International Journal
of
Radiology and Diagnostic Imaging

E-ISSN: 2664-4444
P-ISSN: 2664-4436
IJRDI 2018; 1(2): 35-38
www.radiologypaper.com
Received: 18-06-2018
Accepted: 25-07-2018

Dr. Pankaj Sarmah
Assistant Professor,
Department of Radiodiagnosis,
ICARE Institute of Medical Sciences, Haldia, West Bengal, India

Correspondence
Dr. Pankaj Sarmah
Assistant Professor,
Department of Radiodiagnosis,
ICARE Institute of Medical Sciences, Haldia, West Bengal, India

The assessment of hepatic deposits in intra-abdominal malignancies using intraoperative ultrasound

Dr. Pankaj Sarmah

DOI: https://doi.org/10.33545/26644436.2018.v1.i2a.368

Abstract
Aim: The purpose of this research was to assess the accuracy, sensitivity and specificity of intraoperative ultrasound (IOUS) in detecting hepatic deposits in intra-abdominal malignancies.
Materials and Methods: Forty patients who were admitted to the Gastrointestinal Surgery Unit with intra-abdominal malignancies and for whom elective open surgical intervention was recommended participated in this study.
Results: Out of the total of 40 patients enrolled in this research, 18 (45%) were female and 22 (55%) were male. The age at admission varied between 39 and 75 years, with a mean of 57.00±9.12 years.
IOUS identified hepatic lesions in eight (20%) of the patients included, including six (15%) cases that had been detected prior to surgery.
Conclusion: This research has demonstrated that IOUS detects lesions more effectively than other noninvasive preoperative imaging modalities, which has a substantial bearing on the modification of the intended surgical approach.

Keywords: Intraoperative ultrasound (IOUS), hepatic deposits, intra-abdominal malignancies

Introduction
Metastatic disease most frequently affects the liver, constituting approximately 25% of all reported cases. In the majority of gastrointestinal malignancies, metastasized liver disease is prevalent; patient prognosis is highly dependent on the management of this condition, which necessitates precise localization of hepatic deposits [3].
Although the predominant type of metastatic tumor is adenocarcinoma, primary hepatocellular or biliary tumors are less conspicuous in nature than metastatic hepatic tumors. Squamous cell carcinoma, neuroendocrine carcinoma, lymphoma, sarcoma, and melanoma are among the considerably less frequent subtypes. Around 70% to 80% of instances involving metastasis are confined to the hepatic region. Metastatic liver disease originating from the gastrointestinal tract was observed in individuals aged 70 and above [4, 5]. Carcinomas comprised 92% of the metastatic hepatic lesions. Adenocarcinomas comprised 75% of the carcinoma lesions observed. In general, males had a higher incidence of histologically confirmed hepatic metastases than females, and the majority of patients were over the age of 50 [6]. Both the portal vein and the hepatic artery provide blood to the liver. Venous drainage from the pancreas, spleen, and nearly the entirety of the gastrointestinal tract is gathered in the portal vein. This generally facilitates the hepatic metabolism of recently assimilated and digested nutrients via first-pass metabolism. It also signifies that the liver is susceptible to metastasis from a vast array of abdominal and extra-abdominal malignancies when malignancy is present. Patients afflicted with liver metastasis may present with an array of symptoms, contingent upon the site and extent of the disease. Fatigue, abdominal pain, ascites, and jaundice are some of these symptoms [7].
The efficacy of intraoperative ultrasound (IOUS) in detecting liver metastases has been demonstrated by the following values: sensitivity of 93.8%, specificity of 94.4%, positive predictive value of 92.0%, and negative predictive value of 95.7%. In light of recent developments in preoperative imaging, however, the function of IOUS has become controversial [8, 9]. Despite the growing prevalence of preoperative liver lesion detection, preoperative imaging studies remain inadequate in replacing the dynamic intraoperative localization provided by intraoperative ultrasound scanning (IOUS). This capability enables precise parenchymal transactions, thereby enhancing the safety of liver surgery and monitoring margin status. By facilitating adequate resection margins, IOUS not only aids the surgeon in comprehending the three-dimensional relationship between the tumor and hepatic

vasculature, but also enhances patient prognosis [10].
The objective of this research endeavor was to assess the utility of IOUS in the identification of hepatic deposits in intra-abdominal malignancies, placing particular emphasis on its precision, sensitivity and specificity.

