



Ultrasound guided interventions in the diagnosis and management of hepatic lesions

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Abstract

Background: Space occupying lesions of the liver are frequently reported during imaging of the abdomen. Patients with these lesions may be symptomatic or asymptomatic. Most of these lesions have nonspecific imaging findings. Hepatic lesions can be inflammatory like abscesses, benign lesions like hemangiomas or malignant lesions like hepatocellular carcinoma. Guided interventions in the liver may be for diagnostic purposes like fine needle aspiration cytology or biopsy for focal lesions or for therapeutic purposes like fine needle aspiration cytology (FNAC) or catheter drainage for abscesses and collections.

Aims and objectives: The aims of this study were 1) to conduct US guided biopsy in hepatic lesions and to evaluate the safety of procedures as well as quality and adequacy of specimens obtained. 2. To conduct US guided aspiration or catheter drainage of hepatic abscesses and to evaluate the clinical outcome. 3. The utility of these ultrasound guided interventions to laboratory procedures.

Methods: The study is a hospital based observational study of ultrasound guided interventional procedures in patients with liver lesions (benign or malignant) for. The study includes patients both sexes with age ranging from 4 years to 80 years. The study period was for duration of 18 months from October 2018 to May 2019. The study includes two groups of patients, one with liver abscesses for drainage and other with focal or diffuse hepatic lesions for diagnostic biopsy or cytology under sonographic guidance referred from various departments

Results: This study describes the safety of ultrasound guided interventions in patients with varying hepatic lesions, the quality and adequacy of specimens obtained in diagnostic biopsy and FNACs and the clinical out come in patients with hepatic abscess treated by percutaneous abscess aspiration. Ultrasound guided intervention was performed in 55 patients with varying hepatic lesions. 25 patients with clinical and imaging diagnosis of hepatic abscess were treated with needle aspiration (21) or by pig tail catheter drainage (4). The patients were followed up until were discharged with complete clinical cure. Out of 25 patients only one patient was not cured and he had multiple complications due to liver abscess per se. Rest of 24 patients were completely cured with hospital stay ranging between 3 to 7 days after the procedure. Diagnostic biopsy (18) and FNAC (11) were performed in 29 patients with clinical and imaging diagnosis of malignant hepatic lesions. Out of 11 ultrasound guided FNACs one was suboptimal due to inadequate sample. Repeat trucut needle biopsy in that patient yielded adequate sample with histopathological diagnosis of hepatocellular carcinoma. The diagnostic yield of ultrasound guided FNAC was 91%.

Conclusions: Ultrasonography is choice of image guidance as it provides real time visualization of needle (and catheter) position and movement, cost effective and free of ionizing radiation. Sonographically guided liver biopsy with 18-20-gauge automated gun biopsy needles is a safe procedure in expert hands with low morbidity. Ultrasound guided diagnostic biopsy or cytology provides requisite and decent quality specimen for histopathological examination

Keywords: Shoulder apophysitis, Painful shoulder, Athlete, Sports, Cricket, Acromion, Paediatric

Introduction

Liver has attracted the interest of mankind from time immemorial. The Babylonians and Assyrians considered it the seat of the soul and used animal livers to foretell the future; Greek and Roman readers rarely took important decisions without having a priest inspect an animal liver; numerous other peoples have stressed its importance in the balance of human characteristics, particularly is respect of courage or cowardice (“lily-livered”) and arrogance (“gall”) or timidity ^[1]. Space occupying lesions of the liver are frequently reported during

imaging of the abdomen. Patients with these lesions may be symptomatic or asymptomatic. Most of these lesions have nonspecific imaging findings. Hepatic lesions can be inflammatory like abscesses, benign lesions like hemangiomas or malignant lesions like hepatocellular carcinoma. Guided interventions in the liver may be for diagnostic purposes like fine needle aspiration cytology or biopsy for focal lesions or for therapeutic purposes like aspirations or catheter drainage for abscesses and collections. Some of the benign lesions do not need

biopsy confirmation if they strictly adhere to some diagnostic criteria. However atypical appearance of these lesions may require invasive interventions like fine needle aspiration cytology or core biopsy [2]. Liver is the organ most subjected to the development of abscesses, solitary or multiple.

Aspiration or catheter drainage forms mainstay of treatment of pyogenic abscesses where as amebic abscesses are more commonly medically treated [3]. The principal advantage of percutaneous drainage is lower morbidity and decreased hospital stay of the patient with improved clinical outcome [4].

The risk of major complications from blind percutaneous liver biopsy is reported to be in the range of 0.24 % to 3.8 % [4]. In a recent randomized trial, patients whose liver biopsies were ultrasound guided had significant reduction in complications requiring hospitalization compared with patients who underwent blind biopsies [5-6].

An advantage of ultrasound in these invasive procedures is that the needle can be observed and placed in real time with continuous feedback allowing accurate and rapid orientation of needle as it approaches the lesion. Another advantage of ultrasound is that needle can be oriented in non-axial planes with no difficulty.

2. Methodology

The study is a hospital based observational study of ultrasound guided interventional procedures in patients with liver lesions (benign or malignant) for. The study includes patients both sexes with age ranging from 4 years to 80 years. The study period was for duration of 18 months from October 2018 to May 2019.

Inclusion Criteria

- Patients with hepatic abscesses not improving with antibiotic therapy the more than 48 hours.
- Patients with focal or diffuse hepatic lesions.

Exclusion criteria

- Patients with altered bleeding and clotting parameters
- Patients with ascites
- Suspected hepatic vascular lesions
- Local skin infections

The study includes two groups of patients, one with liver abscesses for drainage and other with focal or diffuse hepatic lesions for diagnostic biopsy or cytology under sonographic guidance referred from various departments of Azeezia Medical College and attached hospitals. Subjects were selected with preprocedural imaging diagnosis in the form of sonography, computed tomography or magnetic resonance imaging. bleeding and clotting parameters in the form of clotting time, bleeding time, prothrombin time and aPTT were determined in all patients. Subjects with normal bleeding and clotting parameters were included in the study and rest were excluded. Detailed history of patients was collected including medical history, alcohol consumption, history of blood transfusion and previous history of similar episodes.

