

Determination of Malignant and Non-Malignant Liver Lesions with Triphasic Computed Tomography

RAIHA HANIF¹, MUHAMMAD ADIL RIAZ², MUHAMMAD HABIB UR REHMAN³, SAIMA TABBSUM⁴

¹Student DMRD UOL

²SMO Radiology S.S.Hospital Lahore.

³Professor of Anatomy, Nawaz Sharif Medical college, Gujrat.

⁴Master of Science, (V. Microbiology) UAF, Faisalabad.

Correspondence to Dr. Muhammad Adil Riaz Email: adilriaz227@gmail.com Cell:0301-7699650

ABSTRACT

Background: Triphasic computed tomography is favored non-invasive diagnostic technique for liver lesions. It is often the sole imaging technique needed to identify the nature of lesion, to differentiate malignant from non-malignant lesions, evaluating the vascular supply and it commonly confirms the diagnosis.

Aim: To determine the malignant and non-malignant liver lesions with triphasic computed tomography among patients visiting Radiology department of Lahore General Hospital, Pakistan.

Methods: It is a cross-sectional, descriptive study regarding triphasic computed tomographic differential diagnosis of liver lesions among patients. The study was carried out at Radiology department of Lahore General Hospital, Lahore, Pakistan on a sample of 122 patients over a period of 06 months, from March 2018 to August 2018. Convenient Sampling technique was used. Both male and female patients of adult age groups with suspicion of hepatic lesion on clinical, laboratory or ultrasonographic findings were scanned

Results: In our study malignant liver lesions were more common, found in 94 (77.0%) patients and non-malignant liver lesions were found in 28(23.0%) patients. Among malignant lesions, multifocal hepatocellular carcinoma was the most common lesion, present in 47(50.0%) patients, solitary HCC in 33(35.10%) patients, metastasis in 12(12.70%) patients and fibrolamellar carcinoma in 2(2.12%) patients. Among non-malignant liver lesions, hemangioma and hepatic abscess were the most common lesion present in 8(28.57%) patients each, hepatic cyst in 7(25%) patients, hydatid cyst in 1(3.57%) and regenerative nodule in 4(14.29%) patients.

Conclusion: It is concluded from this study that malignant liver lesions are more common than non-malignant lesions. Among malignant lesions, Hepatocellular carcinoma is the most common primary hepatic tumor followed by metastasis. Hemangioma and hepatic abscess are more common among non-malignant lesions followed by hepatic cyst and regenerative nodule. Hepatic lesions are more common in males.

Keywords: Triphasic CT scan, malignant and non-malignant liver lesions

INTRODUCTION

Computed tomography is frequently used imaging modality for focal hepatic lesions characterization and detection, but the hepatic complex blood supply aggravates the optimal contrast-enhanced CT protocol search¹. Subsequently, the favored technique of liver CT must syndicate a lesion detection high sensitivity along with characterization of lesion, to distinguish pathologies that require additional treatment for lesions or diagnostic tests². A triphasic CT scan was introduced for imaging of entire liver in three phase's i.e. arterial, portal and equilibrium phase to meet these requirements³. Triphasic CT is very crucial in distinguishing a benign lesion from malignant to avoid unnecessary invasive procedures especially in benign tumors like haemangioma⁵. Usually liver metastases are hypovascular in nature and subsequently are top noticed throughout the portal venous phase. Certain metastases (for example, carcinoids, pancreatic islet cell carcinomas, pheochromocytomas, melanomas, sarcomas, and choriocarcinomas) and hypervascular primary liver malignancies (for example, hepatocellular carcinomas) have a proportionally larger arterial hepatic blood supply, so they are usually diagnosed on arterial hepatic phase images⁶.

Liver is a vital organ and serves foremost purpose of detoxification, digestion and has dual vascular supply by hepatic artery (30%) and portal vein (70%)⁷. From hepatic artery, most of the primary and metastatic liver tumors, obtain their vascular supply therefore change the usual quantity of liver vascular supply⁸. These differences in design of vascular supply formulas the foundation of liver triple phase scan. This technique has facilitated to explicate the radiological topographies of primary and secondary hepatic tumors⁹.

