

Sonographic patterns of Liver metastases among patient with known primary extra hepatic cancer at radiology department of Tikur Anbessa specialized hospital, TASH.

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Title: Sonographic patterns of liver secondaries among a patient with known primary extra hepatic cancer at radiology department of Tikur Anbessa specialized hospital, TASH.

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Contents

page

Acknowledgement-----	4
Abstract-----	5
1.1 Introduction-----	6
1.2 Statement of the problem-----	7
1.3. Justification of study-----	9
2. Literature reviews-----	10
3. Objective of the study-----	14
3.1. General objective-----	14
3.2. Specific objective-----	14
4. Material and methodology-----	15
4.1. Study design and period-----	15
4.2. Population-----	15
4.4. Source of population-----	15
4.5. Study population-----	15
4.5.1. Inclusion criteria-----	15
4.5.2 Exclusion criteria-----	16
4.6. Patient preparation and technique-----	16
4.7. Sample size and sampling technique-----	17
4.8. Variable of the study-----	17
4.9. Data quality control-----	18
4.10. Operational definition-----	18
4.11. Dissemination of result-----	18
4.12. Ethical consideration-----	18
5. Result-----	19
6. Discussion-----	30
7. Conclusion-----	36
8. Recommendation-----	37
Reference-----	38
Annex I-----	39
Annex II-----	41

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Abstract

Background: The most common malignancy of the liver is metastases from other organs.

25–50% patients with a known non-haematological malignancy have liver metastases at the time of diagnosis. The incidence of hepatic metastases depends on the type of primary tumor and its stage at initial Detection. Ultrasonography being used worldwide with high frequency as a reliable method for the initial diagnosis of liver metastases.

Aim of study: To assess the common Sonographic patterns of liver metastasis among patient with known extra hepatic primary malignancy.

Materials and methods: institution based prospective cross sectional study of 93 patients with known primary extra hepatic malignancy was conducted at sonography unit of Radiology department of Tikur Anbessa specialized Hospital (TASH) Addis Ababa, Ethiopia from February 1 to August, 2017 using a sonoscape SSI-8000 model ultrasound machine.

Result: The highest numbers of patients (30.1%) were in the age group of 48 – 57 followed by 38 – 47 and 58 – 67 age group respectively. 81 of 93 patients (87.1%) had multifocal liver metastases disease, where as 12 of 93 cases (12.9%) had single or solitary hepatic metastases. The commonest types of liver lesion identified were target (42%), echogenic (18 %) and Hypo echoic (17 %). Out of 21 primary breast cancer patients 13 patients had Target liver lesion and 5 had hypo echoic liver lesions. Thirteen patients with primary colonic cancer 4 had echogenic, 3 had hypo echoic and 4 had target liver lesions.

Conclusion: the most common primary tumor resulting hepatic metastases are those from GI tract with colonic adenocarcinoma being on the top followed by Breast and pancreas. Majority of primary extra hepatic tumor produce multifocal liver metastases .The ultrasound pattern of liver metastases is quite varied and there is no consistent relation between the ultrasound pattern and type of tumor that allows one to specify primary malignant. The various common ultrasound patterns include multiple target, echogenic, hypo echoic and mixed patterns. Other less commonly seen Sonographic pattern of liver metastases is that of complex cystic, calcified and bizarre appearance which we couldn't easily categorized easily under above common patterns.

1. Introduction

1.1 Background

25–50% patients with a known non-haematological malignancy have liver metastases at the time of diagnosis with decreasing frequency in colon, gastric, pancreatic, breast and lung cancer (1)

Metastases to the liver are blood-borne through the hepatic artery or portal vein, the portal vein provides direct access to the liver for tumor cells originating from the gastrointestinal tract and probably accounts for the high frequency of liver metastases from organs that drain into the portal circulation.(1)

Metastatic disease is multifocal in approximately 90 percent of patients. Occasionally metastatic disease may be solitary or confined to one segment or lobe, in which case surgical resection of part of the liver is possible. The differential diagnosis of liver metastases includes common benign lesions such as cysts, Hemangioma and focal nodular hyperplasia (FNH) as well as primary malignant liver tumours (hepatocellular carcinoma (HCC) and cholangiocellular carcinoma (CCC)). A sound knowledge of common ultrasound patterns of liver metastatic disease important for early detection and staging patient for management. (2)

Ultrasonography (US) is one of the diagnostic tools that have shown significant improvement within the last decade for the diagnosis of liver tumors, US examination has the advantages of real-time observation, simple technique, non-invasiveness lack of ionizing radiation, and availability. This modality is being used worldwide with high frequency as a reliable method for the initial diagnosis of liver tumors]. (3)

This is particularly true in developing countries like Ethiopia, where the absence or the high cost of the other modalities like CT and MRI makes sonography a suitable diagnostic tool in the radiological metastatic work up in patient with known extra hepatic malignancy.(4)

1.2. Statement of the problem

Cancer is an increasing public health burden for Africa and sub-Saharan Africa at large including Ethiopia. Approximately 60,000 new cases of cancers diagnosed annually in the sub-Saharan Africa. by the year 2030, cancer and other non-communicable disease may over take some infectious disease as leading cause of death in the Africa region. Currently cancer accounts for four (4%) percent of all deaths in Ethiopia. Many of these deaths can be avoided if the cancer can be detected and treated early. (5).

The liver is one of the commonest sites for metastasis and terminal involvement is the rule in all except CNS neoplasm. This can be attributed to its large size, high rate of blood flow and double perfusion by the portal vein and hepatic artery. The route of tumor spread to the liver is more likely to be hematogenous rather than lymphatic, because for the most part of the liver's lymphatics are hepatofugal. (6)

Both benign and malignant focal liver lesions are extremely common and imaging the liver for focal lesions especially in cancer patients is one of the most frequent tasks in everyday radiological practice. The most common malignancy of the liver is being metastases from other organs and Accurate and timely detection of hepatic metastases is very important because of the far-reaching therapeutic and prognostic implications. (7)

The echo patterns of metastases are numerous, but some patterns are said to be commonly associated with certain primary tumours. US appearances of metastases may vary within a given patient as well as over time and especially following chemotherapy. Accurate assessment of number, size and segmental location of metastases is required to identify patients suitable for surgical or interventional therapy, for treatment planning and for follow-up imaging under chemotherapy.(8)

Most metastases are round with well-defined margins. Hypo echoic metastases are more common (approximately 65%) than hyper- or isoechoic. A hypo echoic halo surrounding the lesions is seen in 40%; uncommonly, liver metastases may present as a diffuse process

throughout the liver, and differentiation from normal or other diffuse liver diseases may be difficult. (9)

The differential diagnosis of liver metastases includes common benign lesions such as cysts, Hemangioma and focal nodular hyperplasia (FNH) as well as primary malignant liver tumours (hepatocellular carcinoma (HCC) and cholangiocellular carcinoma (CCC)). (9)

For the diagnosis of liver tumors, US examination has the advantages of real-time observation, simple technique, non-invasiveness lack of ionizing radiation, and availability. This modality is being used worldwide with high frequency as a reliable method for the initial diagnosis of liver tumors. (10)

1.3. Justification of the study

Accurate and timely detection of hepatic metastases is very important because of the far-reaching therapeutic and prognostic implications.

