Role of Color Doppler Flow Imaging in Focal Hepatic Lesions

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By

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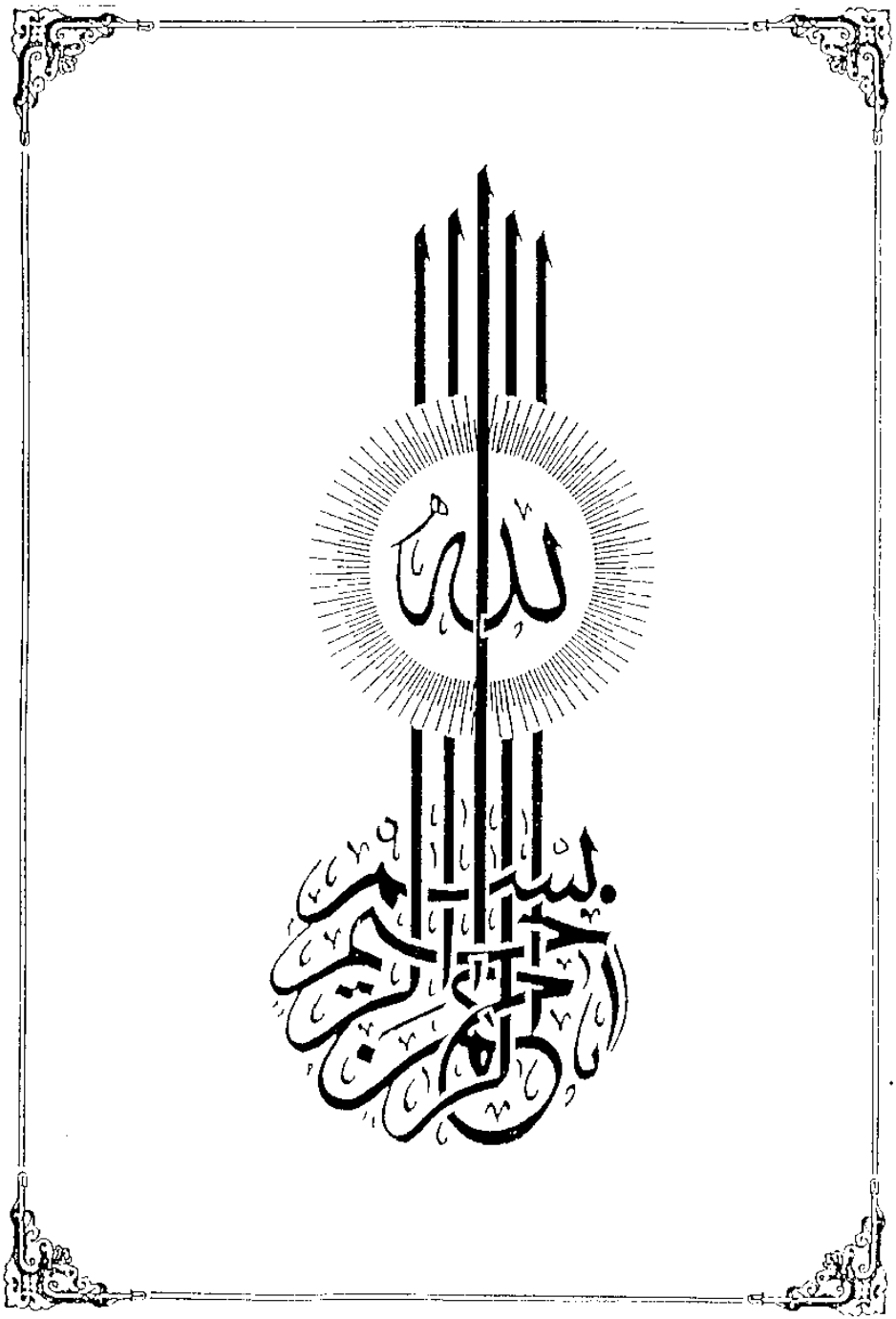

Contents

- Introduction and Aim of the Work 1
- Review of Literature
  - Anatomy 3
  - Pathology 27
  - Doppler physics 55
- Material and Methods 75
- Results 79
- Illustrative Cases 99
- Discussion 171
- Summary and Conclusion 183
- References 185
- Arabic Summary .....

List of Tables

Table No.	Details	Page No.
1	Hepatic fissures	14
2	Segmental anatomy of the liver	19
3	Final diagnosis of our cases	79
4	Clinical criteria, radiological imaging and result of biopsy of all groups.	80
5	Demonstration of sex distribution in different focal hepatic lesions	87
6	Demonstration of age distribution in the different focal hepatic lesion	88
7	Comparison between the diameter of the lesion in different groups	89
8	The velocity of range and the mean velocity ± S.D of the three groups	92
9	Compare the peripheral systolic velocity of the different focal hepatic lesions.	93
10	Comparison of velocity between malignant lesions (HCC and metastasis) and benign lesions as regard the cut off frequency 1.36 KHz.	94
11	Comparison of velocity between HCC and metastases as regard the cut off frequency 3KHz	95
12	Comparison of the mean peripheral velocity of HCC in the presence or absence of cirrhosis	96
13	Comparison of RI in the different focal hepatic lesions	97

