have been present. After the result of biopsy or cytology, the findings of US-guided biopsy were confirmed by correlating with the final diagnosis based on clinical course, biochemical, haematological, US and histopathological evidence by laparoscopy and laparotomy, then a post biopsy questionnaire was send to clinician indicating: (a) A grade from 1 to 5 of the impact of US-guided PFNAB and US-guided automated PNCB on final diagnosis and treatment. (b) Investigation performed after US-guided biopsy (c) Complications, and (d) Investigations performed before US-guided biopsy that could have been avoided.[4]

In 91.99% cases, US-guided PFNAB/US guided PNCB contributed significantly in obtaining diagnosis, in that 68.66% cases final diagnosis was made with high probability by clinical examination and various other investigations and were confirmed by US-guided PFNAB/US guided PNCB, and in rest 23.33% cases US-guided PFNAB/US guided PNCB was the only diagnostic test, since US-guided PFNAB/US-guided PNCB had changed the diagnosis with high probability by clinician. In 0.66% cases, US-guided PFNAB/US-guided PNCB lead to wrong diagnosis but did not lead to additional investigation, as in our study the clinician was suspecting left hypernephroma, IVU shows non-visualised left kidney, on ultrasound it was suspected to be large splenic abscess with non-visualised left kidney, US-guided fine needle aspiration showed inflammatory cells and correlated with ultrasound findings, the diagnosis of splenic abscess was kept, on laparotomy huge pyonephrosis with pelviureteric junction obstruction was found. And in 22% cases the procedure did not influence the diagnosis since it was already highly suspected with high probability[4] [Table 3].

Table 2: Showing result of US-guided PFNAB/PNCB diagnosis of malignancy in 159 lesions

US guided PFNAB/PNCB results	Positive for malignancy	Negative for malignancy	Cases
Positive	136	000	136
Negative	009	014	023
Total	145	014	159

PFNAB = Percutaneous fine needle aspiration biopsy, PNCB = Percutaneous needle core biopsy, Overall accuracy of diagnosis of malignancy is 93.79%; Sensitivity is 92.18%; Specificity is 100%

Table 3: Showing effect of Percutaneous Fine-needle aspiration biopsy/percutaneous needle core biopsy on diagnosis

Type	Effect of US-guided PFNAB/PNCB on diagnosis	No. of cases	Percentage of cases
ED1	Leads to wrong diagnosis and lead to investigations that would not have been done	00	00.00
ED2	Leads to wrong diagnosis but does not lead to additional investigations.	01	00.66
ED3	Very little or no effect	11	07.33
ED4	Played a significant role in obtaining diagnosis	103	68.66
ED5	PFNAB/PNCB was the diagnostic test	35	23.33
	Total	150	100.00

PFNAB = Percutaneous fine needle aspiration biopsy, PNCB = Percutaneous needle core biopsy, ED = Effect on diagnosis

The effect of US-guided PFNAB/US guided PNCB on the treatment was obtained by comparing the probable line of treatment before US-guided PFNAB/US guided PNCB with the result of US-guided PFNAB/US-guided PNCB and final line of treatment. In 57.33% cases, the US-guided PFNAB/US-guided PNCB did not alter treatment choice but increases physicians confidence in the choice, since it established the probable line of treatment as final line of treatment. In 13.33% cases, the procedure did not influence the treatment since it was already planned and probably in many cases of malignant disease there is no completely curable treatment treatment at our set up (e.g. highly suspected Hepatoma on clinical examinations, confirmed by US-guided NCB as hepatocellular carcinoma). And in only 29.32% cases, treatment was influenced by US-guided PFNAB/US-guided PNCB (e.g. mass suspected to be mesenteric sarcoma, was found to be secondaries from seminoma testis on US-guided FNAB/NCB), thus the line of treatment is changed[2,4] [Table 4].

There are certain investigations already performed before US-guided PFNAB/US-guided PNCB that could have been avoided. Hence, it is suggested that US-guided PFNAB/US-guided PNCB should be done immediately after the lesion is suspected or found and as an outpatient patient, whenever possible[4] [Table 5].

Certain investigations that were not planned before US-guided PFNAB/US-guided PNCB were performed afterwards, either to delineate the lesion further before undertaking specific therapy (e.g. IVU for confirmation of ureters involvement, after diagnosis of malignant ovarian tumor by US-guided PFNAB/US-guided PNCB before surgery) or to search for primary neoplastic lesion, if a diagnosis of metastatic disease is established by US-guided PFNAB/US-guided PNCB [Table 5].

US-guided PFNAB/US-guided PNCB contributed to decreasing the total number of tests and length of stay, and hence cost savings of about 20%.[4,16,17] Calculation of the cost savings by PFNAB/PNCB is = {Costs of investigations avoided + cost of hospital stay shortened by PFNAB/PNCB} – {Cost of PFNAB/PNCB + investigations performed afterward that were not previously planned}.[4]

The mean length of hospitalization was 6 days and could have been shortened since 16% of investigation performed before US-guided PFNAB/US-guided PNCB could have been avoided. So, for higher cost effectiveness US-guided PFNAB/US guided PNCB should be done immediately after the lesion is detected, as an outpatient procedure, whenever possible.[1,18]

So, the US-guided PFNAB/US-guided PNCB contributed significantly in diagnosis by getting the biopsy from the needed area of lesion for accurate histopathological diagnosis. In most of the cases, it did not change treatment choice but increased clinicians confidence in the choice, since it established the probable line of treatment as final line of treatment. We can avoid number of investigations especially invasive ones, it helps in decreasing morbidity and mortality, shortening hospitalization and hence is cost-effective [4-6,12,16,17,19] So, overall the procedure US-

Table 4: Showing effect of Percutaneous Fine-needle aspiration biopsy/percutaneous needle core biopsy on treatment

Type	Effect of US-guided PFNAB/PNCB on treatment	No. of cases	Percentage of cases
ET1	Lead to inappropriate treatment choice.	00	00.00
ET2	No influence on treatment choice.	20	13.33
ET3	Did not alter treatment choice, but increase clinicians confidence in the choice.	86	57.33
ET4	Played major role in treatment choice.	13	08.66
ET5	Instrumental in changing chosen treatment.	31	20.66
	Total	150	100.00

PFNAB = Percutaneous fine needle aspiration biopsy, PNCB = Percutaneous needle core biopsy, ET = Effect on treatment

Table 5: Showing investigations avoided and done after US-guided PFNAB/PNCB

Investigation/ Procedure	Investigations avoided by US-guided PFNAB/PNCB	Investigations done after US-guided PFNAB/PNCB
Barium enema	13	14
Barium swallow	10	07
Barium meal follow through	17	13
Bronchoscopy	02	05
Mammography	01	03
Endoscopy	06	02
Intravenous pyelography	13	07
Laparoscopies	12	03
Laparotomies	08	00
Percutaneous transhepatic cholangiography	03	01
Computed tomography	22	10
Total	107	65

PFNAB = Percutaneous fine needle aspiration biopsy, PNCB = Percutaneous needle core biopsy

guided PFNAB/US guided PNCB is an economic healthcare resource.

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