Materials and Methods

- Forty consecutive patients admitted to the Gastrointestinal Surgery Unit with intra-abdominal malignancies for whom elective open surgical intervention was recommended participated in this study.
- The study exclusively enrolled patients who had undergone a dedicated preoperative imaging study within a maximum of one month prior to the commencement of surgery.
- All patients were duly informed about the procedure and provided with written informed consent prior to its execution, following approval from the local ethics committee.
- All patients who were enrolled in the study underwent comprehensive laboratory examinations, preoperative imaging studies (Including computed tomography (CT) scans), and any other necessary investigations (e.g., endoscopy) to thoroughly evaluate the primary tumor.
- Any inflammatory adhesions were removed via the extended right subcostal incision or the standard midline abdominal exploratory incision. A thorough examination and palpation of the liver's surface was conducted initially, followed by the implantation of an IOUS probe and subsequent liver examination to detect liver metastases in the absence of liver mobilization by a radiologist.
- A convex-array probe or a real-time B-mode electronic scanner system with color Doppler capabilities, Toshiba TA311 (Tokyo, Japan), or a T-shaped linear array probe operating at 7.5-10 MHz was utilized. A sequential scan of the liver was performed with overlapping fields extending from the caudal margin to the dome, traversing the entire organ from left to right.
- Subsequently, the left portal pedicles to segments I, II, III, and IV were identified, as were the right portal pedicles. The examination commenced with the identification of the hepatic veins, which were accomplished by positioning the probe on the anterior portion of segment IV with its inclination superiorly as they entered the inferior vena cava. The veins are distinguished by their nearly hyperechoic walls and the probe is guided along each vein until it reaches its peripheral tributary branches, which are utilized to ascertain the sectors and segments. The porta hepatis was subsequently assessed. After identifying a lesion, a comprehensive examination was conducted to ascertain its location, maximum size, characteristics, and shape, as well as its relationship to the intrahepatic vessels.

Results

Table 1: Distribution of patients

Patients		N	%
Gender	Male	22	55%
	Female	18	45%
Mean		57.00±9.12 years	

Out of the total of 40 patients enrolled in this research, 18 (45%) were female and 22 (55%) were male. The age at admission varied between 39 and 75 years, with a mean of 57.00±9.12 years.

Table 2: Distribution of patients according to surgery

Surgery	n	%
Hepatobiliary pancreatic tumors surgery	12	30%
Gastrointestinal tract tumors surgery	28	70%

This study included 12(30%) patients who underwent surgery for hepatobiliary pancreatic tumors and 28 (70%) for gastrointestinal tract tumors.

Table 3: Preoperative CT/MRI findings

Findings	N
Hepatic lesions	6 (15%)
Simple cyst	2 (5%)
Single mostly benign lesion	3 (7.5%)
Single mostly malignant lesion	2 (5%)

Four of the included patients (10%) underwent MRI in addition to the preoperative CT. There are six cases (15%) that exhibit hepatic lesions, two cases (5%) have uncomplicated cysts, three cases (7.5%) have a single predominantly benign lesion, and two cases (5%), have a single predominantly malignant lesion.
Preoperative imaging studies were undertaken on all cases included in this study within the month prior to the procedure in which IOUS was executed. In this study, the interval between preoperative imaging and surgery varied from 10 to 25 days, with a mean of 19.81±3.52 days and a median of 21 days.
IOUS identified hepatic lesions in eight (20%) of the patients included, including six (15%) cases that had been detected prior to surgery. IOUS confirmed the diagnosis of the two lesions that CT identified preoperatively as a benign hepatic lesion and an uncomplicated hepatic cyst. IOUS determined that both of the two lesions that necessitated additional evaluation by MRI prior to the procedure met the criteria for malignancy; thus, in one instance, the interpretation of preoperative imaging was contradicted.
The time required by operators to perform a comprehensive hepatic scan and characterize identified lesions using IOUS was documented. In the majority of cases (70 percent), the duration of the IOUS procedure did not surpass five minutes. The duration of comprehensive hepatic scanning varied between 3 and 9 minutes, with a mean of 6.00±1.38 minutes and a median of 5 minutes. This did not significantly impact the scheduled operative time.
Out of the forty cases included in this research, the implementation of IOUS altered the operative decision in five (12.5% of the patients included and 50% of the cases involving detected liver lesions). Hepatic metastasectomy was performed in two of those cases (five percent) where hepatic deposits were detected during a small intestinal carcinoid tumor excision. In the remaining three cases (7.5%), surgical limitations were achieved through the implementation of gastrojejunostomy in a case of stomach cancer (which was originally scheduled for distal gastrectomy) and pancreatic cancer (which was originally intended for Whipple's operation) due to the confirmed presence of hepatic deposits; both patients experienced gastric outlet obstruction to some degree.

