

Original Research

DETECTION OF LIVER TUMOR METASTASIS BY ULTRASONOGRAPHY

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Conflict of Interest

All the authors have no conflict of interest

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1. INTRODUCTION

Liver metastasis is a malignant tumor, which spread to the liver from outside place (Figure No. 1). This cancer is also called secondary liver cancer. Patient with hepatitis or cirrhosis are commonly affected by primary liver cancer. Ultrasonographic liver imaging is frequently utilized to assess liver metastases. Metastases, the most common malignant liver lesions, are 18–40 times more prevalent than

ABSTRACT

Research Objective: The purpose of this study is to detect liver tumors by ultrasound and to diagnose liver tumor metastasis areas using Doppler ultrasound.

Methodology: The study was conducted on 100 normal patients who was suffering from liver disease. Data collected from DHQ (district head quarter hospital) Faisalabad and National hospital Faisalabad. The Doppler study of hepatic region to diagnosis the liver tumors and detected the metastasis. Inclusive and exclusive criteria was used according to age group. Good resolution linear array probe (5-15MHZ) was used to design these studies. Three manners was utilized: B-mode gray imaging, color Doppler flow, and duplex imaging.

Results: The mean frequency of the patients was on the basis of gender. There was a 100 patients in total, including 55% male and 45% female patients. During study we had outdoor patients 45% and 55% indoor patients. The indoor patients were 55% which effected by liver disease. Fever patients were 84.0%. For the cause, most patients were affected by the virus, alcohol abuse, fatty liver, and smoking. The affected of liver texture by homogenous patients was 52.0% and heterogeneous patients was 48.0% are the diagnosis findings. Hypertrophy of normal size patients were 68.0% and affected patients were 32.0%. Mostly patients had acuties 31% by diagnosis findings of reports of Doppler ultra-sonogram. Liver metastases appearances were present in 13(13%) patients and 87(87%) were not affected by the tumor.

Conclusion: As the ultrasonographic findings were diagnosis the liver tumor metastasis and these sonograms showed the liver right lobe was highly affected. According to this study, the ultrasonography was not giving clear results of metastatic patients; it can be used to diagnosis for initial stages of tumors. Most patients had other diseases of the liver.

Key words: Liver tumors, liver metastasis, Doppler ultrasonography

primary liver tumors (Imam and Bluemke, 2000). In oncology liver metastasis is prevalent disease. Epithelial carcinoma commonly effect live by metastasis, and secondly it affects regional lymph nodes. Colon cancer is also one of the deadliest tumors which Colorectal cancer is one of the most malignant tumors in which partially similar to live metastases (Schima et al., 2005).

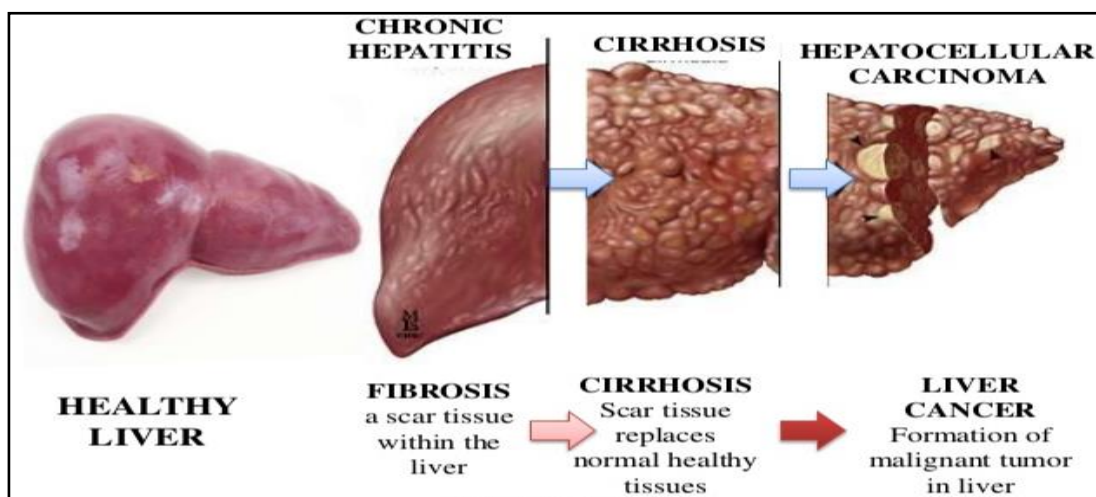


Figure no. 1: Show the healthy liver to cancerous liver

The anatomy of the portal vein system separates the right and left hemi liver at the junction where gallbladder structure is present, which is connected to the inferior vena cava (IVC) and middle hepatic vein (MHV), which indicate the intersegment plane (Muriel, 2017). The intersecting line between the

hemiliver's sides is called Rex-Cantlie's line. Cantlie independently presents the similar anatomical properties of the liver and indicates its clinical application during hepatectomy or portal vein ligation (Fasel and Schenk, 2013).

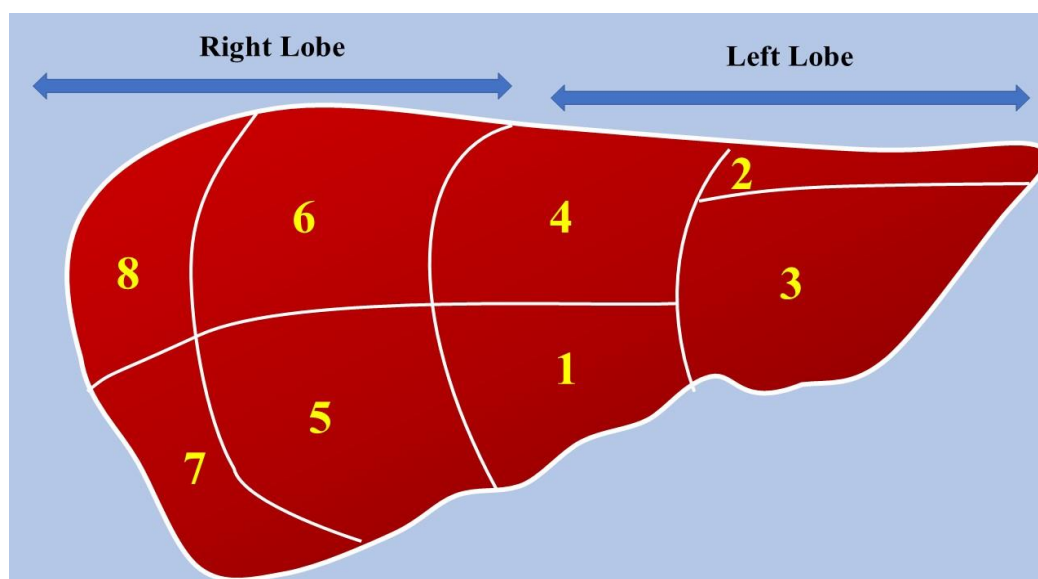


Figure 2: Show the Right and left lobes segment names (1) Caudate lobe (2) Left posterolateral (3) Left anterolateral (4) Left medial (5) Right anteromedial (6) Right anterolateral (7) Right posterolateral (8) Right posteromedial