Informed consent

Informed consent was taken from Patient or patient's relatives for

the interventional procedure. The intention of the procedure, its necessity and projected advantage in the form of clinical outcome and its complications were explained in his/ her language. The benefits of performing sonographic guided intervention over blind procedure were also explained.

Preparation of the patient

Suitable antibiotic cover was started a day prior to the procedure. No fasting was required for the procedure. The hypochondrium and epigastric regions were shaved and cleaned.

Immediate preprocedural ultrasound was done to locate the site of the needle puncture and the direction of track for advancing the needle towards the lesion and the site was marked. The local area was cleaned with betadine and spirit. With aseptic precaution sufficient local anesthesia was given with 5% lignocaine and in pediatric patients when necessary general anesthesia was given and following procedures were performed by free hand technique.

Ethical clearance

The study required invasive ultrasound guided procedures on patients depending on the type of liver lesions. Ethical clearance was obtained from the institutional Ethical Review committee of Azeezia Medical College and Research institute.

Methods of statistical analysis

Data was entered in the Microsoft excel. Data analysis was presented in numbers and percentages. Yield of ultrasound guided procedures were calculated.

Equipment used

Ultrasound Machines – Wipro Ge Logiq 500

Siemens G 50

L & T A/ C Sigma

Aloka – Ssd 900

Wipro Ge Logiq 100 Pro

Instruments used – Automated gun biopsy needles (ACECUT, 18-20 G) 18 – 20 G aspiration, lumbar puncture and hypodermic needles

Pig tail drainage catheters (BIORAD, 8-12 G)

Radiofrequency ablation needle with generator.

3. Results

This was hospital based observational study of patients with varying clinical diagnosis of liver lesions undergoing ultrasound guided intervention either for therapeutic procedure in case of liver abscess or diagnostic in patients with benign, diffuse and malignant hepatic diseases.

This hospital based observational study had 55 patients, in which 41 were male and 14 were female. The age group of patients in the study ranges between four years to eighty years.

Maximum numbers of patients were in age group of 51 to 60 years with a value of 15, accounting for 27 % of patients. Followed by age group of 31 to 40 years had maximum number of patients with value of 12.

The least number of patients was in the age group of 11 to 20 years with a value of one.

Table 1: Sex and age distribution of patients

| Age group in Years | Male | Female | Total Number |
|--------------------|------|--------|--------------|
| BELOW 10 | 02 | 01 | 03 |
| 11 TO 20 | 00 | 01 | 01 |
| 21 TO 30 | 04 | 00 | 04 |
| 31 TO 40 | 09 | 03 | 12 |
| 41 TO 50 | 05 | 01 | 06 |
| 51 TO 60 | 11 | 04 | 15 |
| 61 TO 70 | 07 | 03 | 10 |
| MORE THAN 70 | 03 | 01 | 04 |
| TOTAL | 41 | 14 | 55 |

Out of the 55 patients in the study, three were of pediatric age group (less than 18 years of age). The age group of the pediatric patients was in the range of 4 to 10 years and all were suffering from liver abscesses.

Table 2: Distributions of patients into adults and pediatric age groups

| | |
|-----------|----|
| Adults | 52 |
| Pediatric | 3 |
| Total | 55 |

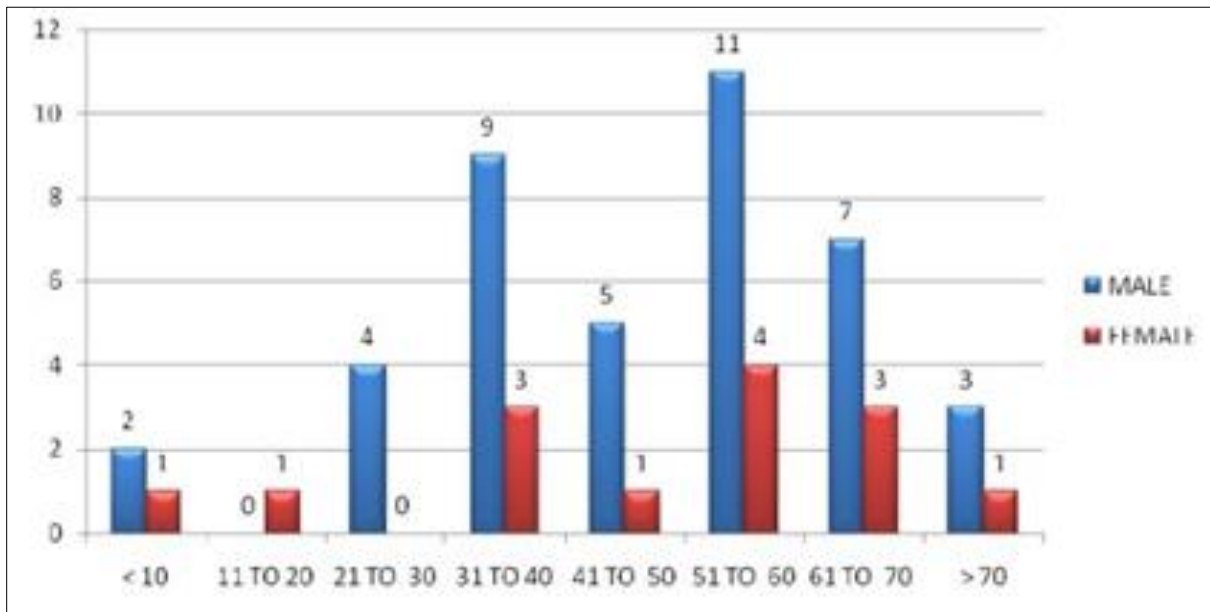


Fig 1: sex and age distributions of patients.