In Europe and United States, metastatic deposit is more likely to represent a focal liver lesion as compared to primary liver tumor; conversely, in Pakistan, the fourth most common liver disease is HCC with 8-10% prevalence. When compared to western data, this frequency rate is high. As compared to primary hepatic malignancies, liver metastases are 18-40 times more common¹⁰. Among benign growths, haemangioma is the most frequent hepatic lesion¹¹. Characterization of these lesions is essential, for the reason that of the extraordinary prevalence rate of non-malignant hepatic lesions for example haemangiomas, cysts and focal nodular hyperplasia¹². With various imaging modalities, it is frequently problematic to describe liver disorders but histopathology is always not an option as it an expensive and invasive tool. Although, it is the gold standard technique¹³. So, triphasic computed tomography scan is safe, cost effective, non-invasive tool for detection of hepatic lesions.

Received on 13-04-2019

Accepted on 17-07-2019

METHODOLOGY

It is a Cross-sectional, Descriptive study regarding triphasic computed tomographic differential diagnosis of liver lesions among patients. The study was carried out at Radiology department of Lahore General Hospital, Lahore, Pakistan on a sample of 122 patients over a period of 06 months, from March 2018 to August 2018. Convenient Sampling technique was used. Both male and female patients of adult age groups with suspicion of hepatic lesion on clinical, laboratory or ultrasonographic findings were scanned and their demographic data was collected and analyzed with SPSS version 24 to determine the various morphological types of liver lesions in relation to age and sex. Triphasic computed tomography was done with 128 slicer Toshiba CT scanner to scan the patients.

RESULTS

Among 122 patients, the mean age and standard deviation was 56±13.24 years and there were 38 (31.1%) patients in age range of 51-60 years being the most common. Majority of the patients were males 69(56.6%) and 53(43.4%) were females with M:F of 1.3:1. Most belonging to lower middle class 54(44.3%).

In our study, jaundice was the most common clinical presentation observed in 104(85.24%) patients, history of pain in right hypochondrium was present in 88(72.13%) patients, fever in 64(52.45%), decreased appetite in 68(55.73%), weight loss in 82(67.21%), hematemesis in 6(4.91%) and malena in 13(10.65%) patients. Hepatitis B and C virus were detected in serum of 21(17.21%) and 71(58.19%) patients respectively.

In our study malignant liver lesions were more common, found in 94(77%) patients and non-malignant liver lesions were found in 28(23%) patients. Among malignant lesions, multifocal HCC was the most common lesion, present in 47(50%) patients, solitary HCC in 33(35.10%) patients, metastasis in 12(12.70%) patients and fibrolamellar carcinoma in 2(2.12%) patients. Among non-malignant lesions, hemangioma and hepatic abscess were the most common lesion present in 8(28.57%) patients each, hepatic cyst in 7(25%) patients, hydatid cyst in 1(3.57%) and regenerative nodule in 4(14.29%) patients.

Out of 122 cases, there were 68(55.7%) cases with multiple lesions and 54(44.3%) cases with single lesion. Margins of liver were irregular in 78(63.9%) patients and regular in 44(36.1%) patients. Portal vein was involved in 28(23%) patient and hepatic duct in 3(2.5%) patients. Biliary channels involvement was seen in 6 (4.9%) patients. Necrosis of liver lesions was noticed in 50(41%) patients. Splenomegaly, ascites, lymphadenopathy and varices were seen in 61(50.0%), 46(37.7%), 25(20.5%) and 58(47.5%) patients with liver lesions, respectively.