Discussion

Historically, the adoption rate of IOUS for evaluating hepatic metastasis decreased between decades. However, the majority of published literature confirms that the impact of IOUS has plateaued over the past decade, notwithstanding further developments in preoperative imaging. It appears that modern preoperative imaging does not preclude the use of IOUS on its own, and that a combination of preoperative imaging and IOUS can provide the most effective results in detecting hepatic deposits, given the current rate of change in surgical strategy [11, 12].

The literature deems IOUS to be the imaging technique utilizing the greatest resolution when analyzing the liver. It enables an exceptionally accurate characterization of focal liver lesions, exceeding 90% in both sensitivity and specificity.13 As mentioned earlier, the objective of this research was to assess the diagnostic efficacy of IOUS in identifying malignant or benign hepatic lesions in patients with abdominal tumors, irrespective of the location of the primary tumor, and to determine whether this information would influence the intended surgical approach.

While all patients were administered preoperative CT scans, four patients (10%) underwent additional MRI. All patients underwent IOUS within a mean of 19.81±4.52 days (ranging from 10 to 25 days) since their previous preoperative imaging. This time interval closely aligns with the findings of Yang *et al.* [14], who observed that the effectiveness of preoperative CT in detecting colorectal liver metastasis decreased as the time between imaging and surgery increased. Their model predicted that a CT scan could not be performed more than 26 days prior to the procedure in order to obtain a sensitivity of greater than 90%. In addition, Wagnetz *et al.* [8] assert that studies conducted within six weeks of surgery can accurately assess the sensitivity of IOUS.

IOUS identified focal hepatic lesions in eight (20%) of the forty patients included in our study; these lesions were categorized as malignant in five (62.5%) patients and benign in three (37.5%) patients. The frequency of benign liver lesions reported by Damian *et al.* [16] was 43.8% of the lesions they identified, whereas Zacherl *et al.* [15] reported a frequency of 10-30% for benign liver lesions, which is comparable to the frequency of this study. According to Ciriembei *et al.* [17], new hepatic lesions were identified by IOUS in 22.91% of the cases. Additionally, Zacherl *et al.* [15] reported that in 29.5% of the cases, IOUS revealed treatment-relevant new information regarding hepatic metastases. According to Luck AJ *et al.* [18], the percentage of new hepatic lesions detected by IOUS ranges from 5% to 30% of the time, contingent on the lesion's type and dimensions, the complexity of preoperative investigations, and the lesion's dimensions.

Although preoperative imaging studies do improve the rate at which liver lesions are detected prior to surgery, they are unable to match the dynamic intraoperative mapping provided by IOUS. This mapping enables a precise transaction of parenchyma, which enhances the safety of liver surgery and provides information on the status of margins. By defining adequate resection margins, IOUS not only assists the surgeon in comprehending the three-dimensional relationship between the liver vasculature and tumor, but also enhances patient prognosis [19]. Upon examination of the data obtained in this research, and as previously illustrated, our study affirms that despite the decreased necessity for IOUS due to advancements in preoperative imaging, this method continues to provide exceptional precision in identifying and characterizing focal liver lesions. However, the research unequivocally established that intraoperative ultrasound scanning (IOUS) remains advisable, not only to validate the outcomes detected on preoperative imaging but also to furnish the surgeon with supplementary data that may influence the intraoperative approach.

The study is subject to several limitations, including the non-blindness of the radiologists and surgeons undertaking IOUS in our series to the results of the preoperative imaging modalities, the small number of patients included, and the absence of histopathological analysis of liver deposits.

Conclusion

This research has established that IOUS detects lesions more effectively than other non-invasive preoperative imaging modalities, which has a substantial bearing on the modification of the intended surgical approach.