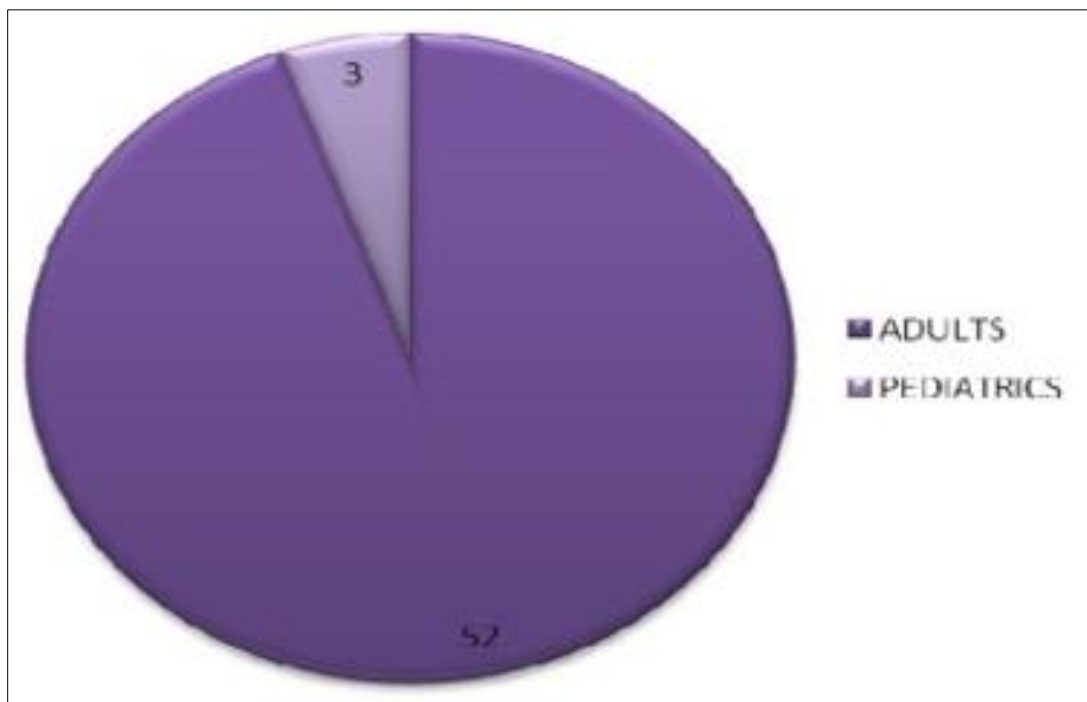


Fig 2: distributions of patients into adult and pediatric age group.

Maximum number of patients with clinical and imaging diagnosis of liver abscess was in age group of 31 to 40 years accounting for 28 % of all patients with liver abscesses and accounting for 58% of patients in the same age group. All three pediatric patients diagnosed to have liver abscesses. The next

group of patients with maximum number of liver abscesses were of 61 to 70 years accounting for 20 % of all patients with liver abscesses and accounting for 50% of patients in the same age group.

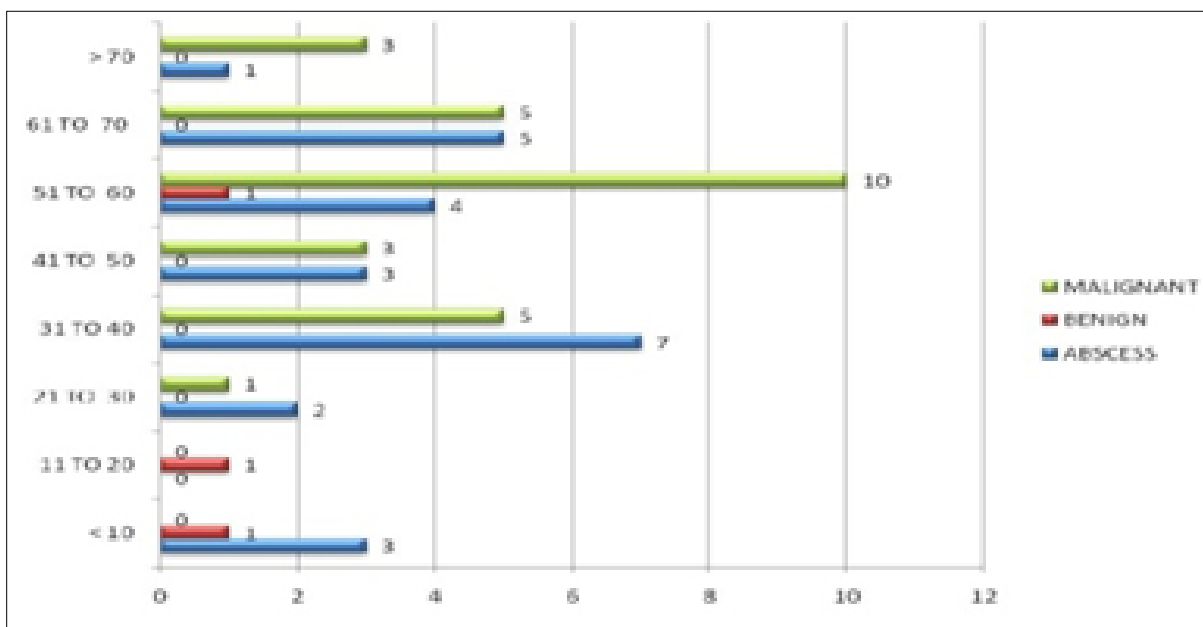


Fig 3: classification of lesions according to age distributions

Table 3: classification of lesions according to age distributions

| Age group | Total number | Abscess | Diffuse | Malignant lesion |
|--------------|--------------|---------|---------|------------------|
| BELOW 10 | 03 | 3 | 0 | 0 |
| 11 TO 20 | 01 | 0 | 1 | 0 |
| 21 TO 30 | 04 | 2 | 0 | 1 |
| 31 TO 40 | 12 | 7 | 0 | 5 |
| 41 TO 50 | 06 | 3 | 0 | 3 |
| 51 TO 60 | 15 | 4 | 1 | 10 |
| 61 TO 70 | 10 | 5 | 0 | 5 |
| More than 70 | 04 | 1 | 0 | 3 |
| Total | 55 | 254 | 3 | 28 |

The maximum numbers of patients with clinical and imaging diagnosis of malignant hepatic lesions were in age group of 51 to 60 years accounting for 35 % of all patients with malignant hepatic disease and 66 % of patients in the same age group. 61 to 70 years and 31 to 40 years were other next age groups with maximum number of patients with malignant hepatic lesions with a value of five.