Patterns of enhancement in arterial, portal and equilibrium phase were different in both benign and malignant hepatic lesions. Four patterns were observed in HCC. Patterns are based on lesion enhancement in arterial phase, portal phase and equilibrium phase respectively. Pattern 1(heterogenous, washout, hypodense) was the most common, seen in HCC 21(63.6%) and multifocal HCC 35(74.5%) cases. Pattern 2 (heterogenous, washout, isodense) was present in HCC 4(12.1%) and multifocal

HCC 9(19.1%) cases. Pattern 6 (homogenous, washout, hypodense) observed in HCC 6(18.2%) and multifocal HCC 2(4.3%) cases. Pattern 11 (homogenous, washout, isodense) was present in only HCC 2(6.1%) and multifocal HCC 1(2.1%) case. Metastatic lesions showed 4 patterns. Pattern 5 (absent, hypodense, hypodense) was observed in 5(41.7%) cases, pattern 10(peripheral, hypodense, hypodense) also in 5(41.7%) cases. Pattern 7 (homogenous, isodense, isodense) was observed in 1(8.3%) case and pattern 12(peripheral, isodense, isodense) also in 1(8.3%) case of metastatic hepatic lesion. Both cases of fibrolamellar carcinoma 2(100%) showed pattern 9(lamellar, hyperdense, isodense with central hypodense scar in all three phases).

All hemangioma 8(100%) lesions presented with pattern 4(peripheral nodular, central fill in, complete fill in). In hepatic abscess, pattern 3(peripheral, ring enhancement, hypodense) was observed in 6 (75.0%) and pattern 5 (absent, hypodense, hypodense) in 1(12.5%) lesion. In hepatic cyst and hydatid cyst, pattern 5 (absent, hypodense, hypodense) was present in all 7(100%) cases and 1(100%) case respectively. Regenerative nodule showed two patterns. Pattern 7(homogenous, isodense, isodense) in 2(50%) and pattern 8(subtle enhancement, isodense, isodense) also in 2(50%) cases.

Table: Frequency of malignant and benign lesions

Malignant lesions	Frequency	%age
HCC	33	35.1
Multifocal HCC	47	50.0
Metastasis	12	12.7
Fibrolamellar carcinomas	2	2.12
Benign lesions		
Hemangioma	8	28.57
Hepatic abscess	8	28.57
Hepatic cyst	7	25
Hydatid cyst	1	3.57
Regenerative nodule	4	14.29

