ORIGINAL RESEARCH ARTICLE

Analytical Study of CT Findings in Liver Lesions

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A B S T R A C T

Introduction: liver is also one of the commonest sites for metastatic neoplasm for primary tumors elsewhere. The characterization of liver lesions as benign or malignant is important for the correct triage of patients to surgical versus nonsurgical therapies. Aim to assess the role of triphasicmultidetector computed tomography in characterization of a wide range of hepatic lesions.

Material and methods: this was a prospective observational study, conducted in department of radio diagnosis at kamineni hospitals, l.b.nagar, hyderabad, telangana. Overall study duration was 24 months (june 2017 to may 2019) and 50 cases of focal liver lesions were included in the study.

Results: Mean age of subjects was 53.82 ± 16.88 years. Range of the subjects was from 21 to 88 years. Majority of subjects were in the age group 51 to 60 years (26%). On triphasic ct, 32% were diagnosed to have liver abscess, 22% had metastasis, 16% had hepatocellular carcinoma, 12% had hemangioma, 10% had simple cyst, 6% had hydatid cyst and 2% had metastasis/abscess. Based on triphasic ct findings 30 (60%) subjects were diagnosed as benign lesions, 19 (38%) as malignant lesions and 1 (2%) subject was inconclusive and was categorized in to metastasis/abscess. Triphasic ct had high validity in diagnosis of focal liver lesions in comparison with hpe.

Conclusion: triphasic ct is an equivalent tool to hpe in the diagnosis of focal liver lesions.

Keywords: Liver, Triphasic CT, Benign Lesion, Malignant Lesion, Metastasis.

INTRODUCTION

Liver being one of the largest organs in the body is the site for a wide gamut of benign and malignant neoplasms. It is also one of the commonest sites for metastatic neoplasm for primary tumors elsewhere. Complex diffuse diseases like cirrhosis and chronic viral infections also affect it. The metabolic functions of the liver and its dual vascular supply have made the management of liver neoplasms a challenge to clinicians and surgeons. Prior to surgical treatment of liver tumors, it is important to detect, characterize, and accurately localize them. Improved detection and characterization can help determine which hepatic tumors may be amenable to aggressive surgical techniques and which indicate palliative treatment. The characterization of liver lesions as benign or malignant is important for the correct triage of patients to surgical versus nonsurgical therapies.

Since the mid-1970s, there has been an explosion of imaging technology for the liver. The clinician is confronted by a tantalizing array of expensive tests for the evaluation of focal and diffuse hepatic disease. The best imaging strategy is critically related to the indication for imaging. Ultrasonography is used as a screening modality in the evaluation of hepatic lesions. However sonography lacks specificity due to overlap of imaging features and is not an adequate imaging modality in the presence of background parenchymal liver disease like cirrhosis.

CT continues to be the workhorse of hepatic imaging and newer techniques such as biphasic helical scanning have improved its standing. Helical computed tomography is widely accepted as the state-of-the art technology for evaluation of focal liver lesions.[1] the relatively recent introduction of helical ct scanners with higher heatcapacityenables multiple-phase helical examinations of about 20 seconds each with a short time interval. It is widely accepted as the preferred imaging technique for suspected liver tumor and detecting metastases, because of its low cost, high accuracy and ready accessibility. This technology permits examinations of the abdomen in multiple phases with a single monophasic bolus of intravenous contrast material, thus improving lesion detection and characterization of the livertumors.[2]

Detection of hepatic lesions with ct is optimized by rapid delivery of iodinated contrast material and scanning during the phase of maximum difference in attenuation between the neoplasm and normal parenchyma. Detection and characterization of both focal and diffuse pathologic conditions in the liver require an understanding of the principles of hepatic perfusion. Normal liver parenchyma receives about 70% of its blood from the portal vein and 30% from the hepatic artery. Most primary and metastatic liver tumors, however, receive their blood from the hepatic

artery. Thus hypervascular tumors like hepatocellular carcinoma are more conspicuous in early scanning phase, called arterial phase. While hypovascular tumors like most of the metastatic lesions become conspicuous in the later phase called the portovenous phase. Hence currently multiphasic contrast enhanced dynamic ct of whole liver has shown promise in better characterization of the morphology of hepatic tumors.[3,4]