The study included 55 interventional procedures under ultrasound guidance for liver lesions. Abscess drainage accounted for 45 % of all interventional procedures with a value of 25. Next most common procedure was diagnostic liver biopsy accounting for 32 %. One intraoperative ultrasound guided radiofrequency ablation of hepatocellular carcinoma was done. Clinical features in patients suffering from liver abscess were nonspecific. Most common symptom was fever, seen in 22 of 25 patients suffering from liver abscess. The next most common symptom was abdominal pain localized to right hypochondrium

or epigastric region. Jaundice was the rare symptom seen only in one patient. Other symptoms were loss appetite, vomiting and chest pain.

Liver function tests were performed in 15 of 25 patients with clinical and imaging diagnosis of hepatic abscess. Out of 15 patients seven had normal liver function test and other eight showed altered parameters in the form of elevated serum bilirubin, Alanine aminotransferase (ALT), Aspartate aminotransferase (AST) and alkaline phosphatase and decreased serum albumin. Only one patient out of 15 showed elevated serum total bilirubin and two showed decreased serum albumin. Most common abnormal parameter was elevated alkaline phosphatase ((Normal 42 -128 U/L)) seen in seven patients with maximum value of 235 U/L followed by elevated values of serum AST (Normal 0-35 U/L) and ALT (Normal 0-35 U/L) seen in five patients with maximum values of 270 U/L and 310 U/L respectively.

Table 4: distribution of types of ultrasound guided proeduers

| Type of procedure | number of procedures |
|-------------------|----------------------|
| Abscess drainage | 25 |
| biopsy | 18 |
| fnac | 11 |
| Rfaof tumor | 01 |
| total | 55 |

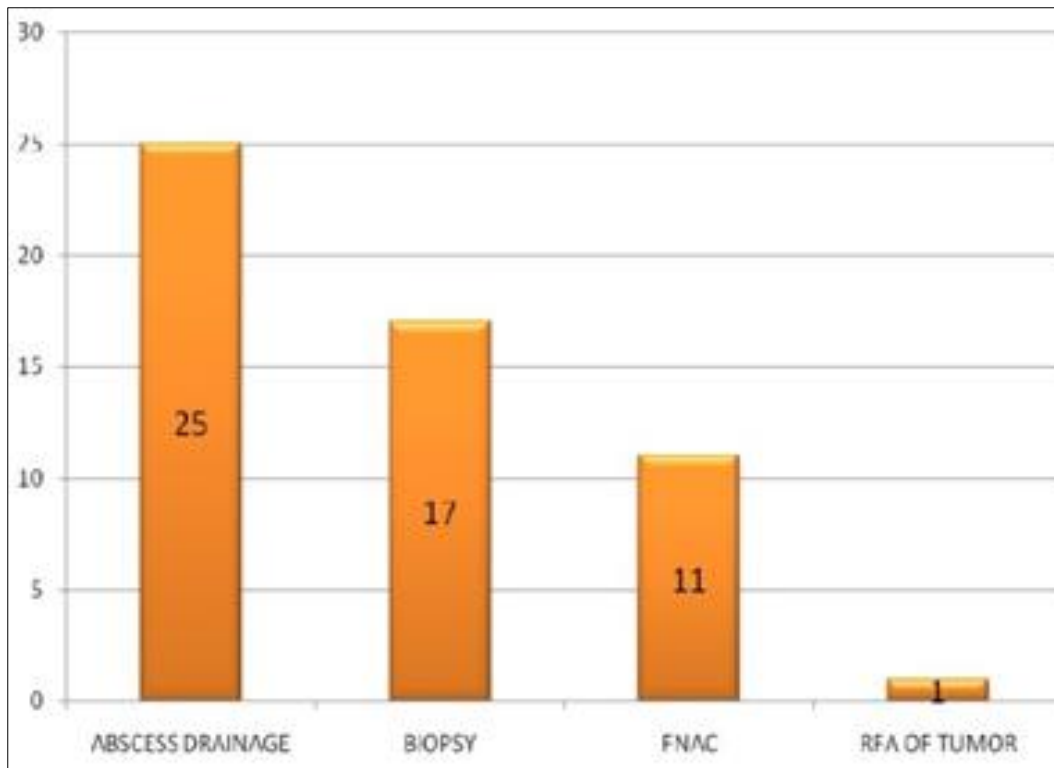


Fig 4: distribution of types of ultrasound guided proeduers

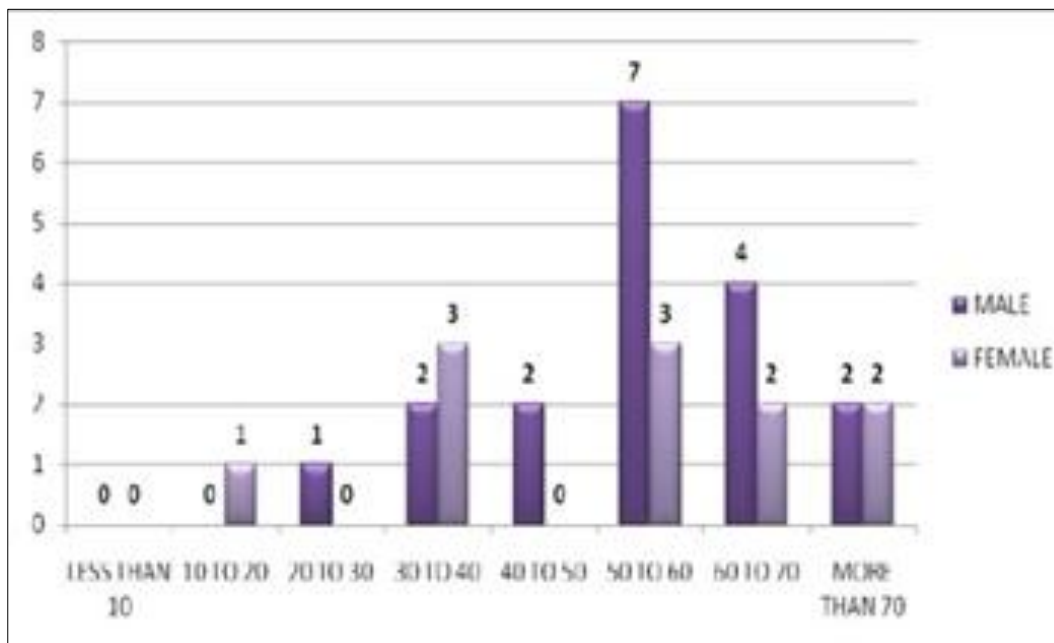


Fig 5: Classification of Ultrasound Guided Diagnostioc Interventions According to Age and Sex Distribution