List of Figures

Figure No.	*Details*	*Page No.*
1	Surface markings of the liver	4
2	Diaphragmatic surface of the liver	7
3	Visceral surface of the liver continuous with the posterior diaphragmatic surface to show hepatic lobes	9
4	Relations of visceral surface of the liver.	10
5	Segmental division of the liver.	17
6	Branches of hepatic artery and its relations	21
7	Intrahepatic distribution of the hepatic and portal veins	24
8	Hepatic adenoma	29
9	cavernous hemangioma of the liver.	34
10 A,B	Hepatocellular carcinoma	41,42
11 A,B	Fibrolamellar carcinoma	45,46
12	Multiple epithelioid hemangioendotheliomas	49
13	a. Multiple metastases flow a primary gastric carcinoma b. Intrasinusoidal growth of metastatic carcinoma of liver	51 52
14	The Doppler effect	57
15	Schematic representation of parabolic flow	60
16	Schematic representation of explanation of the systolic window formation.	60
17	Continuous and pulsed Doppler signals	62
18	Principle of pulsed Doppler	63

19	Color Doppler flow imaging of the liver showing color signals of the site of portal veins and hepatic vessels	66
20	Doppler indices	72
21	Case No. 1. a, b,c and d. Grade II moderately differentiated HCC.	100
22	Case No. 2. a, b and c. Grade III undifferentiated HCC.	103
23	Case No. 3. a, b, c and d. Grade I well differentiated HCC.	106
24	Case No. 4. a, b, c and d. Grade III undifferentiated HCC.	109
25	Case No. 5. a, b and c. Grade II moderately differentiated HCC.	113
26	Case No. 6. a, b and c. Grade I well differentiated HCC	116
27	Case No. 7. a, b and c. Grade III undifferentiated HCC	119
28	Case No. a, b and c. Hepatoplestema.	122
29	Case No. 9. a, b, c and d. Grade II moderately differentiated HCC.	126
30	Case No. 10. a, and b. Liver metastases from ductular adenocarcinoma of the breast	129
31	Case No. 11. a, b, c and d. Liver metastases from adenocarcinoma of the color.	132
32	Case No. 12. a, b, c and d. Liver metastases from adenocarcinoma of the color.	135
33	Case No. 13. a, b,c and d. Metastainoma of the liver of unknown origin.	138

34	Case No. 14. a and b. Liver metastases from adenocarcinoma of the stomach.	141
35	Case No. 15. a, b, c, d and e. Undifferentiated malignant tumour of the liver of unknown origin.	144
36	Case No. 16. a, b and c. Pyogenic abscess.	148
37	Case No. 17. a, b, c and d. Regenerating nodule.	151
38	Case No. 18. a, b and c. Fasciolocyst with worm inside.	154
39	Case No. 19. a, b, c, d, e and f. Haemangioma of the liver	157
40	Case No. 20. a, b and c. Focal nodular hyperplasia.	162
41	Case No. 21. a, b and c. Grade II well differentiated HCC of the liver by power Doppler.	165
42	Case No. 22. a,b,c,d,e and f. Pyogenic abscess by power Doppler	168

Abstract

This study was conducted on 94 patients (52 males and 42 females) with the aim of presenting the role of color Doppler flow imaging in differentiating heptocellular carcinomas from metastases and malignant from benign hepatic lesions.

The result of this work revealed that the mean peak systolic velocity of hepatocellular carcinomas (HCCs) was significantly higher than that of metastases and benign lesions and this high peak systolic velocity is unrelated to the age of the lesion, presence or absence of cirrhosis and the grade of malignancy.

Peripheral peak systolic velocity exceeding 3 KHz suggests a HCC with 100% specificity and 51.1% sensitivity. We also found that the mean peripheral peak systolic velocity of malignant lesions (weather primary a secondary) was significantly higher than that of benign lesions. Peripheral peak systolic velocity exceeding 1.36 KHz suggests a malignant rather than benign lesions with 100% specificity and 71% sensitivity. Overlap was found between HCCs and metastatic lesions.

We concluded that color Doppler flow imaging aids in distinguishing hepatomas from metastases and malignant from benign lesions with a high degree of specificity but relatively low sensitivity.

Introduction & Aim of the Work

Color Doppler ultrasound has benefits in evaluation of haemodynamic characteristics of abdominal tumors *(Shimamoto et al., 1987 and Itoh et al., 1990).*

If both the tumor image and blood flow image could be displayed on a single sonogram by using color Doppler flow imaging, it would be possible to obtain information that can be gained with both sonography and hepatic angiography *(Tanaka et al., 1990).*

The latest color Doppler equipments can display relatively slow blood flow *(Itoh et al., 1990).* This flow distribution within and around the tumor with analysis of Doppler spectral patterns are helpful in characterization of various tumors *(Shimamoto et al., 1992 and Reinheld et al., 1995).*

The differential diagnosis of focal hepatic lesions continues to present a diagnostic challenge despite recent advances in CT and MR imaging *(Bennett et al., 1990 and Lombardo et al., 1990).* Several studies have been published on the utility of duplex and color Doppler imaging in

characterization of hepatic lesions *(Shimamoto et al., 1987 and Taylor et al., 1987).*

Aim of the Work :

The aim of this work is to present the role of color Doppler flow imaging in the differentiation of various hepatic tumors and to determine the validity of this method in differentiating hepatocellular carcinomas from metastases and malignant from benign hepatic lesions.