Liver metastases (Figure no. 3) are cancerous tumors which are another place in the world. Imaging of liver is usually performed in patients with history of

cancer. Liver imaging is usually performed in patients with cancer history, following lymph nodes; the liver is commonly affected by metastases. Liver

metastases often start from primary tumors in stomach, breast, lung, pancreas and colon (Oliva and Saini, 2004). The imaging of cancer metabolism which is the key point of cancerous growth and malignancy there is the most biochemical pathway especially pentose phosphate (PPP), glycolysis and

TCA cycle are subject to different regulation in the cancer cell. The metastasis is not growth cancer it is replaced from the other side, in this hepatic region, cancer arises from the colorectal region (Ganapathy-Kanniappan and Geschwind, 2013).

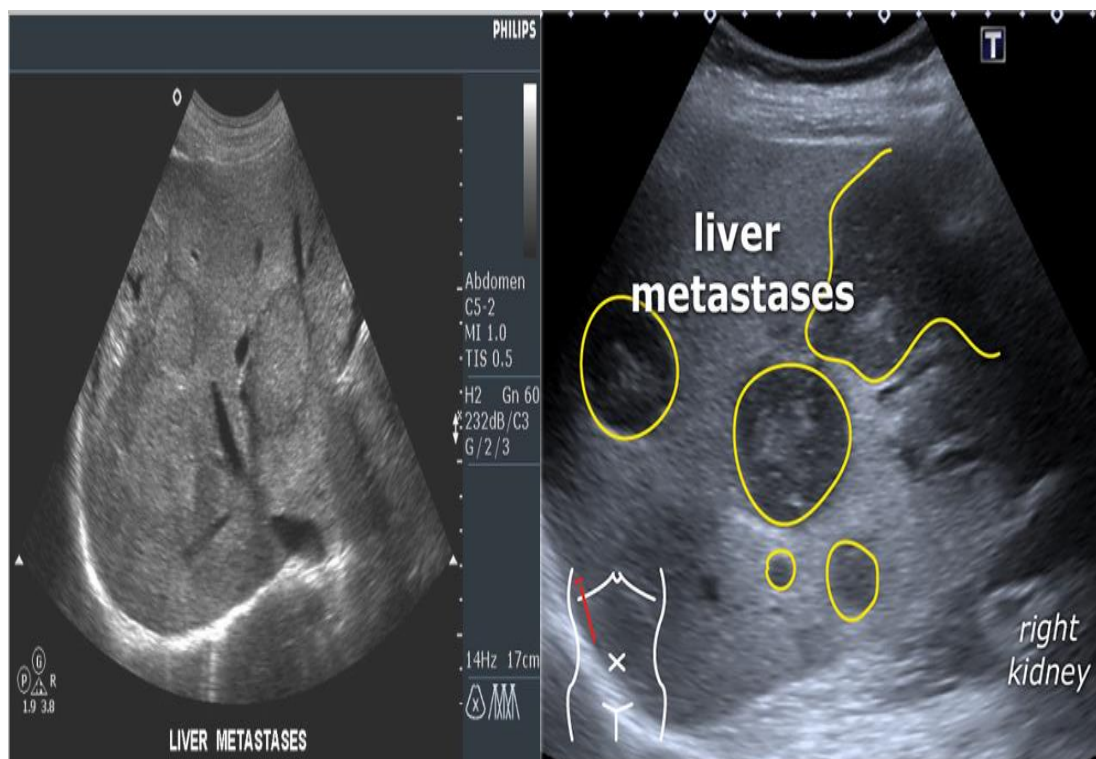


Figure 3: (a) Sonogram of Metastases liver (b) Sonogram findings of Liver metastases

Mesenchymal tumor is most frequent Haemangiomas liver tumor cancer. which range in size from a few millimeters to >20cm. This cancer is commonly diagnosed in women in the 30-50 years of age, indicating 3:1 female to male ratio. Hence, haemangiomas is most prevalent in woman as compared to man (Chibbaro et al., 2018). The second most common benign tumor cancer is focal Nodular Hyperplasia, which is approximately 2.5-8% taken in the liver. FNH is originating in both male and female across all ages. On the other hand, it is frequently present in women in 8:1female to male ratio and occurs between third and fifth decades of life. The hepatic normal parenchymas are replaced by spread regenerative hypertension (Virgilio and Cavallini, 2018).

During post-mortem studies, the liver tumor depends on the nutrition of the hepatic artery, where cytotoxic arterials perfusion. The mostly liver masses benign, there are more difficulties for differential from malignant and benign some time benign have

malignant potential. The homing of colorectal cancer cells of the liver is a nonrandom process by crosstalk between host tissue components and tumor cells (Dezso et al., 2009).

Ultrasonography works on the basis of the piezoelectric field, In 1880 French physicist Pierre curie's the French physicist created piezoelectricity. A plastic-enclosed piezoelectric transducer produces sound waves. Strong, minute electrical waves start the ultrasound machine by setting the transducer's desired frequency. The range of frequencies can be between 1 and 18 MHz, However, biomicroscopy has been performed over 50-100MHz in the ocular cavity (Kesim et al., 2020). Medical ultrasound utilizes ultrasound for assessment. Ultrasound scans of muscles, joints, blood vessels, and inside organs were taken. Its objective is to monitor disease which causes or cure pathology (Garcia-Garcia et al., 2011). There are many types of ultrasounds, One of the non-invasive techniques is Doppler ultrasound, which analyze the blood flow in blood arteries by reflection

of high-frequency sound waves. CEUS is electromagnetic contrast substance for medical sonography. Ultrasound contrast materials depend on the various ways to reflect sound waves by various barriers of material. (Ferraioli and Meloni, 2018). Molecular ultrasonography (ultrasound molecular imaging); which is used for molecular level. Interventional ultrasonography; it involved in the biopsy, emptying fluids, intrauterine transfusion. Compression ultrasonography: In ultrasonography of deep venous thrombosis, the lack of vein collapse shows thrombosis. Only in people with symptoms could compression ultrasonography detect distal thrombosis of deep veins with good sensitivity and specificity. For high-risk postoperative individuals like orthopedic patients, results are insufficient when the patient is free of symptoms and must be confirmed. MRI's disadvantages include motion artifact caused by to the length of individual MRI sequences and the liver MRI examination (15 to 20 minutes). (Welle et al., 2020).