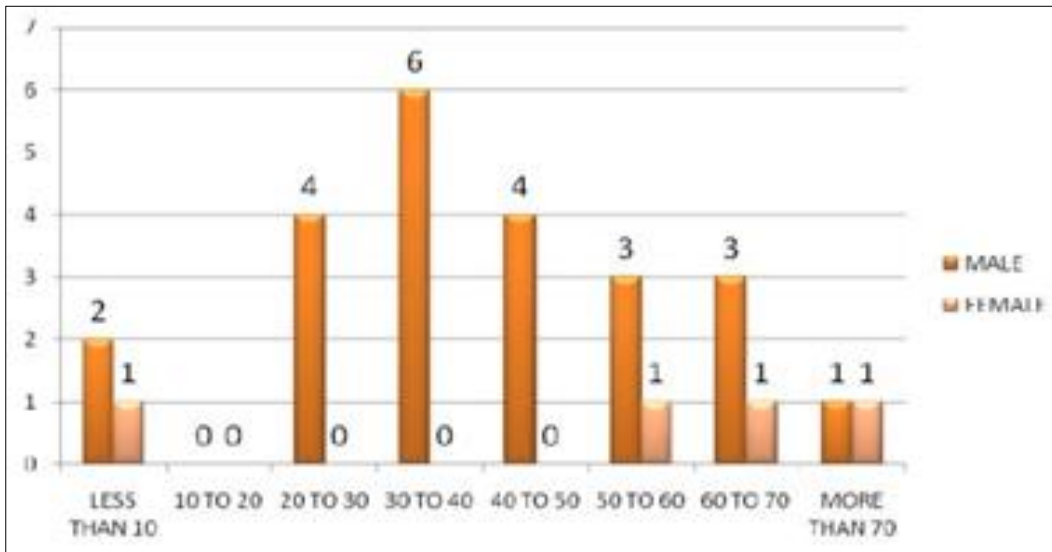


Fig 6: Classification of Ultrasound Guided Therapeutic Interventions According to Age and Sex Distribution

Table 5: Classification of Symptoms of Patients with Liver Abscess

| symptoms | number |
|----------------|--------|
| fever | 22 |
| Pain abdomen | 19 |
| Loss appetite | 05 |
| vomiting | 05 |
| jaundice | 01 |
| Other symptoms | 05 |

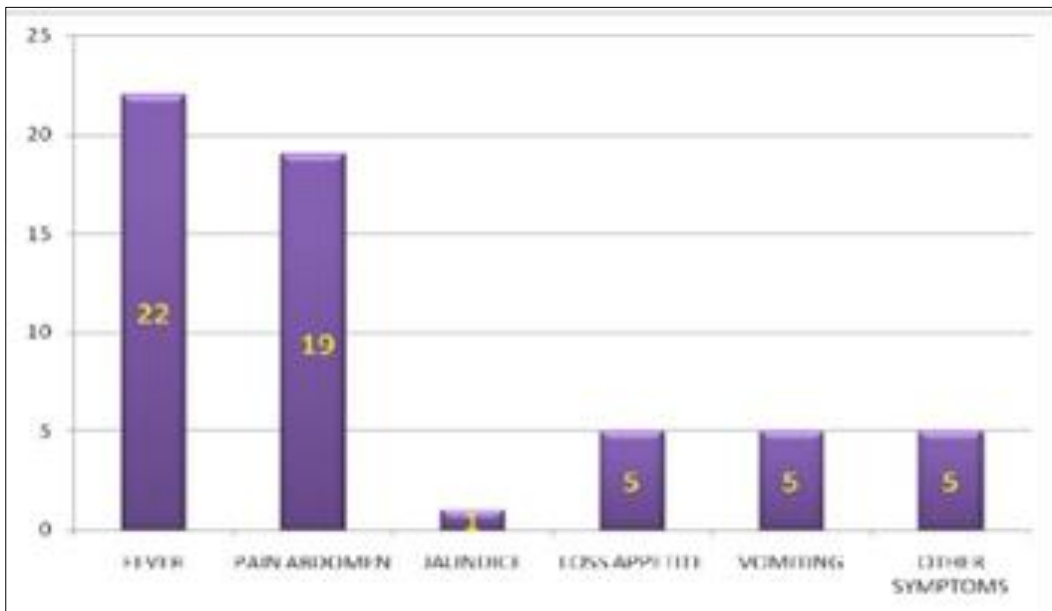


Fig 7: Classification of Symptoms of Patients with Liver Abscess

Six of ten patients with clinical and imaging diagnosis of hepatocellular carcinoma were investigated for serum alpha feto protein (AFP). Three patients of six showed elevated AFP (Normal value for adults less than 30 nano gram per ml), ranging between 375 to 1782 nano grams per ml. Other three had normal AFP levels even though they later proved to be hepatocellular carcinoma on diagnostic biopsy.

All 55 patients with clinical suspicion of diffuse and focal hepatic lesion were subjected to Sonographic evaluation. Out of 55 patients 25 patients were diagnosed to have hepatic abscess, 10 hepatocellular carcinoma, 16 metastasis, one Candidal infection and two as diffuse liver disease. Further imaging in the form of CT abdomen and pelvis, plain and contrast were performed in 15 patients, three with hepatic abscesses and 12 with tumors.