Ability to scan the liver during arterial phase [ap], portal venous phase [pvp] of enhancement and the potential added value of delayed phase images increase the lesion conspicuity and boost the diagnostic confidence. Scanning the liver twice sequentially allows detection of both hypervascular and hypovascular tumors. [5]

Triphasic ct has become the primary imaging modality for detection and characterization of focal liver lesions. It is an effective aid in determining the number, location, and nature of such lesions and monitoring their size over time. In patients with cancer, the accurate detection of metastatic disease at the time of diagnosis or during the course of treatment remains crucial to management of the disease.[4] purpose of this study was to assess the role of triphasicmultidetector computed tomography in characterization of a wide range of hepatic lesions.

Aim and objectives

Aim

To assess the role of triphasicmulti detector computed tomography in characterization of a wide range of hepatic lesions.

Objectives

1. To analyze the findings of focal liver lesions on triphasic mdct.
2. To determine the morphology of and enhancement patterns of these hepatic lesions
3. To correlate the lesions with other imaging /cytological / pathological / postsurgical findings.
4. To provide information that could help in the patient management and prognostication.

MATERIAL AND METHODS

Study setting

Department of radiodiagnosis, kamineni hospitals, l.b. nagar, hyderabad.

Type of study

A prospective observational study, first of its kind in our department. Prior approval by the institutional review board and ethical committee was obtained.

Study period: 24 months (june 2017 to may 2019)

Sample size

Sample size was estimated by using the sensitivity of mdct (80 to 100%) in diagnosis of focal hepatic lesions in comparison with histopathology from the study by kamlesh gupta et al.[6] using the formula

$$N = [z\alpha^2 * sn * (100 - sn)] / (d^2 * p)$$

Z = standard normal value at 95% confidence level

Sn = sensitivity = 80%

100 – sn = 20%

D = desired absolute precision = 5%

P = prevalence = 5%

By considering above values

N = 49.15 subjects

N = 50 subjects with focal liver disease were included in the study.

Inclusion criteria

- All clinically suspected and prior diagnosed cases of hepatic masses on initial screening imaging modalities.
- Age groups >18yrs.
- Both sexes are included.

Exclusion criteria

- Any person with abnormal renal function tests.
- Known allergy to intra venous contrast.
- Age groups <18yrs.
- Pregnant women with focal liver lesions.

Method of collection of data

Risks of contrast administration are explained to the patient prior to the study and informed written consent was taken from participating individual.

A detailed history is obtained using pre structured questionnaire.

Imaging Protocol

MDCT 128 slice scanner (Ingenuity CT, Philips medical systems, Best, the Netherlands) is used for the study.

Study variables

The images will be analyzed for number of lesions, tumor size, location, and signal intensity changes, areas of hemorrhage, cystic changes, calcification, intensity and pattern of contrast enhancement.

STATISTICAL ANALYSIS

Data was entered into Microsoft excel data sheet and was analyzed using SPSS 22 version software. Categorical data was represented in the form of Frequencies and proportions. Chi-square test was used as test of significance for qualitative data.

Observation

In our study, a total of 50 patients with diagnosis of focal liver lesions were studied.In the study 20% were in the age group <40 years, 18% were in the age group 41 to 50 years, 26% were in the age group 51 to 60 years, 22% were in the age group 61 to 70 years and 14% were in the age group >70 years. Mean age of subjects was 53.82 ± 16.88 years.

Sex distribution among subjects

In the study 37 (74%) were males and 13 (26%) were females.

Past history distribution among subjects

In the study 9 subjects had significant past history. In the study most common presenting complaint was pain abdomen (56%), followed by it was fever (32%), appetite loss (14%).