CEUS of the liver with SonoVue (contrast agent) detects higher sensitivity in the diagnosis of liver metastases as compared to unenhanced sonography and identifies up to 40% greater of metastases. This is mainly because of the progressed detection of metastases within the superficial subphrenic areas and in the region of the ligament teres. Especially with small nodular metastases and after chemotherapy, losses gained from the further information expected by CEUS. Mainly in those wounded, we do not put out of your mind contrast-enhanced ultrasound to be a dangerous part of present-day therapy (Konopke et al., 2007).

Sonography has low sympathy but high specificity: cirrhotic liver patients with hepatocellular carcinoma and dysplastic nodules require liver transplantation. Sonography shouldn't be used solely to identify defects prior transplant in these patients (Bennett et al., 2002). In the hepatic region, colorectal cancer is effective almost in Western countries especially in developing countries, where presenting by highly morbidly. In the abdominal region the anatomically affected the organs here the colorectal to hepatic liver lobes. Due to portal circulation, colorectal cancer metastases occur mostly in the liver. Valderrama-Treviño et al. (2017) found that 14-18% of colorectal cancer patients have metastases at the initial medical discussion and 10-25% at the time of primary resection (Valderrama-Treviño et al., 2017).

Still, the increasing expenses of health care to makes a compelling case for only complete imaging test for

2.3 Exclusive Criteria:

a while, intraoperative ultrasound can efficiently diagnose liver lesions, it increases the total interval of surgery and it has less capacity to differentiate benign tumors from malignant lesions, while sometimes we used the MR Imaging to evaluate liver lesions. The sensitivity of conventional and gadolinium-chelate-added MR imaging is greater than contrast-enhanced computed tomography (CT) scanning for liver metastases, although with recent advances in MR contrast agents, it is comparable or somewhat inferior to CTAP. MR may replace CTAP, As MR imaging has a number of advantages over CT such as no risks from radiation exposure and no adverse reactions to iodinated contrast agents but this is both batters then ultrasonography imaging (Zhang et al., 2018).

2. MATERIAL AND METHODS

2.1 Study design

The Doppler ultrasound study was performed by Using GE or Toshiba machine having linear array probe (5-15MHZ).

Study Area

Doppler ultrasonography study of primary liver cancer and metastatic colorectal cancer and colon cancer include mostly inhabitant of DHQ Liver center Faisalabad and National Hospital Faisalabad who was willing to perform this scan at their radiology department.

- **Sample size**

The study was conducted on 100 normal patients who were suffering from liver disease.

- **Study Duration:**

This study duration was 2 months maximally.

- **Sample Collection:**

Collection of samples was based on these two criteria.

2.2 Inclusive Criteria:

This research was based on the population having the disease of primary and metastatic cancer. Gender wise male and female both was included, and patients having any age despite their color, and creed and another physical parameter. Those patients were selected having primary and metastatic cancer for used Doppler ultrasonography parameters. Age selection was a minimum of 18 years to 65 years maximum.

Exclusive all the patients who performed Doppler Scan. About MRI and CT scan of liver cancer was

exclusive because area of study was only an years and more than 65 years both males and females patients.

3. Methodology:

A sonogram of the hepatic region was taken mostly focus region of the liver, we had liver disease patients and the quantities of patients were 100. Study design was based on the following parameters were good resolution linear array probe (5-15MHZ). There we have used three manners: B-mode gray imaging, color Doppler flow, and duplex imaging. Then determined the liver texture, liver normal size, and anatomical region of liver margins. We found the effected lobes, thrombus region and metastasis cell which move toward the normal cell.

First of all, recorded the patient history and explain the whole procedure. He gave to signed the consent form. The ultrasound is a safe and radiation-free procedure for detected liver disease. During the process first took the patient position, the patient was in the left lateral position and inspiration to visualize the superior border of the liver. A gel was used, a fluid that conducts the medium to create bonds between patient skin and transducer.

Then scanned the right lobe of the liver and applied gel to create bonds between the skin and the transducer, the first parasagittal scan plane patient

ultrasonography room. I was exclusive less than 18 had the right side and the liver was visualized in this view, then the other second scan was intercostals Scan plane was the middle and right hepatic venom that was visualized in this view, the third sub costal scan plane and give it to the inside of the ribs to prevent that any ribs or bowel shadowing over the liver on this view of the right portal vial. Then scanned the left side lobe, the probe position was in the epigastria region inferior to the sternum and angle the probe toward the left side which was seen to medial edges of the left lobe.

4. Results:

This study was conducted at the National hospital Faisalabad and DHQ liver center Faisalabad and collected 100 patients of ultrasonography data. On the basis of gender, there was a total of 100 patients 'their frequencies was 55(55%) male patients and female was 45(45%) patients. These both genders are shown in the pie chart and table (Figure no.4; table no.1). We found the frequencies of outdoor, indoor patients, fever, weight loss, etiology of the tumor, liver texture, liver size, liver hypertrophy, affected lobe, thrombus of vessels and metastasis lesion appearance (Table no. 2,3,4, 5, 6,7, 8, 9, 10; Figure no. 5,6,7, 8, 9, 10, 11, 12, 13).