All three hepatic abscesses were confirmed on CECT abdomen. Out of twelve hepatic tumors, eight were diagnosed as hepatocellular carcinoma, three metastatic diseases and one as cavernous hemangioma on CECT. Out of eight hepatocellular carcinomas diagnosed on CT, one turned out to be fibrolamellar carcinoma on biopsy. One patient who underwent CECT abdomen had already biopsy proven cavernous hemangioma. Because of its atypical appearance it was diagnosed as hepatocellular carcinoma on ultrasound and biopsied without further investigation.

Thirteen patients with suspected metastatic or primary liver tumors were investigated with upper gastrointestinal tract endoscopy. Endoscopy was normal in five patients, benign disease in five patients such as ulcers, strictures, diverticuli and gastritis and malignant lesions were found in three like esophageal growth, carcinoma stomach and periampullary carcinoma. Colonoscopy was performed in five patients, three had normal reports and other two had malignant growth in the colon.

Out of 25 patients with liver abscesses, 18 had single abscess, four had two abscesses and three patients had multiple abscesses. Right lobe of liver was involved in 16 patients, left lobe of liver in four patients and both lobes were involved in five patients with liver abscesses. In hepatic abscesses the most common segment involved was segment VIII and segment VI of right lobe in ten abscesses, followed by segment V and segment VII in eight abscesses. The least common segment involved was segment I in left lobe of liver. Most common segment involved in left lobe of liver was segment IV in eight abscesses. Segmental distribution of hepatic abscesses in this study was least important in performing ultrasound guided needle aspiration or pig tail drainage. Out of 55 interventional procedures, liver abscess drainage took lead with 25 interventions being done. Patients with liver abscess were divided into two groups, one treated with needle aspiration and other with pig tail drainage. In this study 21 patients underwent needle aspiration of liver abscess while four for pig tail drainage. The volume of hepatic abscess was calculated by using oblate spheroid formula (width x length x anteroposterior maximum diameters multiplied by 1.57) method. The volume of abscesses ranged between 15 ml to 2500 ml. The largest abscess in the series was measuring about 2500 ml. Maximum number of abscesses were in the range of 100 to 300 ml accounting for nine cases. The amount of abscess drained by needle aspiration ranged between 10 ml to 600 ml. Pig tail drainage was used for larger abscesses and maximum amount of abscess drained by pig tail drainage was 3000 ml. There was mild discrepancy between volume calculated by sonography and amount aspirated, may be due inaccurate calculation or inclusion of granulation tissue in abscess volume.

Out of 29 diagnostic biopsy and cytology, 17 were metastasis and ten were primary liver tumors on histopathological and cytological reports. Out of ten primary tumors seven were hepatocellular carcinoma, one fibrolamellar carcinoma and two were cavernous hemangiomas. Both cavernous hemangiomas had atypical appearance on sonography; they were large well-defined masses with heterogeneous echotexture with increased vascularity on Doppler, hence diagnosed as hepatocellular carcinoma. No other imaging investigations were done and both patients were subjected for ultrasound guided biopsy. In

segmental distribution of mass lesions most common segment involved was segment VIII in ten cases, followed by segment V of right lobe and segment IV of left lobe in eight cases each. The segment least involved in hepatic masses was segment I of the left lobe. In this study segmental distribution was not much helpful in performing the diagnostic biopsy or cytology.

Yield of ultrasound guided fine needle aspiration

Cytology of liver

Total number of FNACs performed for space occupying lesions in liver was 11. Out of which only one was unsuccessful in terms of inadequate sample for cytological reporting.

Biopsy was performed for the same patient and the procedure was successful with a report of hepatocellular carcinoma.

$$\text{Yield of US guided FNAC} = \frac{\text{Total number of FNAC performed} - \text{Number of FNACs failed}}{\text{Total number of FNAC performed}}$$

$$= 11 - 10 / 11$$

$$= 91 \%$$

Hence yield of ultrasound guided fine needle aspiration cytology of liver in this study was 91% with failure rate of 9%.

Yield of Ultrasound Guided Biopsy Of Liver

Total number of biopsies performed for space occupying lesion in the liver was 18. Out of which two were unsuccessful. In our series one needle biopsy failed to yield adequate specimen for histopathological examination and repeat study was not possible as the patient left against medical advice. The other patient whose biopsy showed inflammatory cells underwent CT guided biopsy few days later on physician request as there was still strong clinical and imaging suspicion of malignancy. The report came as metastatic adenocarcinoma.

$$\text{Yield of US guided biopsy} = \frac{\text{Total number of biopsy performed} - \text{Number of biopsy failed}}{\text{Total number of biopsy performed}}$$

$$= 18 - 2 / 18$$

$$= 88 \%$$

Hence yield of ultrasound guided biopsy of liver in this study was 88% with failure rate of 12%.

Complications of Procedures

55 patients with focal or diffuse liver disease underwent ultrasound guided interventional procedures. None of the patients had intra or post procedural complications except for one patient. Patient was 57-year-old female with mixed echogenic mass in left lobe of the liver with vascular flow on Doppler suggesting hepatocellular carcinoma. No other imaging investigations were performed in the patient and she was subjected to ultrasound guided biopsy for histopathological confirmation. On biopsy patient developed hypotension and minimal hemoperitoneum due to bleed from the mass. Patient was kept under observation for one day and recovered.

Rate of complication in ultrasound guided interventions = $\frac{\text{Complications}}{\text{Total no. procedures}}$

$$= 1 / 55$$

$$= 1.8 \%$$

Hence rate of complication in ultrasound guided interventions for hepatic lesions in this study was 1.8%

First post procedural day pain was enquired about. Out of 55 patients 5 patients had pain on the first procedural day and were successfully managed by paracetamol under physician care.



Fig 8: Ultrasound probe guided lesion localization.



Fig 9: Ultrasound guided liver abscess drainage.



Fig 3: Drained liver abscesses.

4. Discussion

Among many deep-seated abdominal organs liver is the most frequent organ to undergo interventional procedures under imaging guidance, be it sonography or CT, as it is one of the most common site for both benign (inflammatory, parasitic, developmental anomaly and neoplastic) and malignant (primary

and secondary neoplastic) space occupying lesions. Because of its well-known abilities like real time examination, ability of changing the scanning plane and low costs, sonography has become preferred imaging technique for guiding needle into liver target lesions for diagnostic or therapeutic purposes [23].