Detecting and characterization of focal liver lesions is one of the most confusing and controversial challenges in imaging today. (2)

Therefore, this study aimed at determining the common Sonographic pattern of liver metastasis in patient with known primary extra hepatic neoplasm. It may also serve as important tool or reference for radiologist and sonographer working in the country to suspect liver metastasis so early in patient with unknown primary or occult malignancy. , especially in our country where Ultrasonography is widely available and less costly imaging modality in health institution of the country compared to other imaging facilities like CT and MRI ,Ultrasonography used as a first line radiological investigation for metastatic cancer workup and playing a profound role in alerting the treating physician or clinician so early ,which is equally important in reducing a morbidity and mortality associated with cancer burden at all.

In addition, there was no much study done on Sonographic patterns of liver metatesis conducted in Ethiopia as to our knowledge.

2. Literature review

There was a cross-sectional study conducted at Department of Radiology, University of California Medical Center, USA. A total of 76 cases with abnormal gray scale of hepatic Parenchymal echogram due to a known or suspected metastatic disease were included in the study. According to result of this study three basic patterns of Parenchymal abnormality were identified and classified them as echogenic, hypo echoic and bulls-eye. A fourth category is composed of cases which do not fit easily into these groups. Generally, these patients showed a mixture of one or more of the above echo graphic patterns, diffusely inhomogeneous echoes, and/ or a large mass otherwise difficult to characterize. The most common echo graphic pattern were that of single or multiple hyper echoic within the liver parenchyma. These lesions are readily separable from the less echogenic surrounding parenchyma and may coalesce into lobular masses. Whether single or multiple, the lesions tend to be large, usually over 4 cm in diameter. In their series of 28 patients (37%) displayed this pattern of echogenic. Of these 28 patients, 20 had primary **adenocarcinoma of the colon**, by far the most common primary lesion in their series and also it is of interest that of the 24cases of adenocarcinoma of the colon, 20 demonstrated this appearance of large echogenic metastases.

In two patients with adenocarcinoma of the colon, central lucent areas were present within a large dense metastasis. They consider this lucency were presumably due to tumor necrosis. One of these patients had received chemotherapy; the other had not been treated. They found a second common manifestation of hepatic metastases in their study that a well defined **hypo echoic** area entirely surrounded by normal liver parenchyma. They also added that a presence of fine low-level echoes within these lesions, indicating their solid nature. In their series, 14 patients (18%) showed this appearance. **Bulls-eye** lesions are those in which a dense central focus is surrounded by a more lucent periphery which in turn is readily separable from the adjacent liver parenchyma. Thirteen patients (17%) had this pattern. They noted this feature in association with a wide spectrum of primary lesions. Four cases of oat cell carcinoma of the lung gave this appearance. Finally, they added that 21 of 76 patients (28%) representing a diverse group of

primary tumors that do not readily fall into one of the above subgroups .A mixed pattern, seen in eight cases, encompasses those instances in which at least two of the previously described gray scale patterns were present simultaneously.

Diffuse inhomogeneity. Characterizes those livers whose echo graphic pattern is clearly abnormal, with multiple coarse, dense, and/or lucent areas, but without a dominant pattern of focal lesions. Five patients exhibited this appearance; eight patients showed one or more poorly defined masses with a variable and often bizarre echo pattern not easily characterized. Four of the eight had received chemotherapy prior to ultrasound examination; they presumed that the finding of this relatively disordered appearance is a manifestation of patient response to therapy.

Scheible, W.etal (6).

In another study in which A cross-section study conducted on Ultrasonography as prime imaging modality for liver metastasis, accordingly One year Cross-sectional study was conducted, with 105 cases of focal liver lesions diagnosed by ultrasound followed by FNAC for confirmation of ultrasound diagnosis. The study Result shows **Age distribution of liver lesion with** The age range between 41 to 50 years had the maximum incidence with 39 cases and <10 years category showed the lowest incidence with 5 cases. **Sex distribution of focal liver lesion,** The maximum incidence was within the age range of 41-50 years constituting 37.1% of the total number of cases. Metastatic deposits in liver were not found below 20 years of age. **Distribution of cases based on Hepatomegaly,** 40 cases out of 105 had hepatomegaly. **Distribution of cases based on number of focal lesions,** Out of 105 cases, 85 cases had multiple liver lesions and 15 cases had solitary liver lesions. Regarding the **Echo Features of Metastasis in liver,** majorities 38 % were hypo echoic, 19.2 % were hyper echoic, 19.2 % showed bull's eye lesion and 23% showed mixed echogenic features.

In their study they discuss that-The most common primary tumors are those from the gut, breast, lung and melanoma and they add that Metastasis may be found in any part of the liver and are usually multiple and The wide ranges of appearances are encountered in live metastatic disease. Focal lesions are commonest but the malignancy may also infiltrate widely. The commonest focal pattern is of **hypo echoic** masses. Highly reflective lesions may be surrounded

by an echo-poor band which may be fine or a few millimeters thick. They called **Bull's eye pattern** and is more often seen in larger lesions.

Highly reflective and target lesions are typically of these are recognized by distal enhancement caused by them. They may contain clear fluid as may be produced by mucin secreting lesion (e.g., cancer pancreas/ ovary) but contain debris when the fluid represents tumor necrosis. These types tend to have shaggy walls and are less likely to be mistaken for simple cysts [15].

They noted that the Calcified lesions have tumors originating in the gastrointestinal tract and urogenital tract, commonly occurs in secondaries from colorectal and gastric carcinomas as well as neuroblastoma. Colonic adenocarcinoma is the most common source of liver metastasis. The cytopathological pattern is characteristic showing malignant columnar epithelial cells in palisaded rows or micro glandular groups with a background of necrotic debris. Thimmaiah, TV

In another study which was conducted at Radiology department of teaching hospital (Charité - Universitätsmedizin Berlin, Germany. A total of 47 patients were recruited. Inclusion criteria were a known extra hepatic malignancy and at least one focal liver lesion seen on conventional ultrasound. The study consisted of a conventional B-mode scan of the liver, 7 patients were excluded from the analysis due to histologic proof of a primary malignant liver tumour (n = 2), inconclusive histology (n = 2) or an incomplete reference examination (n = 3). This left 40 patients (16 men, 24 women, mean age 61 (45 - 79 years)) for analysis. The primary tumours of these patients were colorectal carcinoma (n = 15), bronchial carcinoma (n = 7), malignant melanoma (n = 5), ENT (ear, nose and throat) tumours (n = 4), breast carcinoma (n = 3) and others (n = 8). One patient had three different primary tumours (carcinoma of the colon, ovary and stomach).