Table 1: Gender frequency of male and female patients

Gender		Frequency	Percent
Valid	Male	55	55.0
	Female	45	45.0
	Total	100	100.0

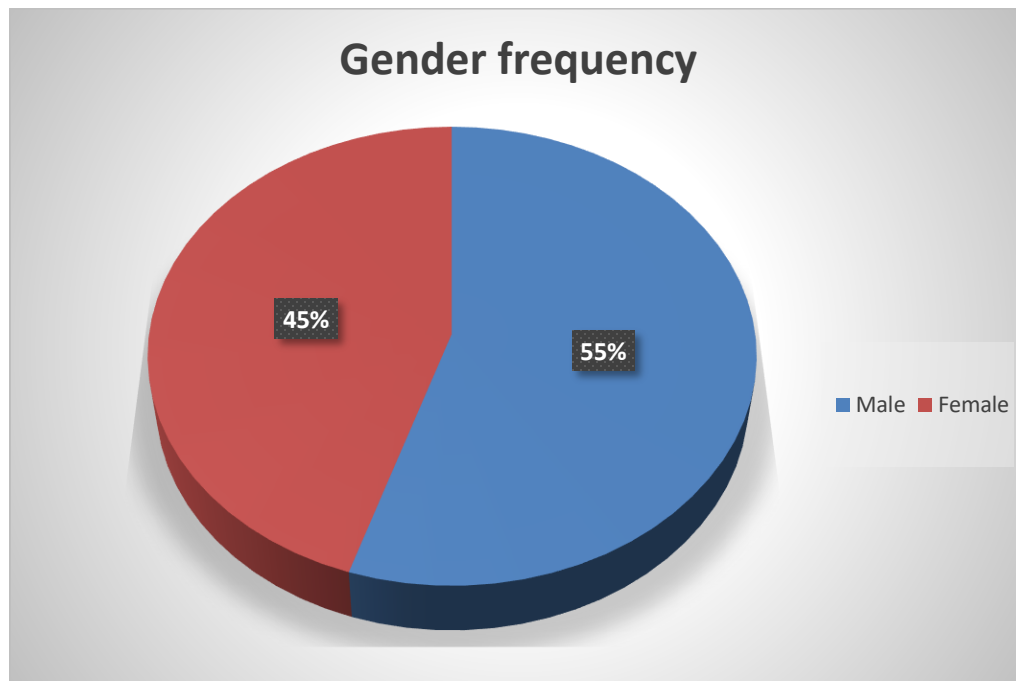


Figure 4: showing the gender percentage

Table 2: show outdoor and indoor case patients

Outdoor case		Frequency	Percent
Valid	Yes	45	45.0
	No	55	55.0
	Total	100	100.0

Indoor case		Frequency	Percent
Valid	Yes	55	55.0
	NO	45	45.0
	Total	100	100.0

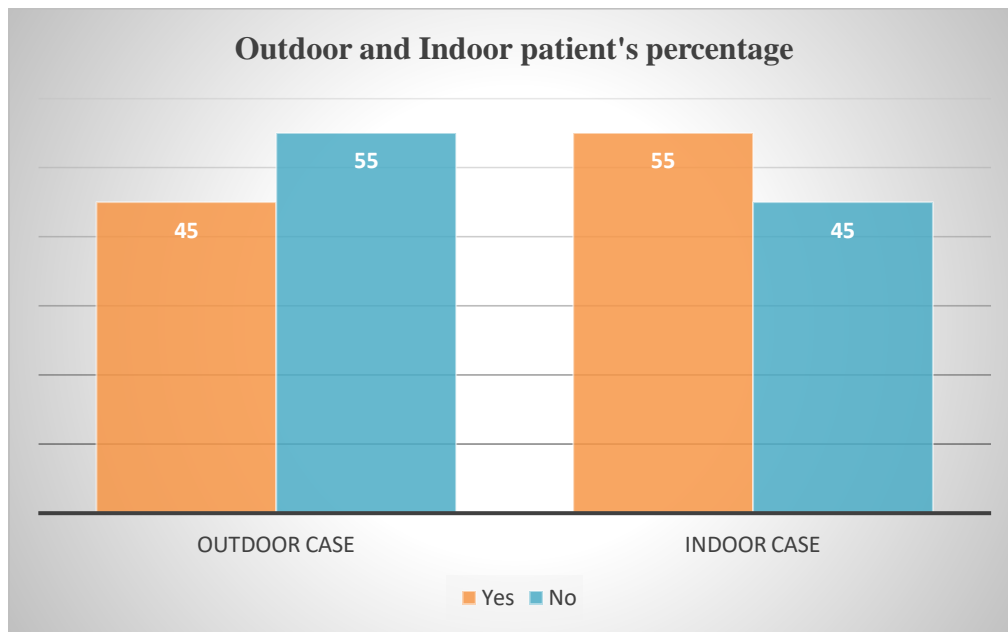


Figure 5: showing the outdoor and indoor patient's frequency percentage

Table 3: shows the frequency of fever and weight loss of patients

Fever		Frequency	Percent
Valid	YES	84	84.0
	NO	16	16.0
	Total	100	100.0

Weight loss		Frequency	Percent
Valid	YES	7	7.0
	NO	93	93.0
	Total	100	100.0

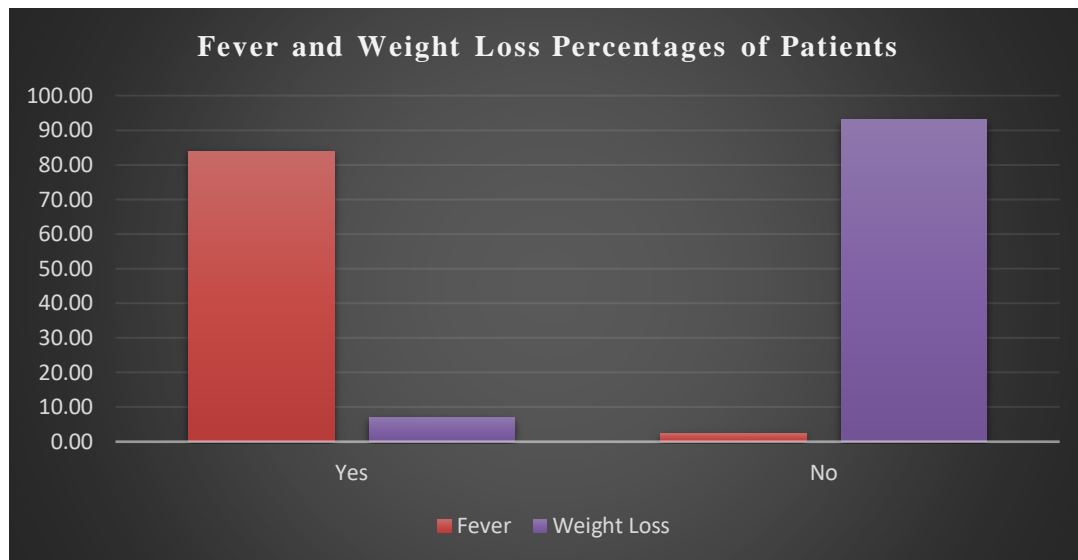


Figure 6:showing the fever and weight loss percentages of patients

Table 4: shows the Etiology of the effected tumor

	Etiology	Frequency	Percent
Valid	Alcoholic, Viral	2	2.0
	By Viral	1	1.0