Anatomy of the Liver

The liver (hepar), the largest gland, lies in the right upper part of the abdominal cavity, occupying most of the right hypochondrium, and epigastrium and extending into the left hypochondrium as far as the left lateral line *(Rouiller, 1964)*.

Borders : (Fig. 1)

Except in the epigastrium, the greater portion of the liver is surrounded by the thoracic cage. With the subject supine, the upper border of the superior surface of the liver lies anteriorly at the level of the fourth and fifth rib on the right and the sixth rib on the left *(Mould, 1972)*. Its superior outline is continued to the median line in the plane of the xiphisternal junction and ends on the left just below the apex of the heart (the left fifth intercostal space approximately 8 cm from the median line).

The inferior margin descends diagonally from that point leaving the diaphragm, passing the left costal margin at the junction of the costal cartilage of the eighth rib, that of the seventh and in the median line, is about midway between the xiphoid process and the umbilicus. The inferior border of the liver reaches the right costal margin at the tip of the ninth costal cartilage and then follows the costal margin downward and posteriorly *(Woodburne, 1978)*.

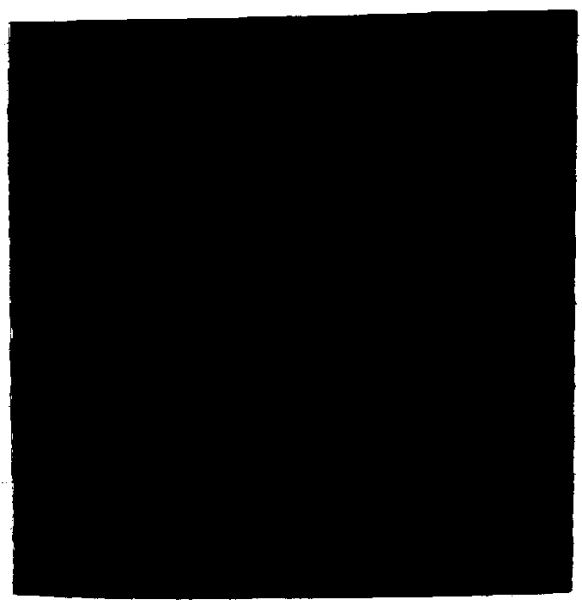

Fig. (1) :

Surface markings of the liver *(Quoted from Sherlock and Summerfield, 1980).*

Despite its weight, it is widely believed that like various other viscera, its position is not maintained by peritoneal or fibrous attachment, but mainly by intraabdominal pressure due to tonus in the abdominal muscles. The continuity of hepatic veins with the inferior vena cava may provide some support *(Williams et al., 1989)*.

At birth the liver is relatively large and occupies nearly two fifth of the abdomen. In infancy and childhood. The liver extends slightly below the costal margin. In thin subjects with narrow chests the liver lies mainly or entirely to the right of median plane. Its inferior margin slopes sharply downward and to the right and its lower right corner may reach the iliac crest. In plump subjects with broad chests, the liver extends much more to the left of the median plane and the slope of the inferior border is much less *(O'Rahilly, 1986)*.

Size :

In males it is generally weights 1.4 - 1.8 kg, and in females 1.2 - 1.4 kg with a range of 1.0 - 2.5 kg *(Williams et al., 1989)*.

The adult liver measures approximately 10 to 12.5 cm in its anteroposterior dimension, 20 to 22.5 cm in its transverse diameter and 15 to 17.5 cm vertically, near its lateral or right surface *(Steinberg and Bernardino, 1987)*.

Hepatic Surfaces

Diaphragmatic surface (Fig. 2) :

The superior surface includes parts of the right and left lobes. It fits closely under the diaphragm, separated from it by peritoneum except for a small triangular area where the two layers of falciform ligament diverge. It is related to the right diaphragmatic pleura and right pulmonary base, to the pericardium and ventricular part of the heart and to part of the left diaphragmatic pleura and left pulmonary base. The superior surface curves directly into the so called anterior and the peritonialised part of the posterior surface of the right lobe. No definable border separates superior, anterior, right lateral and right posterior aspects of the liver and it would be more appropriate to group these as diaphragmatic surfaces mostly separated from the visceral surface by narrow edge or border *(Williams et al., 1989).*

The most notable features on the diaphragmatic surface are the inferior vena cava, (IVC) and the peritoneal ligaments that connect the liver to the diaphragm, the falciform ligaments, left and right coronary and triangular ligaments. The inferior vena cava is embedded in the liver in a deep sulcus which is roofed over in most cases by fibrous tissue, called the ligament of the inferior vena cava, which may contain hepatic tissue converting the sulcus into a tunnel *(Hollinshead and Rosse, 1985).*