Plain ct findings distribution among subjects

In the study on plain ct, 30 (60%) had single,12 (24%) had multiple and 8 (16%) had no lesions. 48 (96%) had hypodense and 2 (4%) had hypo dense with peripheral rim of calcifications.

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	Sensitivity	Specificity	Positive predictive value	Negative predictive value	Diagnostic accuracy
Simple cyst	100%	100%	100%	100%	100%
Liver abscess	94.12%	100%	100%	97.06%	98%
Hemangioma	100%	100%	100%	100%	100%
Hydatid cyst	100%	100%	100%	100%	100%
Hepatocellular carcinoma	100%	100%	100%	100%	100%
Metastasis	100%	100%	100%	100%	100%

Table-1: validity of triphasic ct in diagnosis of various lesions with respect to biopsy

	Author	Age range (years)	Mean age(years)
Liver lesions	Nggada ha et al [10]	14 – 75	47.00
	Drvishwanathet al[8]	06 –69	41.7
	Current study	21-88	53.82
Liver abscess	Azharjawaidbhukari et al [11]	10-60	29.00
	Current study	27-74	52.50
Hepatocellular Carcinoma	Drvishwanathet al[8]	6 – 66	45.4
	Current study	28-88	64.86
Metastasis	Ali nawaz khan et al[12]	50 – 70	60
	Drvishwanathet al[8]	30 – 70	52.2
	Current study	42-72	59.45
Hydatid cyst	Mergen h et al[13]	18 – 85	42.0
	Dilip k das[14]	28 – 60	34.5
	Drvishwanathet al[8]	16 – 60	25.3
	Current study	26-60	47
Hemangioma	Drvishwanathet al[8]	08 – 60	24.3
	Current study	25-70	42.33
Cystic lesions	Richard m spigel et al[15]	5 – 75	40
	Drvishwanathet al[8]	8 – 60	29.2
	Current study	21-73	47.2
Current study showed correlation with previous studies.			

Table-2: Age incidence of focal liver lesions

	Study group	No of cases	No of males	No of females	M:F Ratio
Focal liver lesions	Nggada ha et al[10]	47	38	9	4.2:1
	Drvishwanathet al[8]	105	70	35	2:1
	Current study	50	36	14	2.57:1
Liver abscess	Azharjawaidbhukari et al[11]	53	39	14	2.8:1
	Drvishwanathet al[8]	33	24	9	2.7:1
	Current study	16	12	4	3:1
Hepatocellular Carcinoma	Drvishwanathet al[8]	31	18	13	1.3:1
	Current study	8	5	3	1.67:1
Metastasis	Ali nawaz khan[12]	50	30	20	1.5:1
	Drvishwanathet al[8]	26	16	10	1.6:1
	Current study	11	8	3	2.7:1
Hemangioma	Gandolfi et al[16]	123	41	82	1:2
	Drvishwanathet al[8]	6	5	1	5:1
	Current study	6	5	1	5:1
Hydatid cyst	Mergen h et al[13]	73	38	53	1.6:1
	Dilip k das et al[14]	8	2	6	1:3
	Drvishwanathet al[8]	4	4	0	4:0
	Current study	3	3	0	3:0
Simple cysts	Richard m speigal et al[15]	10	8	2	4:1
	Drvishwanathet al[8]	5	3	2	1.5:1
	Current study	5	2	3	1:1.5
Current study showed correlation with previous studies					

Table-3: Sex incidence of the focal liver lesions

	Kamlesh Gupta et al[7]		Current study	
	Sensitivity	Specificity	Sensitivity	Specificity
Hepatocellular carcinoma	87.5%	98.5%	100%	100%
Metastasis	100%	98%	100%	100%
Amoebic abscess	94.7%	96.4%	94.12%	100%
Pyogenic liver abscess	80%	98.3%	94.12%	100%
Hydatid cyst	100%	100%	100%	100%

Table-4: Validity of mdct in diagnosis of focal liver lesions in comparison with HPE

Contrast ct findings among subjects

On contrast ct, 32(64%) had single and 18(36%) had multiple lesions.19(38%) had lesions in both lobes, 20 (40%) had lesions in right lobe, 10 (20%) had lesions in left lobe and1 (2%) had in caudate lobe.