	By Alcoholic, Viral	1	1.0
	By Viral, Smoking	1	1.0
	By Chronic Disease, Viral	1	1.0
	By Chronic, Fatty	1	1.0
	By Genetically, Viral	3	3.0
	By Viral	40	40.0
	By Viral	1	1.0
	By Viral Infection	2	2.0
	By Viral	4	4.0
	By Viral, Alcoholic Abuse	1	1.0
	By Viral, Alcohol	2	2.0
	By Viral, Alcoholic	2	2.0
	By Viral, Alcoholic Abuse	2	2.0
	By Viral	3	3.0
	By Viral, Drugs	2	2.0
	By Viral, Fatty	2	2.0
	By Viral, Smoking	4	4.0
	By Viral, Alcoholic	13	13.0
	By Viral,	1	1.0
	By Viral,Smoking	2	2.0
	By Viral, Smoking	4	4.0
	By Viral, Smoking	1	1.0
	Viral Infection	1	1.0
	Viral, Alcoholic	1	1.0
	Viral, Alcoholic Abuse	1	1.0
	Viral, Fatty	1	1.0
	Total	100	100.0

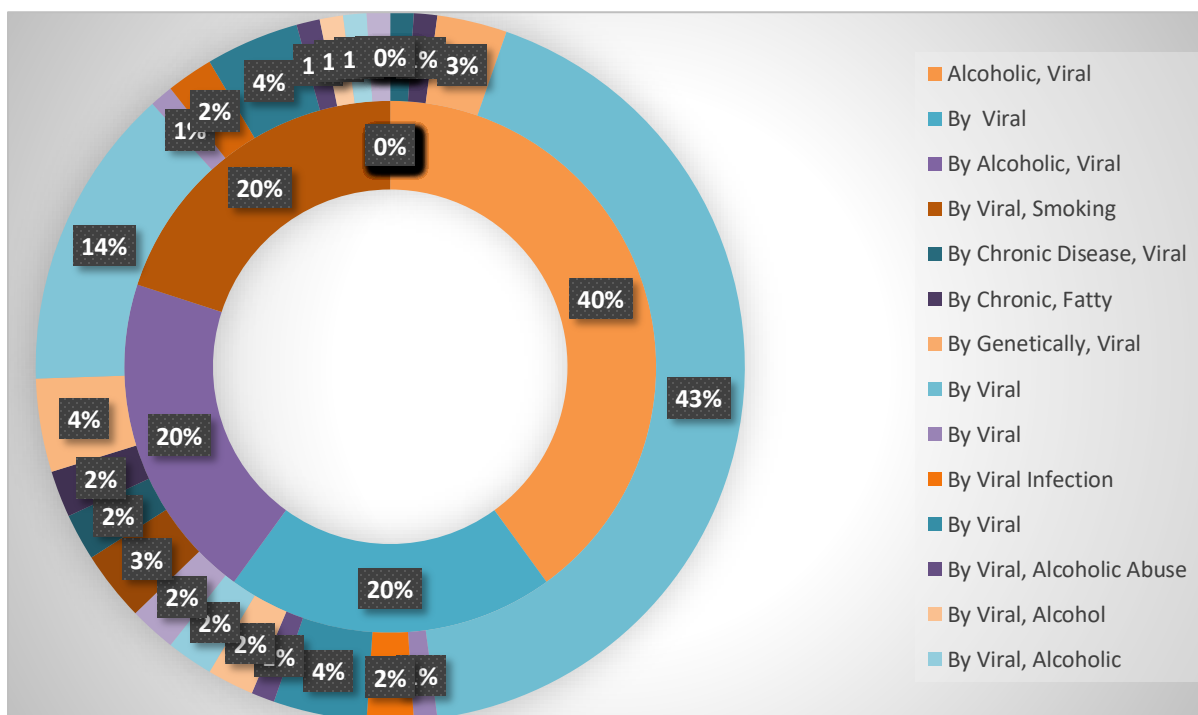


Figure 7: showing the etiology of liver tumors

Radiographic Findings

Radiographic Findings of this study are mentioned in tables and graphs below.

Table 5: Shows the liver texture homogenous and heterogeneous

Liver texture		Frequency	Percent
Valid	Homogenous	52	52.0
	Heterogeneous	48	48.0
Total		100	100.0