References

1. Breitenstein S, Apestegui C, Petrowsky H, Clavien PA. State of the art‘ in liver resection and living donor liver transplantation: A worldwide survey of 100 liver centers. World J Surg. 2009;33:797-803.
2. Weiss L. Comments on hematogenous metastatic patterns in humans as revealed by autopsy. Clin. Exp. Metastasis. 1992;10(3):191-199.
3. De Ridder J, De Wilt JH, Simmer F, Overbeek L, Lemmens V, Nagtegaal I, *et al*. Incidence and origin of histologically confirmed liver metastases: An explorative case-study of 23, 154 patients. Oncotarget. 2016;7(34):55368-55376.
4. Hugen N, Van De Velde CJH, De Wilt JHW, Nagtegaal ID. Metastatic pattern in colorectal cancer is strongly influenced by histological subtype. Ann. Oncol. 2014 Mar;25(3):651-657.
5. Disibio G, French SW. Metastatic patterns of cancers: Results from a large autopsy study. Arch Pathol. Lab Med. 2008;132(6):931-939.
6. Wagnetz U, Atri M, Massey C, Wei AC, Metser U. Intraoperative ultrasound of the liver in primary and secondary hepatic malignancies: Comparison with preoperative 1.5-TMRI and 64-MDCT. Am. J Roentgenol. 2011;196:562-568.
7. Jrearz R, Hart R, Jayaraman S. Intraoperative ultrasonography and surgical strategy in hepatic resection: What difference does it make? Can J Surg. 2015;58:318-322.
8. Itabashi T, Sasaki A, Otsuka K, Kimura T, Nitta H, Wakabayashi G, *et al*. Potential value of sonazoid-enhanced intraoperative laparoscopic ultrasonography for liver assessment during laparoscopy-assisted colectomy. Surg. Today. 2014;44:696-701.
9. D’Hondt M, Vandenbroucke-Menu F, Preville-Ratelle S, Turcotte S, Chagnon M, Plasse M, *et al*. Is intra-operative ultrasound still useful for the detection of a hepatic tumour in the era of modern pre-operative imaging? HPB (Oxford). 2011;13:665-669.
10. Bhattacharjya S, Bhattacharjya T, Baber S, Tibballs JM, Watkinson AF, Davidson BR. Prospective study of contrast-enhanced computed tomography, computed tomography during arterioportography and magnetic

resonance imaging for staging colorectal liver metastases for liver resection. Br J Surg. 2004;91:1361-1369.
11. Reiner CS, Stolzmann P, Husmann L, Burger IA, Hullner MW, Schaefer NG, *et al*. Protocol requirements and diagnostic value of PET/MR imaging for liver metastasis detection. Eur. J Nucl. Med. Mol. Imaging. 2014;41:649-658.
12. Yang S, Hongjinda S, Hanna SS, Gallinger S, Wei AC, Kiss A, *et al*. Utility of preoperative imaging in evaluating colorectal liver metastases declines over time. HPB (Oxford). 2010;12:605-609.
13. Zacherl J, Scheuba C, Imhof M, Zacherl M, Langle F, Pokieser P, *et al*. Current value of intraoperative sonography during surgery for hepatic neoplasms. World J Surg. 2002;26:550-554.
14. Damian CD, Rednic N, Munteanu D, Cazacu M. The role of intraoperative ultrasound for the assessment of the focal liver lesions in patients with colorectal cancer. Med Ultrason. 2014;16:114-118.
15. Cirimbei S, Puscu C, Lucenco L, Bratucu E. The role of intraoperative ultrasound in establishing the surgical strategy regarding hepato-bilio-pancreatic pathology. Chirurgia (Bucur). 2013;108:643-651.
16. Luck AJ, Maddern GJ. Intraoperative abdominal ultrasonography. Br J Surg. 1999;86:5-16.
17. Leen E, Ceccotti P, Moug SJ, Glen P, MacQuarrie J, Angerson WJ, *et al*. Potential value of contrast-enhanced intraoperative ultrasonography during partial hepatectomy for metastases: An essential investigation before resection? Ann Surg. 2006;243:236-240.
18. Joo I. The role of intraoperative ultrasonography in the diagnosis and management of focal hepatic lesions. Ultrasonography. 2015;34:246-257.
19. Patel NA, Roh MS. Utility of intraoperative liver ultrasound. Surg. Clin. North Am. 2004;84:513-524.