This study was designed to determine the efficacy, safety and clinical outcome with ultrasound guided interventional procedures in the diagnosis and management of hepatic lesions. In this hospital based observational study, the total number of patients was 55, in which 41 were male and 14 were female. Three pediatric age group patients were there with age ranging between 4 to 10 years. The age group of patients ranges between 4 yrs. to 80 yrs. Maximum number of patients were in the group of 51 to 60 years, accounting for 27 % of the total patients. The least number of patients were in the age group of 11 to 20 years (Table no. 1). The types of interventional procedures performed were, ultrasound guided fine needle aspiration cytology, trucut biopsy, ultrasound guided liver abscess aspiration and radiofrequency ablation of tumors. All patients were subjected for bleeding and clotting parameters in the form of clotting time, bleeding time, prothrombin time and aPTT. Subjects with normal bleeding and clotting parameters were included in the study and rest were excluded. Out of 55 patients, 25 patients with clinical and imaging diagnosis of liver abscess underwent ultrasound guided aspiration. Most common symptom of patients with liver abscess was fever accounting for 88%, followed by pain abdomen in 19 patients (76%). Jaundice was seen in only one patient (Table no.5). History of vomiting and loss of appetite was seen in five patients each (20%).

According to retrospective analysis of 107 patients with liver abscess for a period of three years in Taiwan, fever was most consistent clinical symptom which was observed in 97.2 % of patients. Next most common symptom was abdominal pain seen in 61 % of patients. None of the patients were jaundiced. Another study by Ferral H *et al* in Mexico in patients with hepatic abscess, most important symptom was fever, abdominal pain and malaise. The incidence of jaundice in patients with amoebic liver abscess as reported by different authors have wide variations, ranging from 6% in study by Chhetri *et al* to 22.2% in the study by Aptekar and Sood²⁵. The cause of jaundice in liver abscess was thought to be due to hepatocellular dysfunction or hepatic biliary obstruction. In the present study one young patient was jaundiced suffering from large right lobe liver abscess with a volume of 200 cc. the cause of jaundice could not be determined in this patient.

Most common laboratory finding in patients with hepatic abscess is leukocytosis and elevated alkaline phosphatase. In series of 133 patients with hepatic abscess, King the Lee and coworkers reported that most common laboratory finding was leukocytosis (109 patients) followed by elevated alkaline phosphatase in 77 patients²². Elevated alkaline phosphatase is most reliable biochemical indicator of amoebic liver abscess.

All 55 patients with clinical suspicion of diffuse and focal hepatic lesion were subjected to Sonographic evaluation. Out of 55 patients 25 patients were diagnosed to have hepatic abscess, 10 hepatocellular carcinoma, 16 metastasis, one Candidal infection and two as diffuse liver disease. Further imaging in the form of CT abdomen and pelvis, plain and contrast were performed in 15 patients, three with hepatic abscesses and 12 with tumors.

All three hepatic abscesses were confirmed on CECT abdomen. Out of twelve hepatic tumors, eight were diagnosed as hepatocellular carcinoma, three metastatic diseases and one as cavernous hemangioma on CECT. Out of eight hepatocellular carcinomas diagnosed on CT, one turned out to be fibrolamellar carcinoma on biopsy. One patient who underwent CECT abdomen had already biopsy proven cavernous hemangioma. Because of its atypical appearance it was diagnosed as hepatocellular carcinoma on ultrasound and biopsied without further investigation.

The predilection of right lobe is attributed to the anatomic consideration, as right lobe receives blood from superior mesenteric vein and portal vein; whereas left lobe receives from inferior mesenteric vein and splenic vein. The studies have suggested that streaming effect in portal circulation is causative.

In hepatic abscesses the most common segment involved was segment VIII and segment

VI of right lobe in ten abscesses, followed by segment V and segment VII in eight abscesses. The least common segment involved was segment I in left lobe of liver. Most common segment involved in left lobe of liver was segment IV in eight abscesses. Segmental distribution of hepatic abscesses in this study was least important in performing ultrasound guided needle aspiration or pig tail drainage.

Patients declared as cured if symptoms were absent for 48 hours after procedure, even though sonological evidence of residual abscess was there. Except for one patient, all 24 patients with hepatic abscess were completely cured and discharged with hospital stay ranging between 1 to 7 days with mean hospital stay of 3 days. One patient who did not recover had complications of rupture of abscess into right pleural cavity and peritoneal cavity. The patient became cachectic and went against medical advice, hence lost for follow up. The success rate of percutaneous aspiration of hepatic abscess was 96% with failure rate of 4% in the present study.

Amoebic abscess is sterile, but secondary infection can occur with reported rate ranging from 7.8% to 25%¹¹. The trophozoites of *Entamoeba histolytica* are usually present in the wall of abscess; hence it is not surprising that many authors report their total absence or very low incidence on microscopic examination of pus. In series of 50 patients, Sanjay *et al* noted that 11 patients showed growth on culture and most common organism isolated was staphylococcus aureus followed by hemolytic streptococci⁹. Amebic abscess was diagnosed in 20 patients by indirect hemagglutination tests. In retrospective analysis, Khee Siang Chan reported that *Klebsiella pneumoniae* was most common pathogen cultured (82.3%) followed by *Escherichia coli* in two patients¹³. Out of 29 cases of diagnostic biopsy and cytology, 17 were metastasis and ten were primary tumors on histopathological and cytological diagnosis. Out of ten primary tumors seven were hepatocellular carcinoma, one fibrolamellar carcinoma and two cavernous hemangiomas. Metastatic disease of the liver accounts for the vast majority of detected liver masses and it is 18 to 20 times more common than hepatocellular carcinoma.

Six of ten patients with clinical and imaging diagnosis of hepatocellular carcinoma were investigated for serum alpha feto protein (AFP). Three patients of six showed elevated AFP (Normal value for adults less than 30 nano gram per ml), ranging

between 375 to 1782 nano grams per ml. Other three had normal AFP levels even though they later proved to be hepatocellular carcinoma on diagnostic biopsy.