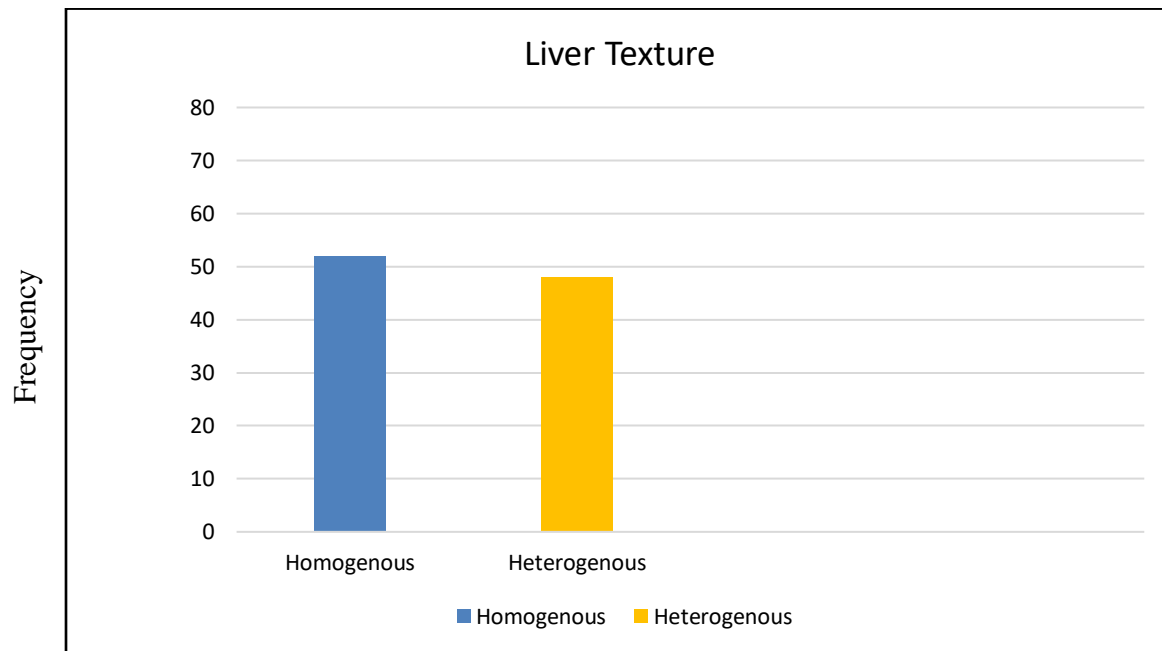


Figure 8: showing the liver texture homogenous and heterogeneous frequency

Table 6: shows the liver normal and enlarged

Liver size		Frequency	Percent
Valid	Normal	63	63.0
	Enlarge	37	37.0
	Total	100	100.0

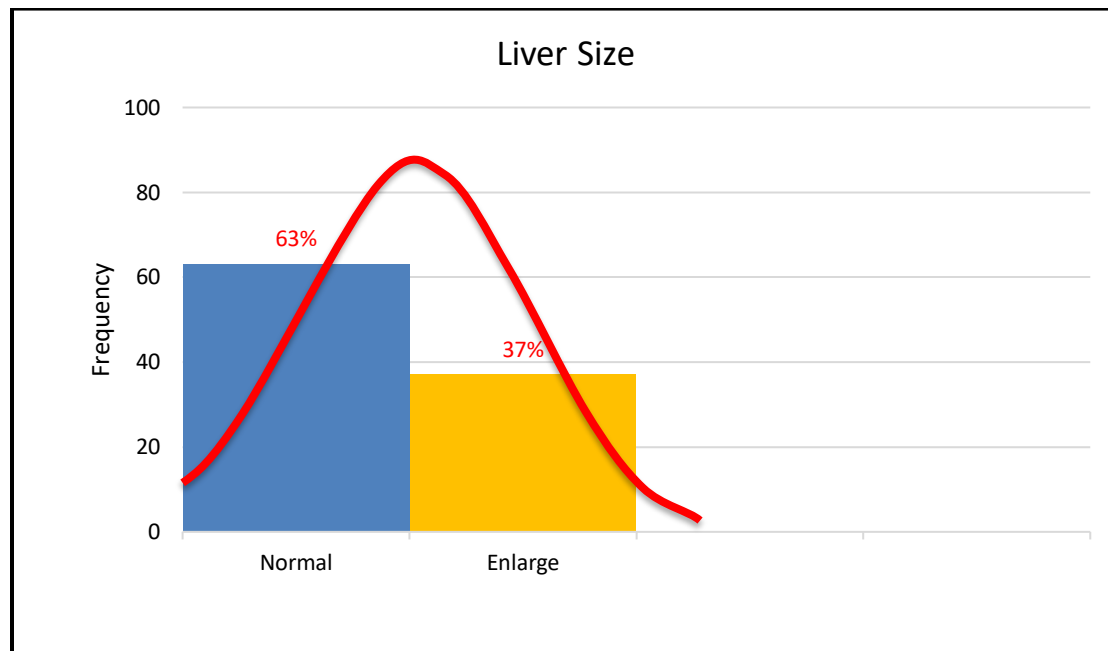


Figure 9: showing normal and enlarged liver size

Table 7: shows the hypertrophy of lobes

Hypertrophy of lobe		Frequency	Percent
Valid	Yes	32	32.0
	No	68	68.0
	Total	100	100.0

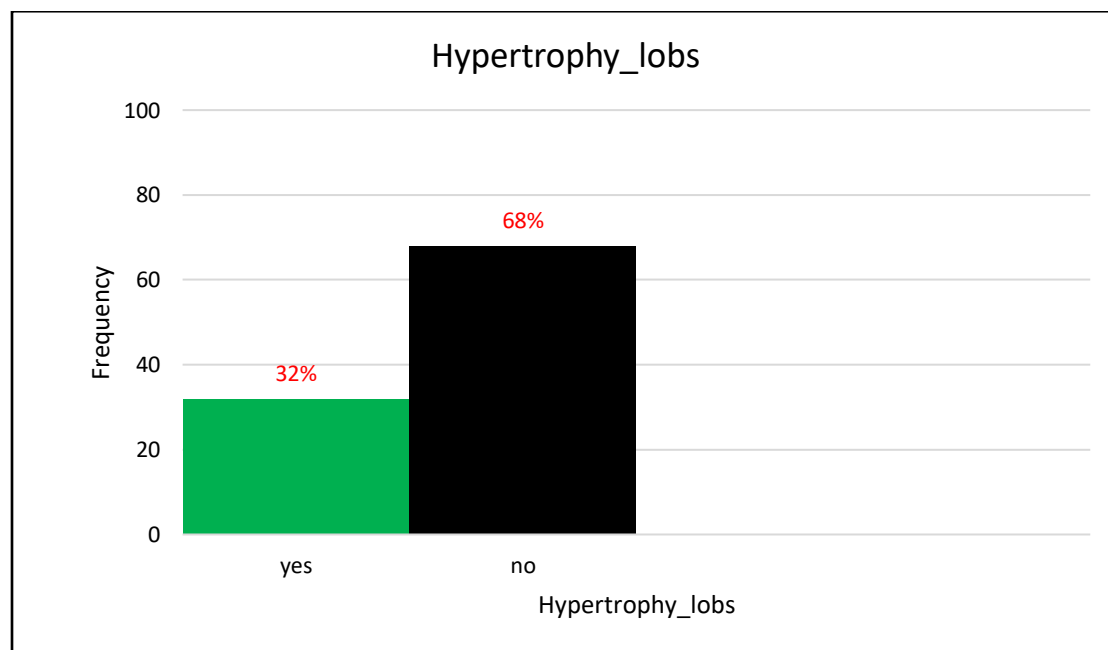


Figure 10: showing hypertrophy of liver lobes

Table 8: show the liver effect lobes

Effect lobes		Frequency	Percent
Valid	both	8	8.0
	left	7	7.0
	no	53	53.0
	right	29	29.0
	yes	3	3.0
	Total	100	100.0