Type of attenuation of lesions and diagnosis among them by triphasic ct findings

In the study 72% (36 subjects) had hypo vascular or hypo attenuation lesions and 28%(14 subjects) had hyper vascular or hyper attenuation pattern.of the 36 subjects with hypo vascular or hypo attenuation, 44.4% had type ii attenuation which was the most common pattern, 13.9% had type iii attenuation, 27.8% had type i attenuation, 5.6% had type iv, type v attenuation and 2.8% had type vi attenuation.out of 13 subjects with hyper vascular or hyper attenuation, 57.2% had type viii attenuation, which was the most common hyperattenuating pattern and 42.8% had type vii attenuation. out of 50 subjects, 30 subjects were diagnosed as benign lesions, 19 as malignant lesions and 1 subjects as metastasis/ abscess.

Portal vein thrombosis distribution among subjects

In the study 4 (8%) had portal vein thrombosis and46 (92%) had no portal vein thrombosis.

Portal vein thrombosis in relation to hepato cellular carcinoma

In the study out of four subjects with portal vein thrombosis, 100% of them had hcc .

Hepatic vein distribution among subjects

In the study 1 (2%) had stunting of hepatic vein , 49 (98%) had normal hepatic vein.

Ivc findings distribution among subjects

In the study1 (2%) had thrombosis of ivc , 1 (2%) had compression of intrahepatic ivc and 48 (98%) had normal ivc.

Triphasic ct diagnosis among subjects

In the study on triphasic ct, 16 (32%) were diagnosed to have liver abscess,11(22%) had metastasis,8 (16%) had hepatocellular carcinoma, 6 (12%) had hemangioma, 5 (10%) had simple cyst,3(6%) had hydatid cyst and 1(2%) had metastasis/abscess.

Site of primary diagnosis among subjects with metastasis

In the study out of 11 subjects with metastasis on triphasic ct, 7(63.6%) had primary from gi site,2(18.2%) from carcinoma of breast and 2(18.2%) had pancreatic malignancy.

Hpe diagnosis among subjects

On hpe, 20% were diagnosed as amoebic liver abscess, 12% as hemangioma, 16% as hepatocellular carcinoma, 6% as hydatid cyst, 22% as metastasis and 14% as pyogenic liver abscess.

Association between HPE diagnosis and triphasic ct diagnosis

In the study among those in whom biopsy was not done, 100% had simple cysts in ct, among 10 subjects with amoebic liver abscess in microbiology, 90% were liver abscess and 10% was diagnosed as metastasis/abscess in ct, among 6 subjects with hemangioma in hpe, 100% were diagnosed as hemangioma in ct, among 8 subjects with hepatocellular carcinoma in hpe, 100% were diagnosed as hepatocellular carcinoma in ct, among 3 subjects with hydatid cyst in hpe, 100% were diagnosed as hydatid cyst in ct, among 11 subjects with metastasis in hpe, 100% were diagnosed to have metastasis in ct and among 7 subjects with pyogenic liver abscess in microbiology, 100% were diagnosed to have liver abscess in ct. There was significant association between triphasic ct diagnosis and hpe diagnosis.

Association between triphasic ct and hpe in diagnosis of benign and malignant lesions

In the study among 19 subjects with malignant lesions on hpe, 100% were diagnosed as malignant in ct (true positive). Among 31 subjects with benign lesions in hpe, 96.8% were diagnosed as benign and 3.2% (false positive) as malignant in triphasic ct.

Validity of triphasic ct in diagnosis of liver lesions in comparison with hpe as gold standard

Triphasic ct had a sensitivity of 100%, specificity of 96.77%, positive predictive value of 95%, negative predictive value of 100% and diagnostic accuracy of 98%.