Graph: Percentage of Gender

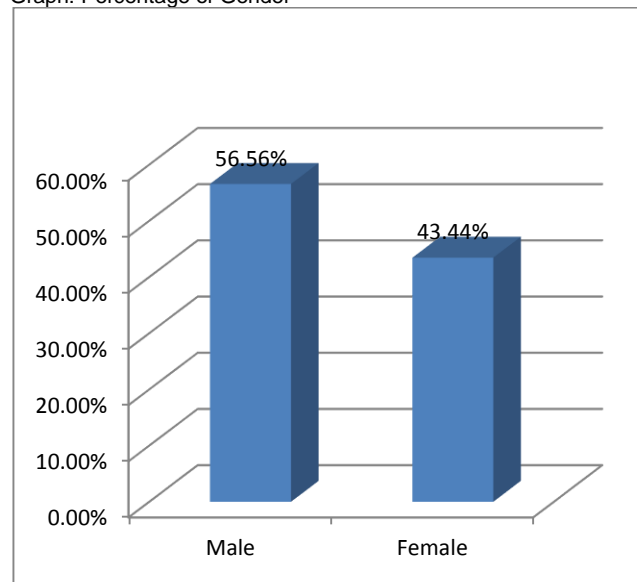


Image 1: Multifocal HCC in 55 year old male

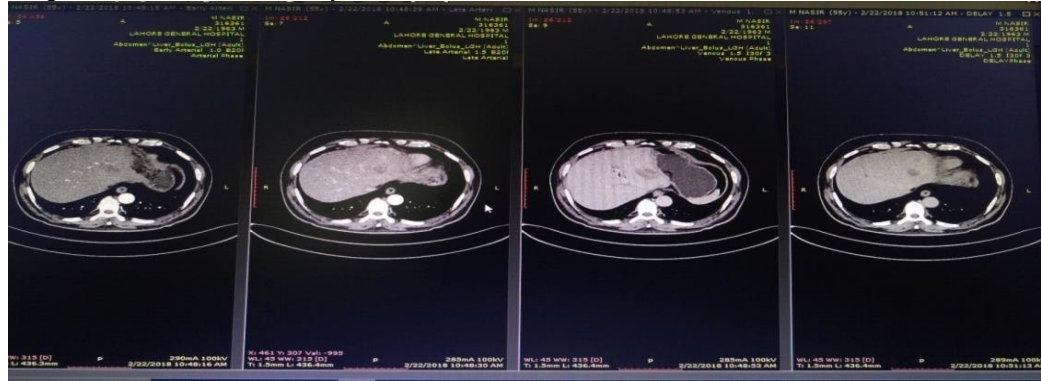


Image 2: Hemangioma in 50 year old female

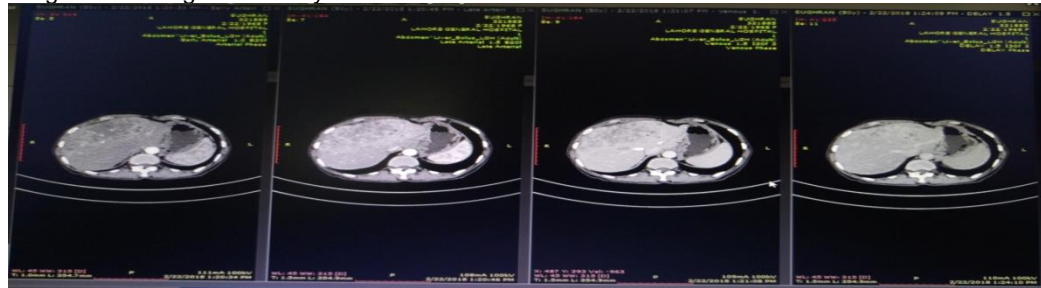


Image 3: Liver metastasis from sigmoid colon mass in 75 year old female.



DISCUSSION

The objective of this study was to determine the malignant and non-malignant liver lesions with triphasic computed tomography and to differentiate common liver lesions among the patients visiting Radiology department of Lahore General Hospital, Pakistan, belonging to different age groups. In my study, the mean age and standard deviation was 56 ± 13.24 years. In a study conducted by Gupta K et al in India, the mean age was 43.8 years¹⁴ while in a study by Hafeez S et al, 46.5 ± 13.4 years were the mean \pm SD for age¹⁵. In my study highest frequency was witnessed in the 51-60 years age group i.e. 31.1% followed by age group 41-50 i.e. 13.9%. In a study by Ahirwar CP et al, population comprises of cases with age ranging from 1 year to 79 years. Most patients were in 41-50 years age group (29.50%) followed by 51-60 years of age group (18.85%)¹⁶. In a study by Gupta K et al, the highest

number of patients were in the age group of 41 to 50 years (31%)¹⁴.

Majority of patients were males 69 (56.6%) and 53 (43.4%) were females in this study with M: F of 1.3:1. These results are similar with a study by Gupta K et al, in which 41 cases (41%) were females and 59 cases (59%) were males¹⁴ and a study by Ahirwar CP et al, in which 54% of cases were males and 46% females¹⁶. Thus, there is male predominance for liver lesions cases.

In my study, jaundice was present in 104 (85.24%) patients, history of pain in right hypochondrium was present in 88(72.13%) patients, fever in 64(52.45%), decreased appetite in 68(55.73%), weight loss in 82(67.21%), hematemesis in 6(4.91%) and malena in 13(10.65%) patients. In a study by Hafeez S et al, jaundice (32%) was the most common clinical presentation trailed by fever (15%) and pain (23%).¹⁵ In a study by Gupta K et al, the presenting complains were abdominal pain (63%), loss of

appetite (41%), progressive abdominal distension (22%), fever (32%), weight loss (39%), jaundice (17%), and gastrointestinal signs in 8% of cases for instance anorexia, nausea and constipation perceived¹⁴.