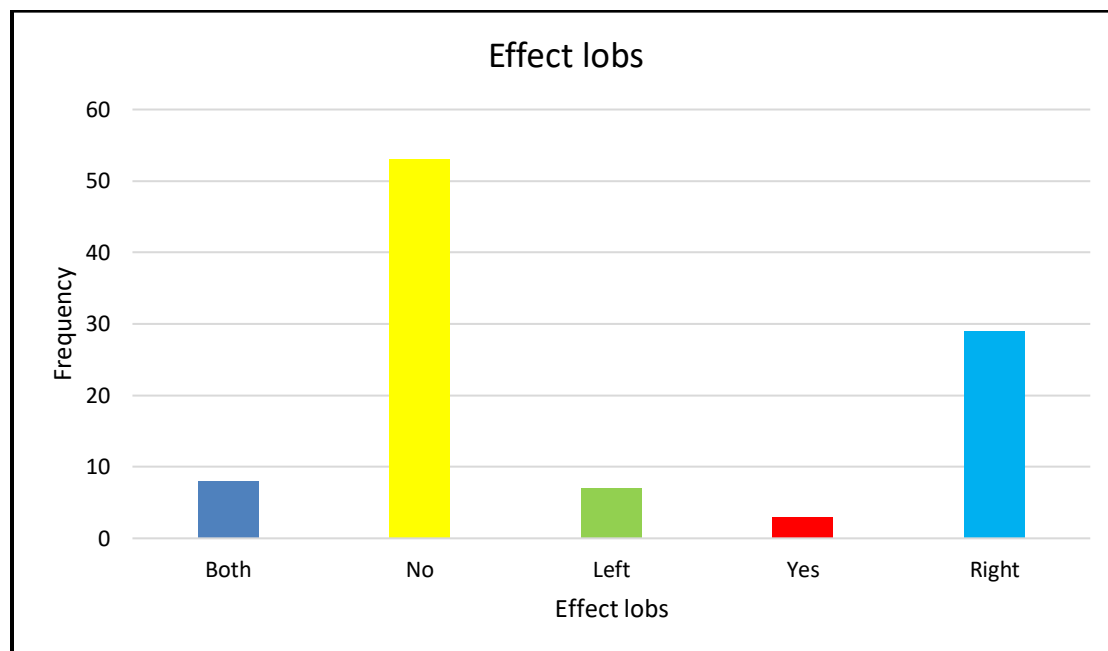


Figure 11: showing the effected lobes frequency

Table 9: shows the thrombus vessels

Thrombos vessels		Frequency	Percent
Valid	no	90	90.0
	PV	6	6.0
	yes	4	4.0
	Total	100	100.0

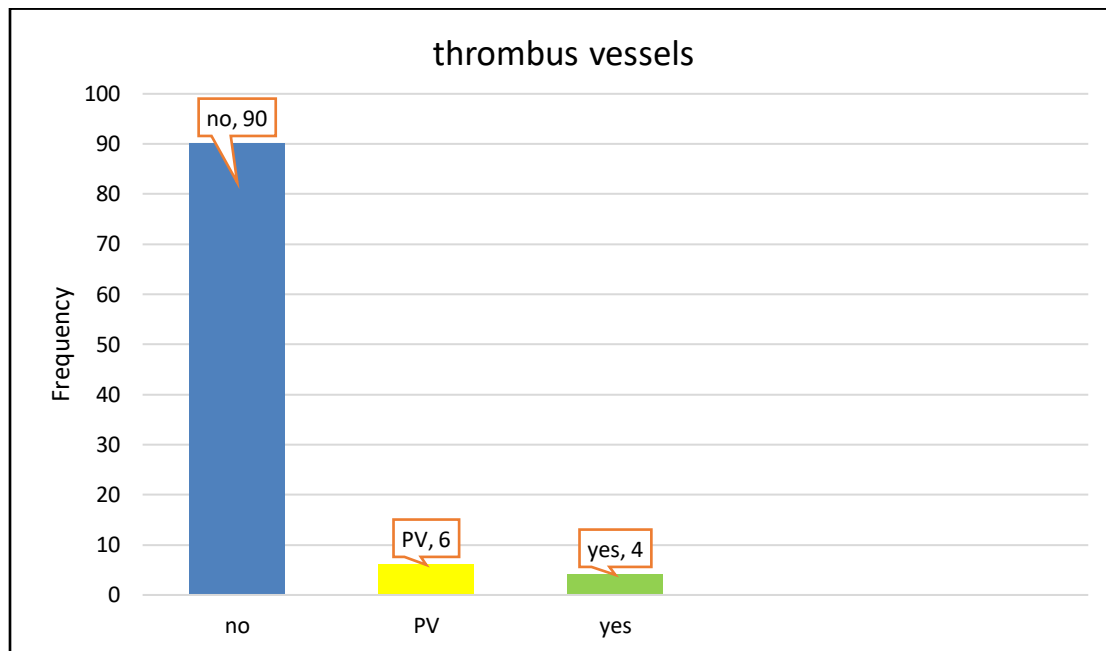


Figure 12: showing the thrombus vessel frequency

Liver metastases appearances are present in 13(13%) patients and 87(87%) are not affected by the tumor. The metastasis region is not clear in the sonogram; they only show the normal appearance.

Table 10: showing the liver metastasis

Liver Metastasis		Frequency	Percent
Valid	Yes	13	13.0
	No	87	87.0
	Total	100	100.0