Association between triphasic ct and type of attenuation

In the study among 36 subjects with hypo attenuating lesions, 33.3% were malignant and 66.7% were benign lesions in triphasic ct. Among 14 subjects with hyper attenuation lesions, 57.1% were malignant and 42.9% were benign lesions in triphasic ct. There was no significant association between type of attenuation and triphasic ct diagnosis.

Association between hpe diagnosis and type of attenuation

In the among 36 subjects with hypo attenuating lesions, 33.3% were malignant and 66.7% were benign lesions in hpe. Among 14 subjects with hyper attenuation lesions, 57.1% were malignant and 42.9% were benign lesions in hpe. There was no significant association between type of attenuation and hpe diagnosis.

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DISCUSSION

In the present study 50 subjects with focal liver lesions in the age group ranging from 21 years to 88 years were evaluated radiologically using multidetector triple phase computed tomography and results were compared with histopathology or cytology to determine the validity of multidetector triple phase computed tomography in diagnosis of focal liver lesions.

In the present study mean age of subjects was 53.82 ± 16.88 years. Majority of subjects were in the age group 51 to 60 years (26%). Of the 50 subjects, 74% were males and 26% were females. Most common presenting complaint was pain abdomen (56%). 18% of them had significant past history related to liver illness and malignancy.

On plain CT: 60% had single, 24% had multiple and 16% had no lesions, which were visualised retrospectively after post contrast images. All the lesions werehypodense and 4% had peripheral rim of calcifications.

On contrast CT: 64% had single and 36% had multiple lesions. 38% had lesions on both lobes, 40% had lesions on right lobe, 20% had lesions on left lobe and 2% had on caudate lobe.

In the study 36 subjects had hypo vascular or hypo attenuation lesions and 14 subjects had hyper vascular or hyper attenuation.of the 36 subjects with hypo vascular or hypo attenuation, 44.4% had type ii attenuation which was the most common pattern, 13.9% had type iii attenuation, 27.8% had type i attenuation, 5.6% had type iv, type v attenuation and 2.8% had type vi attenuation.out of 13 subjects with hyper vascular or hyper attenuation, 57.2% had type viii attenuation and 42.8% had type vii attenuation.out of 50 subjects, 30 subjects were diagnosed as benign lesions, 19 as malignant lesions and 1 subject as metastasis/abscess.

In the study by kamlesh gupta et al;[7] out of 100 patients, 64(64%) patients had benign and 36(36%) had malignant lesions. The findings were similar to our study.

On triphasic ct, 8% had portal vein thrombosis. Out of four subjects with portal vein thrombosis, 100% of them had hepatocellular carcinoma.on triphasis ct, 2% (1 subject) had inferior vena cavathrombosis, the subject had renal cell carcinoma in whom the hydatid cyst was detected incidentally. on triphasic ct, 32% were diagnosed to have liver abscess, 22% had metastasis, 16% had hepatocellular carcinoma, 12% had hemangioma, 10% had simple cyst, 6% had hydatid cyst and 2% had metastasis/abscess.out of 11 subjects with metastasis on triphasic ct, 63.6% had primary from gi site, 18.2% from carcinoma of breast and 18.2% had pancreatic malignancy and 100% of them had hypoattenuating pattern.

Ultrasound guided fnac/biopsy was done for all cases except for 5 cases of simple cyst in which it was not necessary as the lesions could be differentiated from other lesions due to their sharper margins and none of the lesions showed enhancement.

On hpe, 20% were diagnosed as amoebic liver abscess, 12% as hemangioma, 16% as hepatocellular carcinoma, 6% as hydatid cyst, 22% as metastasis and 14% as pyogenic liver abscess.