Three patients showed only benign liver lesions (Hemangioma) on sonography as well as on reference imaging. The metastatic nature of the remaining 37 patients was confirmed by histology (biopsy or resection) in 14, progression and follow-up in 3, remission under chemotherapy in 2 or typical features on reference imaging (CT: n = 12, MRI: n = 6)

The **number, size and location of** all focal lesions were documented on a segmental basis (Couinaud classification). On reference imaging, 37 of the 40 patients displayed one or more liver metastases. Baseline sonography showed metastases in 35 of the 37 positive patients, while contrast enhanced

ultrasound detected metastases in all 37. Three (3) patients only had Hemangioma but no metastases on reference imaging, **in 14 patients**, reference imaging showed a solitary and potentially resectable metastasis. The primary tumours of these solitary metastases were **carcinoma of the colon** in seven (7), **Bronchogenic carcinoma** in three (3), malignant **melanoma** in one (1), carcinoma of the **breast** in (1) one, **thyroid** carcinoma in one (1) and carcinoma of the tonsils also in one patient.

In their discussion Conventional sonography is often used as the first line investigation for hepatic staging of patients with malignancy, especially in those cases where the primary tumour is extra abdominal. Contrast enhanced CT or MRI of the liver is often not performed in patients with extrabdominal malignancy unless conventional US shows lesions suspicious of metastases. T.Albrecht.

3. Objectives of study

3.1. General Objective

- ❖ To study Sonographic patterns of liver secondaries among the patient with known primary extra
Hepatic malignancy coming to the Sonographic unit of radiology department at Tikur Anbessa
Specialized hospital from February 1 to August , 2017.

3.2. Specific objectives

- To assess the common patterns of liver metastasis on ultra–Sonography.
- To determine a specific Sonographic pattern of liver metastases of a primary tumor

4. Material and Methodology

4.1. Study Design and Period

Institution based prospective cross sectional study of all client with known primary extra hepatic malignancy with suspected liver metastases was conducted at sonography unit of Radiology department of Tikur Anbessa Specialized Hospital (TASH) Addis Ababa, Ethiopia from February 1 to August, 2017.

4.2. Population

4.3. Source Population

All Clients who came for routine abdominal ultrasound scan at Sonographic unit of radiology department of TASH during study period.

4.4. Study Population

All clients with known primary extra hepatic cancer with suspicious liver lesion for metastases detected on sonography during study period.

4.5 Inclusion and exclusion criteria

4.5.1. Inclusion criteria

- ❖ Clients with known extra hepatic primary cancer
- ❖ suspicious liver lesion for metastases detected on sonography
- ❖ Age group above and/or 14 years
- ❖ Both male and female sex

4.5.2. Exclusion Criteria

- ❖ Clients with primary liver cancer
- ❖ Benign lesions including Hemangioma
- ❖ poorly cystic lesions
- ❖ cirrhotic liver Parenchymal background
- ❖ Clients below age group of 14 yrs.

4.6. Patient preparation and scanning technique

Informed consent was obtained prior to ultrasound examination, followed by detailed history and brief clinical examination. Patients were kept nil by mouth for six hours prior to ultrasound examination. Patients were examined in the supine position to begin with and then in decubitus (right or left) and sitting position if needed. Liver was scanned in various planes like sagittal, parasagittal, transverse, oblique, sub costal, intercostals and coronal planes. Comprehensive scanning of other upper abdominal organs was done using sonoscape SSI-8000 ultrasound machine with linear and curved probe.

4.7. Sample size and sampling methods

4.7.1. Sample Population

All clients with known primary extra hepatic cancer and suspicious liver lesions for metastases detected with Sonographic examination, who came to Sonographic unit of radiology department of Tikur Anbessa hospital during study period.

4.7.3. Sampling Technique

A convenience sampling method was used. All clients with known extra hepatic malignancy attending the Sonographic unit of TASH will be examined for liver metastasis during data collection period.

4.8. Variables of study

Dependent variable: Sonographic pattern of liver metastasis

Independent variables: Age, sex, primary cancer

Treatment status of patient

4.9. Data Quality Control

4.9.1. Data collection tools and procedures

Data was collected using structured questionnaire which were adopted from Science Journal of Clinical Medicine 2014; 3(6): 106-110 108 different literatures based on objectives of the study. The ultrasound scanning machine used in this study was sonoscape machine, with curvilinear and linear probes which also support tissue harmonic imaging,color and pulse Doppler. The data was collected by post graduate resident and consultant radiologist. At the end of the day principal investigator checked daily activity, completion of the questionnaires and clarity of procedure.

4.9.2. Data Processing and Analysis

All the questionnaires were checked, coded and entered into EPI data version 3.1 and exported to SPSS version 20 for analysis. The results were presented in the form of tables, figures and text using frequencies and summary statistics such as mean, standard deviation and percentage to describe the study population in relation to relevant variables.

4.10. Operational Definitions:

Ultrasonography: Is medical device or machine a technique using echoes of ultrasound pulses to delineate objects or areas of different density in the body.

Sonographic Pattern of liver metastases: is or are different densities of liver lesions that will be detected by the Ultrasonography in patient with extra hepatic cancer in which case a liver lesion or lesions as result of hematogenous spread from distant or near affected organ by cancer.

4.11. Dissemination of the Result

The finding of this study will be presented to the staffs and trainees of department of radiology and manuscript will be submitted for publication (local or international journals).

4.12. Ethical consideration:

Ethical clearance was obtained from the ethical review committee of the CHS of Addis Ababa University and it was taken to Tikur Anbessa specialized hospital radiology department administrators. Accordingly, permission letter was secured from head in chief of radiology department. In addition all of the study participants were informed about the purpose of the study and oral/verbal consent was obtained.

5. Result

5.1 Background

A total of 93 patients who had focal liver lesion were involved in the study and majority i.e. 64(68.8 %) were females whereas 29 (31.2%) were males. The mean age of the patients was 49.4 (SD 11.3).

Only 12 patients (10 females Vs 2 males) had cancer treatment for two or more years. The commonest mode of treatment was chemotherapy. (Table 1)

Table 1 Mode of treatment of cancer for those cases on treatment, TASH July 2017

Mode of treatment	No of cases	%
Chemotherapy	8	66.7
Radiotherapy	1	8.1
Both	3	25
Total	12	100.0

Table 2 primary site of cancer and nature of liver lesion/lesions for those patients on treatment prior to ultrasound examination.

Table 2: primary site of cancer and nature of liver lesion/lesions for patients on treatment

Primary site cancer	nature of liver lesion/lesions					Total
	hypo echoic	target(peripheral halo)	cystic(central necrosis)	infiltrative	mixed	
breast	2	3	-	1	-	6
cervix	-	1	1	-	-	2
colon	-	1	-	-	1	2
lung	-	1	-	-	-	1
nasopharynx	1	-	-	-	-	1
Total	3	6	1	1	1	12

Breast, colon and stomach/gastric were the top three primary sites of cancer. (Table 3)

Table 3 primary site of cancer of patients TASH July 2017

No	Primary site of cancer	No of cases	%
1	Breast	21	22.6
2	Colon	13	14
3	Stomach/gastric	11	11.8
4	Cervix	8	8.6
5	Pancreas	8	8.6
6	Ovary	5	5.4
7	Lung	4	4.3
8	Colorectal	4	4.3
9	Esophagus	4	4.3
10	Rectal	3	3.2
11	Melanoma	3	3.2
12	Endometrium	2	2.2
13	Renal	2	2.2
14	Nasopharynx	2	2.2
15	Parotid	1	1.1
16	Small intestine	1	1.1
17	Mesentery/omental/peritonium	1	1.1
	Total	93	100.0

When we see the histologic type of primary cancer 53(56.9%) were adenocarcinoma, 9 (9.7%) SCC , 5(5.4%) were GIST , 3cases of melanoma (3.2%), 2cases (2.2%) Renal cell carcinoma, 2(2.2%) pancreatic neuroendocrine and 1 (1.1%) Adeno-cystic carcinoma of parotid.