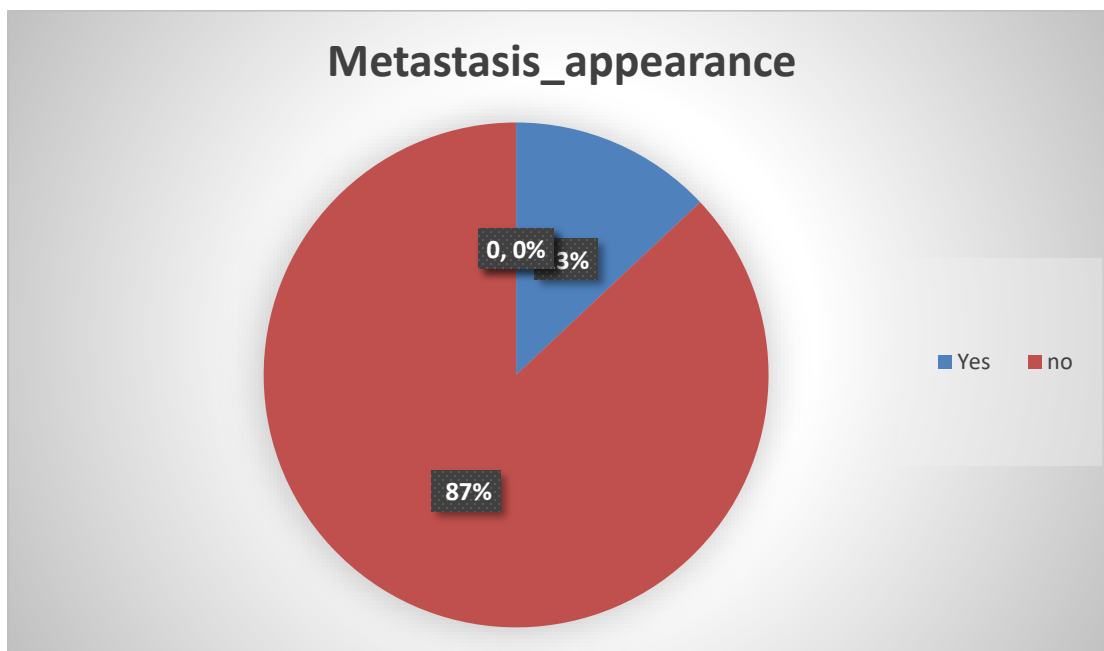


Figure 13: showing the liver metastasis appearance

Table 11: shows Applying the one-sample statistics test.

Sample Statistics	N	Mean	Std. Deviation	Std. Error Mean
Outdoor Case	100	0.55	0.500	0.050
Indoor Case	100	0.45	0.500	0.050
Fever	100	0.16	0.368	0.037
liver texture	100	3.48	0.502	0.050
liver size	100	3.37	0.485	0.049
hypertrophy lobes	100	0.68	0.469	0.047
mass region	100	0.60	0.492	0.049
Number_of_tumors	100	0.66	0.476	0.048
Ascites_in_liver	100	0.91	0.288	0.029
Metastasis appearance	100	0.87	0.338	0.034

Then applied the one-sample statistics test, then we findings the total patients show byN and find the Mean, Std. Deviation and Std Error Mean. According to liver metastasis, 87(87%) patients are not affected and no metastasis lesion appearances are present and 13(13%) patients are affected by metastasis tumor which shows at a figure no 13 and table no. 10.

Table 12: shows the one-sample test

Sample test	Test Value = 0					
	t	Df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Outdoor Case	11.000	99	.000	0.550	0.45	0.65
Indoor Case	9.000	99	.000	0.450	0.35	0.55
Fever	4.342	99	.000	0.160	0.09	0.23
liver texture	69.307	99	.000	3.480	3.38	3.58
liver size	69.451	99	.000	3.370	3.27	3.47
hypertrophy lobes	14.504	99	.000	0.680	0.59	0.77
mass region	12.186	99	.000	0.600	0.50	0.70
Number_of_tumors	13.863	99	.000	0.660	0.57	0.75
Ascites_in_liver	31.639	99	.000	0.910	0.85	0.97
Metastasis appearance	25.740	99	.000	0.870	0.80	0.94

5. DISCUSSION

The overall description of the research is that the liver tumor are two types one is primary tumor which is called a benign tumor, which is at any region of body and not invade to other tissues of body, and the next is the secondary tumor which invades From another region of body in the liver there is spread through by blood vessels and cell by cell move inside of liver lobes, this type is called malignant tumor which and also called liver tumor metastasis. Metastatic tumor invades the region of colorectal or breast region most invented in colorectal and originated inside of liver trusses, the cancer move and blood or cells of trusses. Anatomically liver has 8 parts in two main lobes right and left lobes.

The name of right and left lobes parts are following caudate lobe, Left posterolateral, Left anterolateral, and Left medial Right, anteromedial, Right anterolateral, Right posterolateral, and Right posteromedial. Mostly affected lobe is right lobe their passing blood vessels is portal vein some time PV thrombosis of blood and it converted into cancer by the condition of long-time thrombosis. According to gender wise mostly patients are males affected by liver diseases.

The most common symptoms are present is fever and weight loss are gain by the way of fatty liver patients have weight is increased. In this study, used the Doppler ultrasonography, basically Doppler is used to the blood supply and detect to the affected

region as colorfully imaging, there is not a hundred percent of the result is not give it, we have the only idea of metastasis region appearance view was show it. The liver texture was the change in many patients and the liver size was change also.

Liver texture, normal size, and anatomical region of liver margins are determined. I found the effected lobes, thrombus region and metastasis cell which move toward the normal cell. First of all, recorded the patient history and explained the whole procedure. He had signed the consent form. The ultrasound is a safe and radiation-free procedure for detected liver disease. During the process first, took the patient position, the patient was in the left lateral position and inspired to visualize the superior border of the liver. A gel was used, a fluid that conducts the medium to create bonds between patient skin and transducer. Then scanned the right lobe of the liver and applied gel to create bonds medium between skin and transducer, first the parasagittal scan plane patient have in right side position the right kidney and liver was visualized in this view, then the other second scan was intercostals Scan plane the middle and right hepatic Vein was visualized in this view, third sub costal scan plane gave angle to probe inside of ribs to avoid that any ribs or bowel shadowing over the liver on this view the right portal vein. Then scanned the left side lobe, the probe position was in the epigastria region inferior to the sternum and angle the probe toward the left side which was seen to medial edges of the left lobe.

Liver metastases appearances are present in 13(13%) patients and 87(87%) are not affected by the tumor. The metastasis region is not clear in the sonogram; they only show the normal appearance. The more affected the lobe of the liver was in the right lobe. So, there is no most affect the patients of liver metastasis and the etiology of these diseases is by viral, alcoholic, genetically and smoking is the main cause.

5. CONCLUSION

As the ultrasonographic findings were diagnosis the liver tumor metastasis and these sonograms showed the liver tumor regions most affected the right lobe of the liver. There was eighty-seven percent of patients had no effect and the metastasis patients were thirteen percent. According to this study, the ultrasonography was not giving cleared results of metastatic patients, it can be used to diagnosis for initial stages of tumors. Most patients had other diseases of the liver affected. The sonography is a non-invasive test there is no use of radiation.

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