50 to 70 % of hepatocellular carcinoma patients have elevated AFP levels⁶. It is nonspecific, as AFP is also elevated in germ cell carcinoma, pancreatic and gastric carcinoma. Serum AFP has prognostic value in patients with hepatocellular carcinoma; median survival of AFP negative patients is significantly longer than that of AFP positive patients^[6].

In segmental distribution of mass lesions most common segment involved was segment VIII in ten cases, followed by segment V of right lobe and segment IV of left lobe in eight cases each. The segment least involved in hepatic masses was segment I of the left lobe. In this study segmental distribution was not much helpful in performing the diagnostic biopsy or cytology.

Out of 29 patients who underwent diagnostic biopsy, two patients had diffuse liver disease and both were young patients. Both patients underwent ultrasound guided core biopsy and specimens were adequate with a report of fatty liver in one patient and chronic hepatitis in other. Although the practice of sonographically guided biopsy is increasing majority of liver biopsies with diffuse liver disease are still performed without imaging guidance. Non guided liver biopsies in patients with diffuse liver disease is generally considered safe and effective with success rate of 82 to 94% and complication rate of less than 3%^[13].

Presence of ascites was one of the exclusion criteria in our study. The presence of ascites has been considered as contraindication to percutaneous biopsy of liver. Murphy and coworkers noted that complication rate in liver biopsies guided by CT or sonography performed in the presence of ascites is not higher than similar biopsies performed in the absence of ascites⁹. Hence ascites need not be considered as a contraindication for performing hepatic biopsies under imaging guidance.

There are two ways of performing ultrasound guided interventions, one by free hand technique and other by probe guided technique. In our study all 55 hepatic interventions were done by free hand technique. Free hand technique offers more flexibility in that needle position and angle adjustments can be made as the biopsy is being performed to correct or realign the needle path if necessary. In phantom comparative study on sonographically guided biopsy of focal lesions between free hand and probe guided techniques, Pramit and coworkers have reported that there was no difference in sample quality between two techniques but median time taken for biopsy was less for probe guided technique than free hand technique^[18].

Out of 55 sonographically guided interventions, only one patient had post procedural complication in the form of minimal hemoperitoneum and hypotension. It was case of 57-year-old female with sonological features of large mixed echogenic mass in left lobe of the liver with vascular flow on Doppler suggesting hepatocellular carcinoma. No other imaging investigations were performed for patient and she underwent biopsy of lesion for histopathological confirmation. On biopsy patient developed hypotension and minimal hemoperitoneum due to bleed from the mass. Patient was kept under observation for one day and recovered. Another patient with cavernous hemangioma with no other imaging investigations except ultrasound underwent ultrasound guided biopsy without any complications. The

complication rate in our study was 1.8%. No mortality due to procedure per se was reported in our study. In multicenter study involving liver biopsies, Brett *et al* reported mortality rate of 0.09% with major complication rate of 0.28%¹⁹. In another 22-year single center study by Antonio Giorgio and coworkers, mortality rate of 0.06% and 0.4% of major complication rate were reported^[12].

The intended hypothesis of the effectiveness and efficiency of ultrasound guidance in diagnostic and therapeutic interventions is revalidated in this study.

Conclusion

This study describes the safety of ultrasound guided interventions in patients with varying hepatic lesions, the quality and adequacy of specimens obtained in diagnostic biopsy and FNACs and the clinical outcome in patients with hepatic abscess treated by percutaneous abscess aspiration.

Ultrasound guided intervention was performed in 55 patients with varying hepatic lesions. 25 patients with clinical and imaging diagnosis of hepatic abscess were treated with needle aspiration (21) or by pig tail catheter drainage (4). The patients were followed up until they were discharged with complete clinical cure. Out of 25 patients only one patient was not cured and he had multiple complications due to liver abscess per se. Rest of 24 patients were completely cured with hospital stay ranging between 3 to 7 days after the procedure.

Diagnostic biopsy (18) and FNAC (11) were performed in 29 patients with clinical and imaging diagnosis of malignant hepatic lesions. Out of 11 ultrasound guided FNACs one was suboptimal due to inadequate sample. Repeat trucut needle biopsy in that patient yielded adequate sample with histopathological diagnosis of hepatocellular carcinoma. The diagnostic yield of ultrasound guided FNAC was 91%. Total number of trucut needle biopsies performed in space occupying lesions of liver was 18, out of which two were not successful. One did not yield specimen adequate for histopathological examination and repeat study was not possible as patient went against medical advice. In other, biopsy sample showed inflammatory cells on histopathological examination but CT guided biopsy was performed due to imaging and clinical conviction of malignancy. Biopsy sample reported as metastatic adenocarcinoma on histopathological examination. Overall diagnostic yield of ultrasound guided trucut needle biopsy was 88% in this study.

In this series one patient with hepatocellular carcinoma was managed with intraoperative ultrasound guided radiofrequency ablation. The patient was followed up for six months and was tumor free.

Out of 55 ultrasound guided interventions in this series only one patient had post procedural complication in the form of minimal hemoperitoneum and hypotension. The complication rate in this series was 1.8%.

Ultrasonography is the choice of image guidance as it provides real time visualization of needle (and catheter) position and movement, cost effective and free of ionizing radiation. Sonographically guided diagnostic biopsy or aspiration cytology gives adequate and good quality specimen for histopathological examination. Treatment of liver abscess with percutaneous ultrasound guided drainage (both needle aspiration and catheter drainage) is safe and clinical outcome is good with reduced

hospital stay. Complication rate is low with ultrasound guided interventions in diffuse and focal hepatic lesions.

Ultrasonography is choice of image guidance as it provides real time visualization of needle (and catheter) position and movement, cost effective and free of ionizing radiation.

Sonographically guided liver biopsy with 18-20-gauge automated gun biopsy needles is a safe procedure in expert hands with low morbidity. Sonographically guided diagnostic biopsy or cytology gives adequate and good quality specimen for histopathological examination. Treatment of liver abscess with percutaneous ultrasound guided drainage (both needle aspiration and catheter drainage) is safe and clinical outcome is good with reduced hospital stay.

Complication rate is low with ultrasound guided interventions in both diffuse and focal hepatic lesions.

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