5.2 Focal liver lesions

The highest number of patients (30.1%) was in the age group 48 – 57 followed by 38 – 47 and 58 – 67 age group respectively. (Table 2)

Table 4 Age distribution of focal liver lesion TASH July 2017

Age group	No of cases	Percent
18 – 27	1	1.1
28 – 37	15	16.1
38 – 47	25	26.9
48 – 57	28	30.1
58 – 67	21	22.6
68 – 77	3	3.2
Total	93	100.0

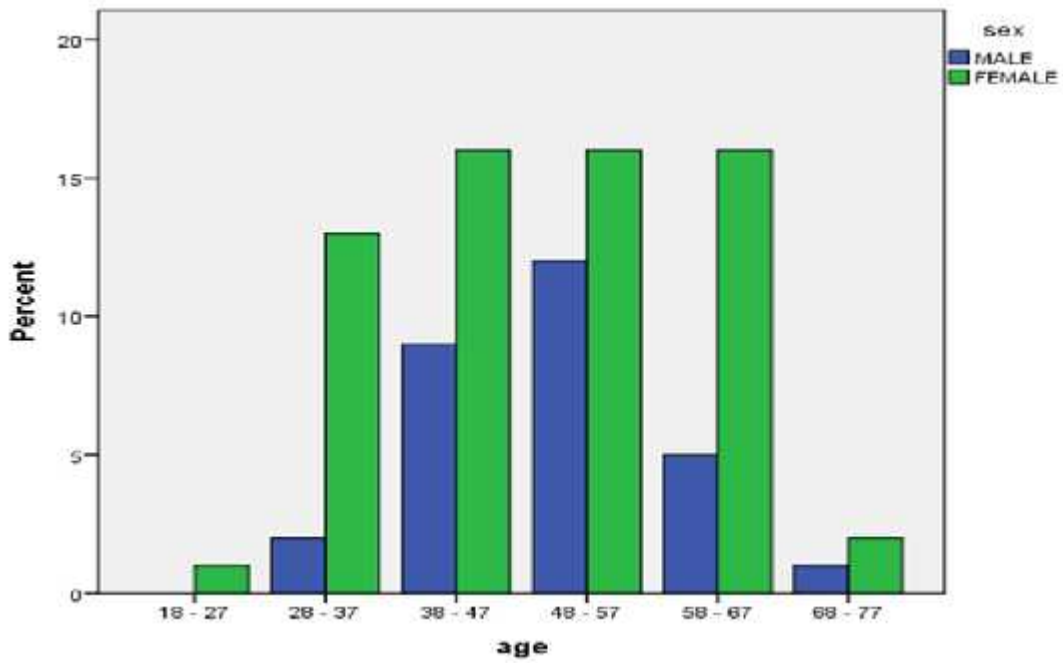


Figure 1 focal liver lesion distribution by age and sex TASH July 2017

Table 5 Age distribution of nature of focal liver lesion TASH July 2017

Age Group	Nature of liver lesion/lesions							Total
	echogenic	hypo echoic	Target	Calcified	cystic(central necrosis)	infiltrative	Mixed	
18-27	-	1	-	-	-	-	-	1
28-37	-	3	7	1	-	1	3	15
38-47	4	3	11	1	2	-	4	25
48-57	7	4	12	1	1	-	3	28
58-67	5	5	7	1	1	-	2	22
68-77	1	-	2	-	-	-	-	3
Total	17	16	39	4	4	1	12	93

Target, Echogenic and Hypo echoic accounted for 41.9%, 18.3% and 17.2% of type of liver lesion respectively. (Figure 2)