Among all cases only one case was wrongly diagnosed radiologically in comparison with hpe. I.e. Out of 10 cases of amoebic liver abscess in hpe, one case was wrongly diagnosed at metastasis/abscess [hypo/mixed/hypo pattern in hepatic/ portal venous phase and delayed phase respectively], it was the only false positive case in the present study. All other lesions diagnosed in triphasic ct, were diagnosed by hpe with 100% sensitivity, specificity, ppv and negative predictive value.

Triphasic ct had a sensitivity of 100%, specificity of 96.77%, positive predictive value of 95%, negative predictive value of 100% and diagnostic accuracy of 98% in differentiation of malignant and benign lesions.also validity of triphasic computed tomography diagnosis with histology (fnac/ biopsy) showed 100% sensitivity, specificity, ppv, npv and diagnostic accuracy in diagnosis of hepatocellular carcinomas, hemangioma, hydatid cysts and in simple hepatic cysts.the validity of triphasic computed tomography in diagnosis of liver abscess was 94.12% sensitivity, 100% specificity, 100% ppv, 97.06% npv and 98% diagnostic accuracy.

out of 7 cases of hepatic cellular carcinomas, 5(71.4%) cases were males and 2(28.6%) were females, indicating higher incidence of hepatocellular carcinoma in males.all the lesions of hepatocellular carcinoma showed partly hypo, partly hyper/ hypo/hypo pattern in hepatic arterial phase, portal venous phase and delayed phase respectively and all the cases showed hyper attenuation pattern.

In the study among those 10 subjects with amoebic liver abscess in cytology/microbiology, 90% were liver abscess and 10% was diagnosed as metastasis/abscess in ct, among 6 subjects with hemangioma in cytology, 100% were diagnosed as hemangioma in ct, among 8 subjects with hepatocellular carcinoma in cytology, 100% were diagnosed as hepatocellular carcinoma in ct, among 3 subjects with hydatid cyst in cytology, 100% were diagnosed as hydatid cyst in ct, among 11 subjects with metastasis in cytology, 100% were diagnosed to have metastasis in ct and among 7 subjects with pyogenic liver abscess in microbiology, 100% were diagnosed to have liver abscess in ct. There was significant association between triphasic ct diagnosis and hpe diagnosis.From the study it was observed that triphasic ct was a good and validity investigation in diagnosis of focal liver lesions in comparison with hpe among all the lesions.

The present study showed similar incidence of focal liver lesions in comparison with vishwanath et al for abscess (31%), metastasis (25%) and hydatid cysts (5%) and incidence of hemangioma (5.7%), hepatic cysts (5%) were lower compared to the present study and incidence of hepatocellular carcinoma (29%) was higher compared to the present study. The results in the present study were also comparable with the findings of garima jain et al[9] as described in the above table.

From the study by kamlesh gupta et al[7] similar findings was observed as mentioned in the above table.

From the above table it shows that results of mdct in our study was almost similar or even better than the findigns by kamlesh gupta et al[7].

Hence from the above discussion it can be observed that mdct is a highly sensitive noninvasive tool for detection and characterization of focal hepatic lesions.

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CONCLUSION

1. Multidetector computed tomography proved to be a valuable tool in the diagnosis of focal liver lesions by studying the pattern of enhancement in arterial, porto venous and delayed phases and helped in better characterization of the lesion.
2. Multidetector computed tomography with triple phase protocol aided in detection of multifocal lesions and early detection of focal lesions in the presence of underlying liver disease.
3. Focal lesions such as hepatocellular carcinomawhich derive blood supply from hepatic artery are better detected in arterial phase of the scan.arterial phase scans are also helpful in detection of tumor thrombus. Metastatic lesions which are showing rim enhancement in arterial phase are detected early in the arterial phaseof the scan.
4. Focal lesions such as hypovascularmetastasis and abscess were better differentiated in portal venous phase by thick peripheral enhancement in metastatic lesions, as compared to abscess which show relatively thin peripheral rim.
5. Multiphase computed tomography was very helpful in detection of hemangioma which shows characteristic peripheral globular enhancement with progressive centripetal filling in venous and delayed phases. Addition of delayed phase was also valuable in diagnosing hemangioma and differentiating it from hepatocellular carcinoma, the latter shows washout in delayed phase.
6. Over all mdct had 98% diagnostic accuracyin differentiating malignant and benign lesions. Hence a similar tool to hpe in differentiating benign and malignant lesions.
7. Validity of triphasic ct diagnosis in comparison with hpe had 100% sensitivity, specificity, ppv, npv and diagnostic accuracy in diagnosis of the focal liver lesions such as hepatocellular carcinomas, hemangioma, hydatid cysts and simple hepatic cysts.
8. Hence the study concluded that mdct is a highly sensitive noninvasive tool for detection and characterization of focal hepatic lesions.