Hepatitis B and C virus were detected in serum of 21(17.21%) and 71(58.19%) patients, respectively. In a study by Yusuf S et al, 35 patients were hepatitis C positive⁵.

In our study malignant liver lesions were more common, found in 94(77%) patients and non-malignant liver lesions were found in 28(23%) patients. These findings are similar to study of Hafeez S et al, Yusuf S et al, Ahirwar CP et al where malignant lesions were more common^{15,5,16}.

Among malignant lesions, multifocal HCC was the most common lesion, present in 47(50%) patients, solitary HCC in 33(35.10%) patients, metastasis in 12(12.70%) patients and fibrolamellar carcinoma in 2(2.12%) patients.

Among non-malignant lesions, hemangioma and hepatic abscess were the most common lesion present in 8(28.57%) patients each, hepatic cyst in 7(25%) patients, hydatid cyst in 1(3.57%) and regenerative nodule in 4(14.29%) patients.

In another study by Gupta K et al, liver metastases (72.22%) were the most common malignant liver lesions and primary hepatic malignancies were rest of cases. These included 3 cases (8.33%) of cholangiocarcinoma, 5 cases (13.88%) of HCC as well as one case each of hepatoblastoma (2.77%) and fibrolamellar carcinoma (2.77%). Among non-malignant lesions, amebic liver abscess (20.31%), pyogenic liver abscess (31.25%), hydatid cysts (12.5%), hemangiomas (17.18%), and simple hepatic cyst (18.75%), were found in decreasing direction of incidence¹⁴.

In a study conducted by Hafeez S et al, non-malignant pathologies comprised focal nodular hyperplasia (n=4), hemangioma (n=3) and adenoma (n=4). Cancerous pathologies were metastasis (n=51) as well as hepatoma (n=74)¹⁵.

Yusuf S et al in his study concluded that HCC is the most common malignant lesion present in 26 patients, metastasis in 5 patients and gall bladder carcinoma in 2 patients while hemangioma is the most common benign lesion present in 13 patients, hydatid cyst in 7, abscesses in another 7, calcified granuloma in 6, primary sclerosing cholangitis in 1 and simple hepatic cyst in 11 patients⁵.

In a study by Ahirwar CP et al, largest group was formed by liver metastases with total 36 cases. Second largest group was of hemangioma with total number of 23 cases. HCC in 13, cholangiocarcinoma in 9, adenoma in 6, FNH in 3 and abscess was present in a single case¹⁶.

Patterns of enhancement in arterial, portal and equilibrium phase were different in both benign and malignant hepatic lesions. Four patterns were observed in HCC. Heterogenous enhancement on arterial phase, contrast washout on portal phase and hypodense lesion on equilibrium phase (pattern 1) was the most common enhancement pattern, seen in HCC 21(63.6%) and multifocal HCC 35 (74.5%) cases. HCC 4(12.1%) and multifocal HCC 9(19.1%) cases had heterogenous enhancement on arterial phase, contrast washout on portal phase but isodense on equilibrium phase (pattern 2).

Homogenous enhancement on arterial phase, contrast washout on portal phase and hypodense lesion on equilibrium phase (pattern 6) observed in HCC 6(18.2%) and multifocal HCC 2(4.3%) cases. Homogenous enhancement, contrast washout and isodense lesion (pattern 11) was present in only HCC 2(6.1%) and multifocal HCC 1(2.1%) case.

In a study conducted by Ahirwar CP et al, all HCC lesions (100%) demonstrated early enhancement in arterial phase with fast washout of contrast in portal phase and become hypodense in equilibrium phase¹⁶.