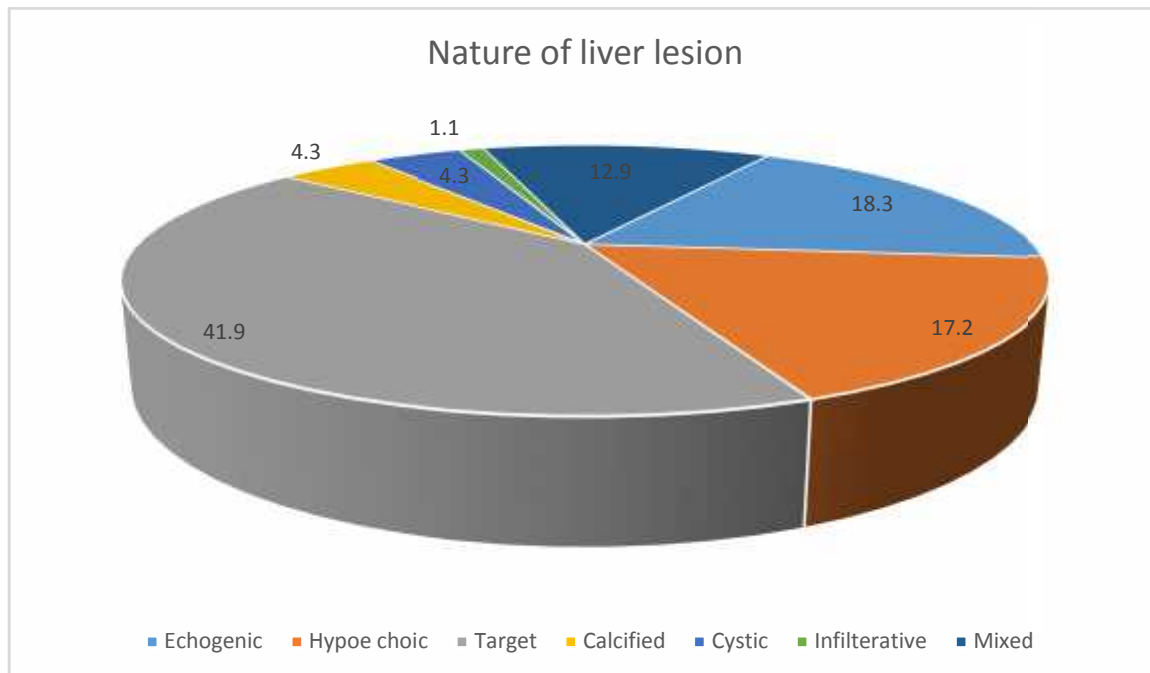


Figure 2 Nature of liver lesion TASH July 2017

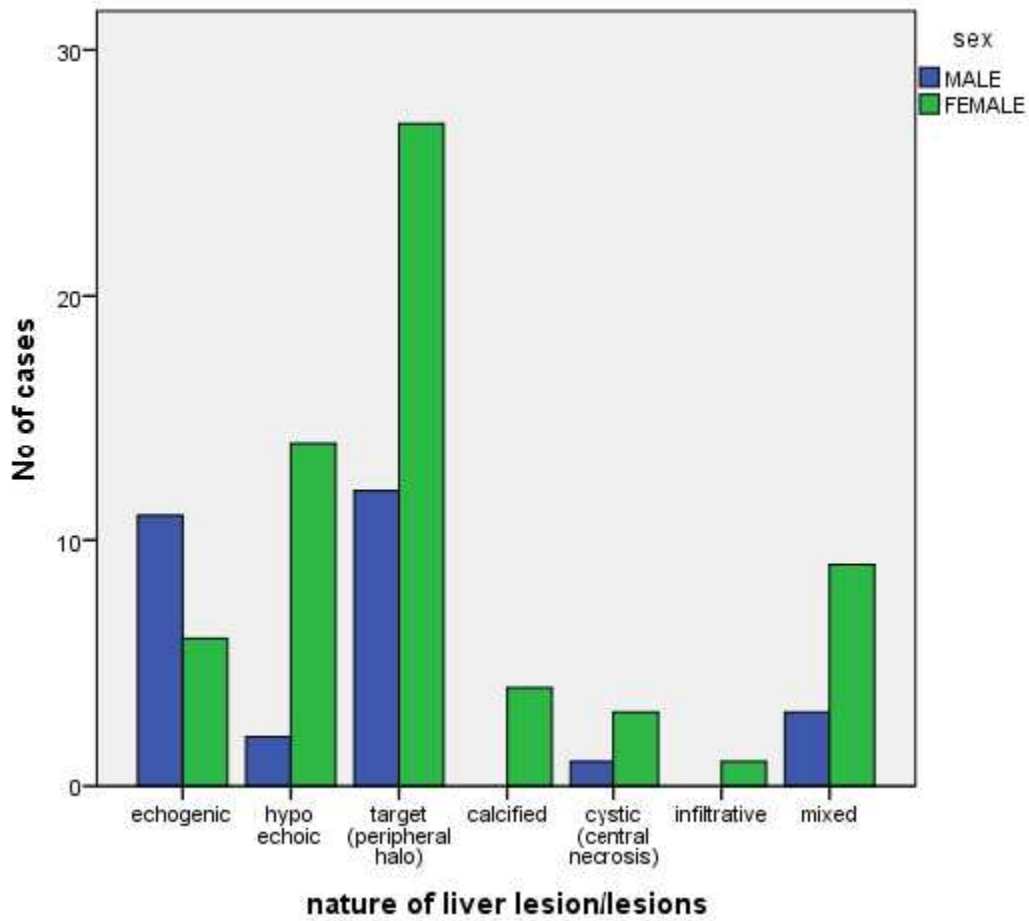


Figure 2 distribution of nature of liver lesion by sex TASH July 2017

Out of 21 patients with breast as primary site of cancer, 13 and 5 patients had target and hypo echoic liver lesions respectively. Out of 13 patients with colon as primary site of cancer; 4 had echogenic, 3 hypo echoic and 4 had target liver lesions. Out of 11 patients with stomach as

primary site of cancer 4 target , 3 mixed echoic 1 echogenic ,1 hypo echoic and 1 calcified (Table 6)

Table 6 Distribution of nature of liver lesion by primary site of cancer TASH July 2017

Primary site of cancer	Nature of liver lesion							Total
	Echo genic	Hypo echoic	Target	Calcified	Cystic/ compl ex	Infiltrative	Mixed	
Breast	1	5	13	1	-	1	-	21
Cervix	-	1	3	-	2	-	2	8
Colon	4	3	4	-	-	-	2	13
Colorectal	3	-	0	1	-	-	-	4
Stomach/gastric	1	1	4	1	1	-	3	11
Lung	-	1	2	-	-	-	1	4
Nasopharynx	1	1	0	-	-	-	-	2
Rectal	2	-	1	-	-	-	-	3
Mesentry/omental /peritoneum	1	-	0	-	-	-	-	1
Esophagus	1	1	1	-	1	-	-	4
Ovary	-	1	-	1	1	-	2	5
Melanoma	-	-	3	-	-	-	-	3
Parotid	-	1	-	-	-	-	-	1
Endometrium	1	-	1	-	-	-	-	2
Pancreas	1	1	5	-	-	-	1	8
Renal	1	-	1	-	-	-	-	2
Small intestine	-	-	1	-	-	-	-	1

Total	17	16	39	4	5	1	11	93
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More than half (54.8%) of patients with focal liver lesion had hepatomegaly (Figure 3).

Majority 81(87.1%) of the patients had multiple focal liver lesions and 12(12.9%) had single. (Figure 4)

In 56(60.2%) of patients both lobes were involved whereas in 24(25.8%) patients the right lobe was involved and in 13(14%) patients the left lobe was involved. (Figure 5)