REFERENCES

1. Kopp AF, Heuschnid M, Claussen CD.Multidetector Helical CT of Liver for Tumour Detection and Characterization.EUR Radiol. 2002;12:745-52.
2. Protugallar HR, Stacher R, Komez G, Aschauer M, Hausegger KA, Szolar DH.The Value of Different Spiral CT Phase in Detection of Liver Metastasis. ROFO 2002;174:452-8.
3. Winterer JT, Kotter E, Ghanem N, Langer M.Detection and Characterization of Benign Focal Liver Lesion with Multislice CT.EUR Radiol 2006;16:2427-43.
4. Van Leeuwen MS, Noordzij J, Felberg MAM, Hennipman AH, Doornewaard H. Focal liver lesions: Characterization with triphasic spiral CT. Radiology 1996;201:327-336.
5. Murcia Nm, Olcoot EW, Jeffrey BR, Lamm LR, Beaulieu FC, Jain AK.Focal Liver Lesions: Pattern-based Classification Scheme for Enhancement at Arterial Phase CT. Radiology 2000;215:746-751.
6. Langman's Medical Embryology 11th ed., Sadler, T W, (Thomas W.); Langman, Jan. Philadelphia: Wolters Kluwer Lippincott Williams & Wilkins, c2010.
7. Kamlesh Gupta, Neelam Gauba, Garima Gupta. "Role of Computed Tomography in Evaluation of Parenchymal Focal Lesions of Liver". Journal of Evolution of Medical and Dental Sciences 2015;4:6257-6268.
8. Dr. Vishwanath. T Thimmaiah. Evaluation of Focal Liver Lesions by Ultrasound as a Prime Imaging modality. Scholors Journal of Applied Medical Sciences. 2013;1:1041-1059.
9. Garima Jain, Sameer R Verma, Rani Bansal, Prashanth K Gupta, Vibhu Garg. Characterization of Focal Hepatic Lesions: A Comparative Study of Ultrasound versus Computed Tomography. IOSR Journal of Dental and Medical Sciences (IOSR- JDMS) 2016;15:44-51.
10. Nggada HA, Ahidjo A, Ajavi NA, Mustapha SK, Pindiga UH, Jahir et al. Correlation between USG findings and USG guided FNAC in the diagnosis of hepatic lesion. Int. J of Gastroenterol. 1999;4:1528: 8323.
11. Azhar Jawaid Bukhari, Khali Javed Abid. Amoebic liver abscess: Clinical presentation and diagnostic difficulties. Kuwait Medical Journal. 2003; 35: 183-186.
12. Nawaz Ali Khan, MacDonald S, Zahir A, Ajay Pankania, David Sherlock, Karai et al. http://: www.medicine.com/radio.topic.394
13. Mergen H, Gen H, Tarus Bay C. Assessment of liver hydatid cyst case – 10 years experience in Turkey. Trop Doct. 2007; 37: 54-56.
14. Das DK, Bhambani S, Chandras Pant CS. Ultrasound guided FNAC diagnosis of hydatid disease of the abdomen and thorax. Diagnostic Cytopathology. 1995; 12: 173-176.
15. Richard M Spiegel, Donald L King, William M Green.. Ultrasonography of primary cysts of the liver. American Journal of Roentgenology. 1978; 131: 235-238.

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