Metastatic lesions showed 4 patterns. There was no enhancement in arterial phase and hypodense lesion on portal venous and equilibrium phase (pattern 5) observed in 5(41.7%) cases. There was just peripheral enhancement on arterial phase and hypodense lesion in both portal and equilibrium phase (pattern 10), also in 5(41.7%) metastatic cases. Homogenous enhancement, isodense, isodense lesion (pattern 7) in three phases respectively was observed in 1(8.3%) case and peripheral enhancement, isodense, isodense lesion (pattern 12) also in 1(8.3%) case of metastatic hepatic lesion. Both cases of fibrolamellar carcinoma 2(100%) showed lamellar enhancement in arterial phase, become hyperdense in portal phase and isodense in equilibrium phase with central hypodense scar in all three phases (pattern 9).

In a study by Gupta k et al, majority of the metastatic lesions were hypodense lesions, multiple, ill defined, scattered throughout the liver on CT scan. These metastatic foci were detected on portal phase. Some metastases (e.g., carcinoid, sarcoma, melanoma, pancreatic islet cell carcinoma, pheochromocytoma and choriocarcinoma) have a greater supply by hepatic artery and thus may be visualized only on arterial phase images. In their study, 7 metastatic cases were hypervascular and best detected on arterial phase instead of portal venous phase due to contrast uptake in that phase. They became isodense to surrounding normal hepatic parenchyma on portal and equilibrium phase¹⁴.

In Ahirwar CP et al study, metastatic lesion 12 cases (33.3%) showed arterial phase enhancement, among these 5 (41.67%) cases had peripheral continuous enhancement and in 7 cases (58.3%) there was complete enhancement. 18 cases (50%) enhanced in portal venous phase. All of the lesions were hypodense in equilibrium phase¹⁶.

All hemangioma 8(100.0%) lesions presented with peripheral, nodular enhancement in arterial phase, central fill in venous phase and complete fill in equilibrium phase (pattern 4)). In hepatic abscess, peripheral enhancement in arterial phase, ring enhancement in venous phase and hypodense lesion in equilibrium phase (pattern 3) was observed in 6 (75.0%) cases and 1(12.5%) case showed absent enhancement in arterial phase and hypodense lesion in portal and equilibrium phase (pattern 5). In all 7(100.0%) cases of hepatic cyst and 1(100%) case of hydatid cyst, there was no enhancement in arterial phase and hypodense lesion in portal and equilibrium phase (pattern 5). Regenerative nodule 2(50%) cases had homogenous enhancement in arterial phase and become isodense lesion in both portal and equilibrium phase (pattern 7). Subtle enhancement in arterial phase and

isodense lesion in both venous and equilibrium phase (pattern 8) was observed in other 2(50%) cases.

In a study by Ahriwar CP et al in 2016, all hemangiomas (100%) showed enhancement in arterial phase (18 lesions demonstrated early nodular, discontinuous, peripheral enhancement in 18 lesions and 6 cases showed flash filling) with progressive centripetal filling in portal and equilibrium phase on triphasic CT scan. These findings were in agreement with those of Bartollota et al¹⁷.

My study determined malignant and non-malignant liver lesions with triphasic computed tomography to conclude its diagnostic ability and to evaluate the triple phase CT features of hepatic lesions in characterization of these lesions with emphasis on the role of different phase imaging, so that staging and diagnosing of liver pathology patients could be achieved and managed effectively. Characterization and detection can aid to triage lesions, which indicate palliative treatment and which hepatic tumors may be amenable to aggressive surgical techniques.

CONCLUSION

This study concluded that triphasic CT is a good, safe, non-invasive tool for studying the liver lesions because of its cost effectiveness, ease and availability. It has ability to detect and differentiate lesions, size and site of lesions, extent of disease, complications and any other associated findings. In Pakistan, where accessibility and cost are the prime factors in deciding the diagnostic tool, triphasic CT scan has promising prospects.