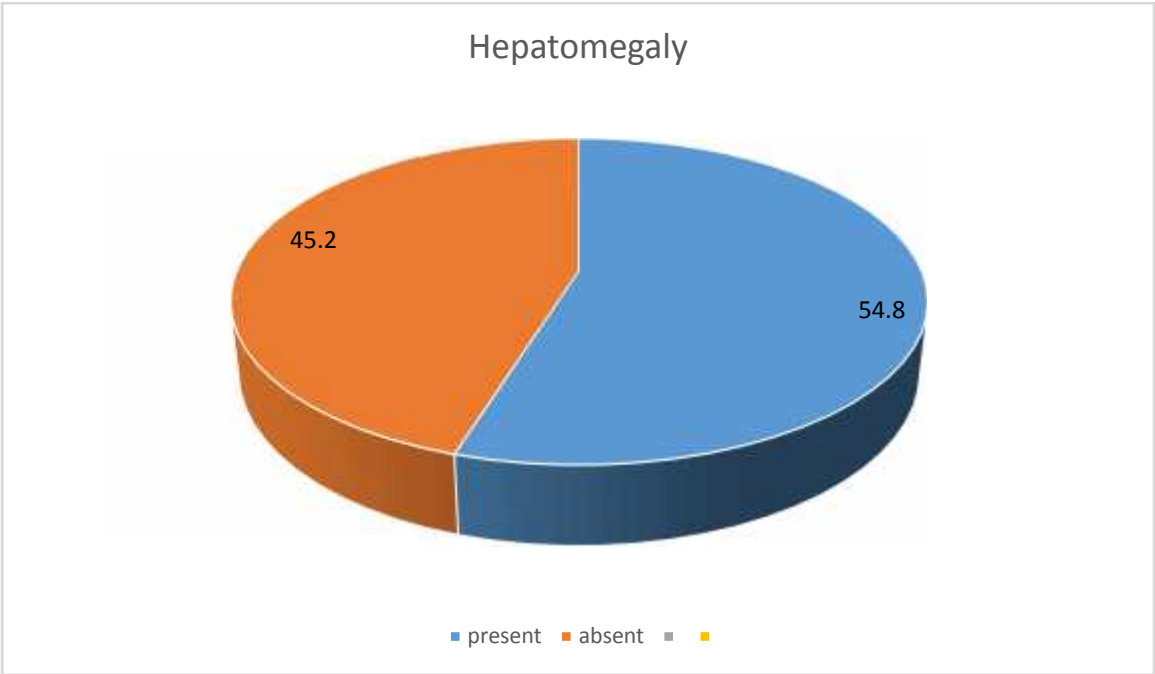


Figure 3 Distribution of cases based on hepatomegaly TASH July 2017

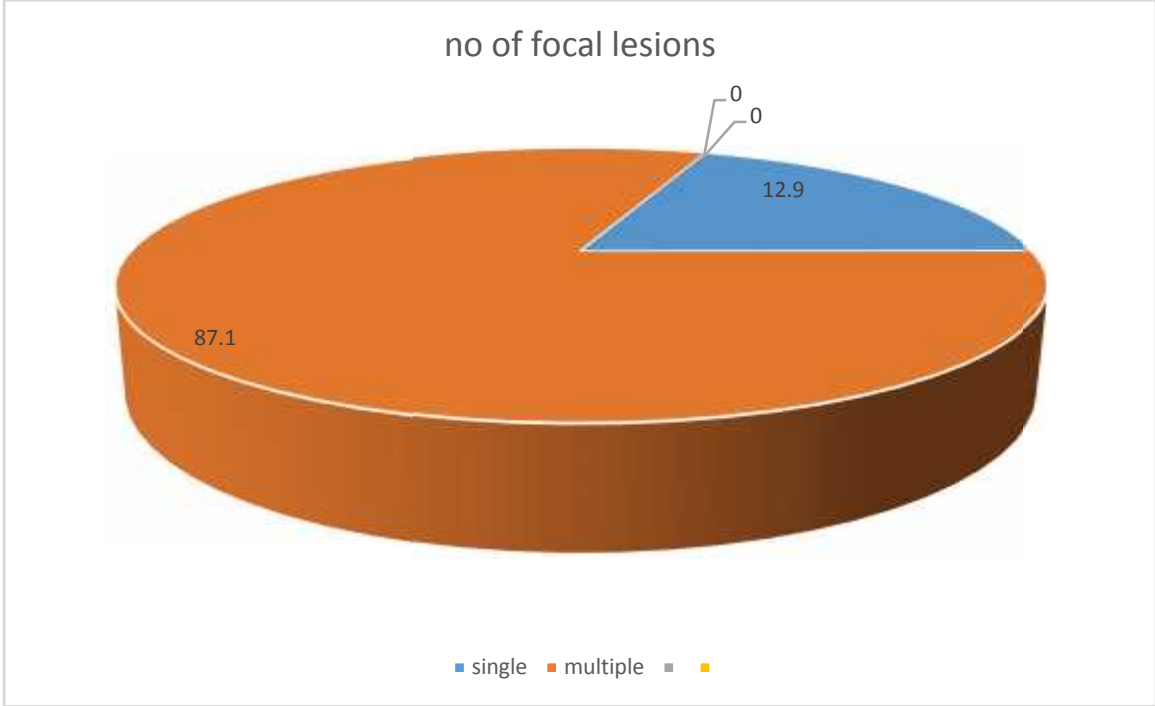


Figure 4 Distribution of cases by no of focal lesions TASH July 2017

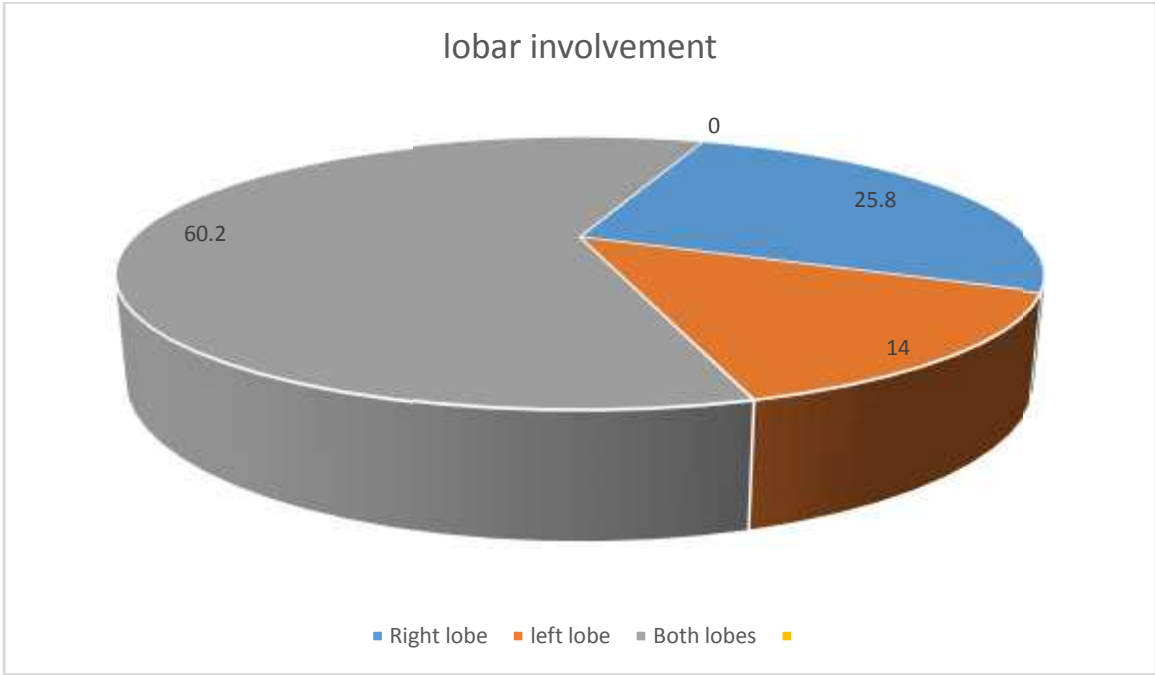


Figure 5 Distribution of cases based on lobar involvement TASH July 2017

Table 7 primary site of cancer and no of focal liver lesion

Primary site of cancer	No of focal lesion		Total
	Single	Multiple	
Breast	5	16	21
Cervix	2	6	8
Colon	1	12	13
Colorectal	-	4	4
Stomach/gastric	-	11	11
Lung	1	3	4
Nasopharynx	1	1	2
Rectal	-	3	3
Mesentry/omental/peritoneum	-	1	1
Esophagus	2	2	4
Ovary	-	5	5
Melanoma	-	3	3
Parotid	-	1	1
Endometrium	-	2	2
Pancreas	-	8	8
Renal	-	2	2
Small intestine	-	1	1
Total	12	81	93

6. Discussion

A total of 93 patients who had known primary extra hepatic cancer and suspected focal liver lesion for metastases is reviewed. Of which 64 (68.8%) were females and 29(31.2%) were males with mean age of the patients was 49.4, and only one patient between the age group of 18-27 yrs. Majority of patients between the age group of 48-57 (30%).

According to other study , Scheible,W etal (6) a total of 76 patients were reviewed of which 45 of them are females with M:F ratio of 0.65:1 and T.Albrecht,(2) , A total of 40 patients with known extra hepatic cancer and focal liver lesion suspected for metastases were reviewed of which 24 patients are females with M: F ratio of 0.67: 1. We also found that the female population dominance in our study too. The strength of present study is that the study population out number both study, 76 & 40, respectively.

Table 10 comparison of sex incidence of focal liver lesions of present study with other studies

Author	No of cases	No of males	No of females	M:F Ratio
Scheible,W etal (6)	76	31	45	0.68:1
T.Albrecht,(2)	40	16	24	0.67:1
Present study	93	29	64	0.45:1

According to result of our study: 81 of 93 patients (87.1%) had multifocal metastases disease, where as 12 of 93 cases (12.9%) had single or solitary hepatic metastases. (Figure 4 Distribution of cases by no of focal lesions TASH July 2017).

In comparison with other study generally we found more or less similar finding even though slight difference in number of study population included in the latter study, in which multi focal metastases common than solitary hepatic metastases, 89 of 105 (84.7 %) multifocal and 16 of 105 solitary metastases,(Thimmaiah, TV 1) & 23 of 37 (62.2 %) multifocal and 14 of 37 (37.8%) solitary metastases , T.Albrecht,(2).

10 of the 12 cases of solitary hepatic lesion had Abdominal CT with contrast as reference image all of them display hypodense to liver parenchyma suggestive of metastases.

Table 11 comparison of number of focal liver lesions of present study with other studies

No of lesions	Authors					
	Thimmaiah, TV 1		T.Albrecht,(2)		Present study	
	No of cases (105)	%	No of cases (37)	%	No of cases (93)	%
Single	16	15.3	14	37.8	12	12.9
Multiple	89	84.7	23	62.2	81	87.1

In our study the most common primary tumor resulting hepatic metastases are those from GI tract, 36 of 93cases followed by Breast 21 of 93 cases, pancreas 8 of 93 and cervix ,8 of 93 total cases. (Table 3 primary site of cancer of patients TASH July 2017). Even though Variable primary tumor is included in present study however, more less we found similar most common extra hepatic primary resulting hepatic metastases of which gastrointestinal primary adenocarcinoma predominate.

The most common primary resulting hepatic metastases according to, Thimmaiah, TV (1) was gut, breast, lung and melanoma in decreasing order and GI-colonic adenocarcinoma, lung pancreas and breast in decreasing order, Scheible,W etal (6).

Table 13 comparison of most common primary cancer of present study and other studies

Author : Present study			Author:- Scheible,W etal (6)		
No of cases (93)	No of cases	%	No of cases (76)	No of cases	%
GI –colonic adenocarcinoma	36	38.7	GI- colonic adenocarcinoma	31	40.8
Breast	21	22.5	Lung	19	25
Pancreas	8	8.6	Pancreas	5	6.5
Lung	4	4.3	Breast	2	2.6

According to result of study, Three basic echo Parenchymal abnormality predominate with commonest echo pattern of liver metastases was target or Bull’s eye pattern (41.9%), echogenic (18.3%) and hypo echoic (17.2%). A fourth category is composed of case which do not fit easily into these above groups. Generally these patients showed a mixture of one or more of the above echographic pattern diffuse inhomogeneous echoes, and/or a large mass otherwise difficult to characterize.

The most common echographic pattern of liver metastases was that of single or multiple lesions in which a dense central focus is surrounded by a more lucent periphery which inturn is readily separable from adjacent liver parenchyma ,which we called it “**Target or bull’s eyes**” lesions. Thirty nine of total 93 cases (41.9%) had this pattern. 13 of 21 patients with primary breast cancer had this pattern of target lesion. 10 of 36 primary gastrointestinal tract (GI) cancer had also this pattern.

It is of interest that of the three cases of **Melanoma** in our series, all of them showed a Target or bull’s eyes lesions. We found this finding quite variable according to one study in which 4 of 76 cases were melanoma they found that only 1 case to showed bull’s eye, (Scheible,W etal (6)). Moreover, five (5) of eight (8) cases of pancreatic adenocarcinoma displays this pattern of target

lesions. (Table 6 Distribution of nature of liver lesion by primary site of cancer TASH July 2017).

We also found this echographic pattern predominate other study, 32 of 105 (30.5%) Thimmaiah, TV (1). This may partially explained by that, the most common primary tumor reviewed in this study are gastrointestinal and breast cancer are also similar with our present study, 36 & 21 respectively.

A second most common Sonographic pattern of liver metastases in our study was that of single or multiple echo dense foci within the liver parenchyma, **echogenic**. In our series seventeen (18.3%) of patients displayed this pattern. Eleven (11) of 17 patients with this pattern had a known primary **colonic adenocarcinoma**. (Table 6 Distribution of nature of liver lesion by primary site of cancer TASH July 2017).

In comparison with other study in which colonic primary adenocarcinoma predominate we found similar pattern of echographic abnormality. 28 of 105 (26.7%), Thimmaiah, TV (1) and 28 of 76 (37%), Scheible,W etal (6).

A third common manifestation of hepatic metastases was that of well defined sonolucent area entirely surrounded by a normal liver parenchyma, **hypo echoic lesion**. Typically, fine low level echoes are noted within these lesions indicating their solid nature. In our series 16 (17.2%) showed this pattern appearance. 5 of 21 cases of primary breast also display this pattern.

This pattern of echographic abnormality is seen in 19 of 105 (18.1%), Thimmaiah, TV (1) and 14 of 76 (18%), Scheible,W etal (6).

11 of 93 patients representing a diverse group of primary tumors including 3 cases of stomach , cervix (2 cases), ovary (2 cases), colonic ca (2 cases) ,lung (1case) and pancreas (1 case), display mixed Sonographic pattern that do not fall in to one of the above sub group pattern. 5 out of 11 cases showed mixed pattern, encompasses those instances in which at least two of previously described gray scale patterns were present simultaneously.

Diffuse inhomogeneity characterizes those whose echo graphic pattern is clearly abnormal with multiple coarse, dense and or lucent areas but without a dominant pattern of focal lesion , all 3 cases of stomach/gastric out of 11 cases display this pattern of mixed echoes , all these 3 cases were representing a case of known gastric GIST.

Finally three (3) patients showed one or more poorly defined masses with variable and often bizarre echo pattern ,not easily characterized. Two of three patients had received chemotherapy prior to ultrasound examination perhaps this relatively disordered appearance is of patient response to therapy.

In addition to these definable abnormalities of hepatic parenchyma, it should be noted that more than half (54.8%) of patients had diffuse enlargement of liver (hepatomegaly). (Figure 3 Distribution of cases based on hepatomegaly TASH July 2017). This feature also should be looked for as additional clues to possible metastases.

This fourth category of mixed - echographic pattern also seen in other study with variable primary tumor, 15 of 105 (14.3%) ,Thimmaiah, TV (1) and 21 of 76 (28%), Scheible,W etal (6).