REFERENCES

- Selzner M, Hany TF, Wildbrett P, McCormack L, Kadry Z, Clavien P-A. Does the novel PET/CT imaging modality impact on the treatment of patients with metastatic colorectal cancer of the liver? *Annals of surgery*. 2004; 240(6):1027.
- Mortelé KJ, Ros PR. Cystic focal liver lesions in the adult: differential CT and MR imaging features. *Radiographics*. 2001; 21(4):895-910.
- Bipat S, van Leeuwen MS, Comans EF, Pijl ME, Bossuyt PM, Zwinderman AH, et al. Colorectal liver metastases: CT, MR imaging, and PET for diagnosis—meta-analysis. *Radiology*. 2005; 237(1):123-31.
- Mitchell DG, Bruix J, Sherman M, Sirlin CB. LI-RADS (Liver Imaging Reporting and Data System): Summary, discussion, and consensus of the LI-RADS Management Working Group and future directions. *Hepatology*. 2015; 61(3):1056-65.
- Yusuf S, Kashmir SB, Mehmood RA. Frequencies of different benign and malignant focal hepatic lesions on Triphasic CT scanning in patients referred with suspicion of Hepatocellular carcinoma. *Rawal Medical Journal*. 2016; 41(1):39-42.
- Bevilacqua V, Brunetti A, Trotta GF, Dimauro G, Elez K, Alberotanza V, et al., editors. A novel approach for hepatocellular Carcinoma detection and classification based on triphasic CT Protocol. *Evolutionary Computation (CEC), 2017 IEEE Congress on; 2017: IEEE*.
- Kaufmann S, Horger T, Oelker A, Kloth C, Nikolaou K, Schulze M, et al. Characterization of hepatocellular carcinoma (HCC) lesions using a novel CT-based volume perfusion (VPCT) technique. *European journal of radiology*. 2015; 84(6):1029-35.
- Hoogi A, Lambert JW, Zheng Y, Comaniciu D, Rubin DL. A fully-automated pipeline for detection and segmentation of liver lesions and pathological lymph nodes. *ARXIV:170306418*. 2017.
- Kalender W. New Developments in computed tomography technology and their impact on patient protection. *Radiation protection in medicine: Setting the Scene for the Next Decade*. 2015:199.
- Parikh T, Drew SJ, Lee VS, Wong S, Hecht EM, Babb JS, et al. Focal liver lesion detection and characterization with diffusion-weighted MR imaging: comparison with standard breath-hold T2-weighted imaging. *Radiology*. 2008; 246(3):812-22.
- Semelka RC, Worawattanakul S, Kelekis NL, John G, Woosley JT, Graham M, et al. Liver lesion detection, characterization, and effect on patient management: Comparison of single-phase spiral CT and current MR techniques. *Journal of Magnetic Resonance Imaging*. 1997; 7(6):1040-7.
- Konopke R, Bunk A, Kersting S. The role of contrast-enhanced ultrasound for focal liver lesion detection: an overview. *Ultrasound in Medicine and Biology*. 2007; 33(10):1515-26.
- Namimoto T, Yamashita Y, Sumi S, Tang Y, Takahashi M. Focal liver masses: characterization with diffusion-weighted echo-planar MR imaging. *Radiology*. 1997; 204(3):739-44.
- Gupta K, Gauba N, Gupta G. Role of computed tomography in evaluation of parenchymal focal lesions of liver. *JEMD*. 2015; 4(36):6257-68.
- Hafeez S, Alam MS, Sajjad Z, Khan ZA, Akhter W, Mubarak F. Triphasic computed tomography (CT) scan in focal tumoral liver lesions. *Journal of the Pakistan Medical Association*. 2011; 61(6):571
- Ahirwar CP, Patil A, Soni N. Role of triple phase computed tomography findings for evaluation of hepatic lesions. *International Journal of Research in Medical Sciences*. 2016; 4(8):3576-83.
- Bartolotta TV, Midiri M, Galia M. Characterization of benign hepatic tumors arising in fatty liver with SonoVue and pulse inversion US. *Abdom-Imaging*. 2007;32(1):84-91.