Other less commonly seen Sonographic pattern of liver metastases is that of **complex cystic** predominantly fluid-filled presumably central necrosis or intralesional hemorrhage, in our series five of 93 patients showed this pattern with variable primary tumor, Cervical squamous cell carcinoma (SCC) 2 of 8 cases, gastric GIST 1 of 5 cases, esophagus SCC, 1cases and 1 case of primary ovary malignancy.

4 cases in our series also demonstrate a well defined densely echogenic multifocal or single hepatic Parenchymal lesion with posterior acoustic dark shadows (**calcified pattern**) this pattern also seen in variable primary tumor including 1 case of mucinous adenocarcinoma of colorectal, 1 case of primary ovarian malignancy, gastric primary (1 case) and 1 case of treated breast ca on chemotherapy prior to ultrasound examination.

Only 1 case out of 93 cases series demonstrate infiltrative pattern with ill defined irregularity of hepatic parenchyma causing focal capsular retraction. This pattern was seen with breast primary on chemotherapy > than 2years of duration prior to ultrasound examination, perhaps this bizarre pattern of response to therapy.

Such bizarre echo pattern finding in patient on chemotherapy prior to ultrasound examination was also found in other study, ScheibleW etal (6).

Table 14 comparison of nature of liver lesion of present study with other studies

Nature of liver lesion	Author					
	Thimmaiah, TV (1)		Scheible,W etal (6)		Present study	
	No of cases (105)	%	No of cases (76)	%	No of cases (93)	%
Echogenic	28	26.7	28	37	17	18.3
Hypo echoic	19	18.1	14	18	16	17.2
Target(peripheral halo)	32	30.5	13	17	39	41.9
Calcified	4	3.8	-	-	4	4.3
Cystic/necrosis	4	3.8	-	-	4	4.3
Infiltrative	3	2.9	-	-	1	1.1
Mixed	15	14.3	21	28	11	11.8

7. Conclusion

The finding of our study and other studies showed that the most common primary tumor resulting hepatic metastases are those from GI tract with colonic adenocarcinoma being on the top followed by Breast. We found that majority of primary extra hepatic tumor produce multifocal liver metastases therefore the presence of multiple hepatic lesions in a patient with known primary extra hepatic malignancy is highly suggestive of metastatic disease. The ultrasound pattern of liver metastases is quite varied and there is no consistent relation between the ultrasound pattern and type of tumor that allows one to specify primary malignant, However: The various common ultrasound patterns include multiple target or bull's eye with peripheral hypo echoic halo, echogenic (dense), multiple hypo echoic and also mixed patterns. With regard to specificity, it would seem that adenocarcinoma of colon generally produces echogenic liver metastases , Breast and pancreatic adenocarcinoma produces target hepatic metastases. Bizarre echo pattern which is difficult to characterize was seen in patient on chemotherapy treatment, perhaps this bizarre pattern of response to therapy. In addition to these definable abnormalities of hepatic parenchyma, it should be noted that more than half (54.8%) of patients had diffuse enlargement of liver (hepatomegaly) in our study, this feature also should be looked for as additional clues to possible metastases.

8. RECCOMENDATION

- ❖ We reviewed 93 cases with abnormal gray scale hepatic echogram due to known or suspected metastatic disease hence the pathologic proof of liver lesion is yet to be established.
- ❖ Bizarre echo pattern of hepatic metastases which is difficult to characterize was seen in patient on chemotherapy treatment prior to ultrasound examination, this finding should be further investigated with large sample study.

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Annex I

Verbal consent form

Title: - *Sonographic pattern of liver secondaries among patient with known primary extra hepatic cancer coming to the Sonographic unit of radiology department at TASH.*

Hi, my name is Dr.Abdulhafiz Idris, Medical Doctor and final year radiology resident. I am involved in a research study called –Sonographic pattern of liver metastasis among the patient with known primary extra hepatic cancer at Tikur Anbessa specialized hospital that will be conducted from February 2017 to September, 2017 G.c with Dr. Tesfaye Kebede (associate professor and consultant radiologist), Dr. Wondim Getnet (consultant radiologist) and Dr. Ferehiwot Bekele (consultant radiologist) at Tikur Anbessa specialized hospital found in Addis Ababa, Ethiopia where abdominal ultrasound examination are performed.

Purpose of the study: - we are asking you to take part in this research because we are trying to determine Sonographic patterns of liver metastasis among patient with primary intrabdominal cancer. You will be asked to allow us to do abdominal ultrasound. The evaluation of this enables us to recommend a common Sonographic pattern of liver metastasis that will aid in early suspicion and detection of liver metastasis for proper diagnosis and management. Confidentiality of all records will be guaranteed and no information by participants can be identified will be released or published. Your participation is voluntary. You can decline to participate, and you can refuse to participate, if you wish to do so, without any negative consequences to you. By you allowing us do abdominal Ultrasound, this means you consent to participate in this research project. Do you have any questions?

If you have any questions or concerns about the research, please feel free to contact me **Dr.Abdulhafiz idris**, AAU, college of health science, department of Radiology, Addis Ababa Ethiopia. **Mobile phone +251911713618**. If you have questions regarding your rights as a research participant, contact Addis Ababa University, department of Radiology Tel office **0115150947**.

I therefore agree to participate in this study

Signature of participant -----

Full name -----

Date ----- Tel-----

Postal address -----

I have been present while the procedure has been explained to the participant and I have witnessed his/her consent to take part in the study.

Signature of witness -----

(The witness should be a person not connected with study)

Full name -----

Date -----Tel -----

Annex II : Data collection format

Title : Sonographic pattern of liver secondaries among patient with known primary extra hepatic cancer coming to the Sonographic unit of radiology department at TASH.

1, Medical record No: -----2, Age----- 3, Sex-----

4, Clinical data-----

5, was he/she on cancer treatment? A, No B, yes

❖ If yes duration and mode of treatment, duration (specify) -----
b ,chemotherapy c, radiotherapy d, both

6, primary site of cancer and histologic type of cancer.

A, primary site (circle one).

- i. Gall bladder (GB)
- ii. Pancreas
- iii. Colon
- iv. Colorectal
- v. Stomach (gastric)
- vi. Duodenum
- vii. Small intestine
- viii. Rectal
- ix. Mesentery ,omental and peritoneum
- x. Esophagus
- xi. Spleen
- xii. Other primary (specify)-----

B, histologic type if known-----

7, Liver

A, size (longitudinal diameter in cm)-----

B , any focal lesion? Circle one 1, No 2.yes

❖ **If yes to above question (circle one)** 1, single 2, multiple

❖ **Which lobe of liver** 1, right lobe 2, left lobe 3, both lobes

C, Nature of liver lesion or lesions (Circle one only) :-

- i. Echogenic
- ii. Hypo echoic
- iii. Target (peripheral halo)
- iv. Calcified
- v. Cystic
- vi. Infiltrative
- vii. Mixed (if possible specify)-----
- viii. Other (specify if possible)-----

D , Is there associated liver Hemangioma ? (Circle one) 1, No 2, yes

8, Is there Ascites? (Circle one) - 1, No 2, yes

