# ULTRASOUND AND COLOR DOPPLER CHARACTERISTICS OF HEPATO-CELLULAR CARCINOMA (HCC) IN RELATION TO SERUM LEVEL OF ALPHA FETOPROTEIN (AFP)

**Thesis**

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# ABSTRACT

**Introduction:** Hepatocellular carcinoma is the 5th most common tumor and the most common primary liver tumor. In Egypt HCC is usually associated with liver cirrhosis and chronic viral hepatitis (HBV & HCV).Alpha Feto Protein (AFP) is glycoprotein. Serum level of AFP rises in primary malignant tumors of the liver and in some liver conditions as liver cirrhosis and hepatitis .

**Aim of the work:** The aim of the work is to detect if there is a realation between the malignant tumor of the liver (HCC ) studied by Ultrasound and Color Doppler to serum level of AlphaFeto-protein (AFP).

**Subjects and methods;** The study was done on 30 patients, using Ultrasound, Color Doppler, Power doppler, Fine needle Aspiration Cytology (FNAC) and Serum level of Alpha Feto-protein (AFP).

**Results:** Hepatocellular carcinoma (HCC), is a hypervascular tumor .It was studied by Ultrasound and Color Doppler, where it had a peripheral and central vasculature , there is high flow (portal ) at the periphery and low flow ( arterial ) at the center of the lesion.. There was no relation between (HCC) and and serum level of AFP.

**Conclusion:** Ultrasonography is an excellent non invasive , inexpensive and reproducible tool in predicting the nature of hepatic nodules, the presence of a halo on grey scale US, the presence of vascular supply that is mainly arterial or mixed on CDUS and Power DUS are all useful to distinguish between true HCC and malignant dysplastic nodules.



**Key words:**- {Hepatocellular carcinoma ( HCC) , Ultrasound and Color Doppler, Alpha Fetoprotein (AFP) , Fine Needle Aspiration Cytology (FNAC)}

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# *List of Abbreviations*

**AFP : Alfa fetoprotein**

**ANA : Anti nuclear Antibody.**

**ANOVA : Analysis Of Variance .**

**BT : Bleeding Time.**

**CA : Celiac Axis**

**CD : Color Doppler.**

**CDUS : Color Doppler Ultra-Sound .**

**CEA : Carcino-Emberyonic Antigen.**

**CLD : Chronic Liver Disease .**

**CT : Computed Tomography.**

**DNA : Deoxy nucleic acid.**

**FNAC : Fine Needle Aspiration Cytology .**

**HA : Hepatic Artery.**

**IGF-II : Insulin-like Growth Factor-II .**

**HBV : Hepatitis B Virus.**

**HCC : Hepatocellular Carcinoma.**

**HCV : Hepatitis C Virus.**

**HIV : Human Immunodeficiency Virus .**

**IFN : Interferon**

**IOUS : Intra-operative Ultra-Sound .**

**IVC : Inferior Vena Cava .**

**LGA ; Left Gastric Artery.**

**LHA : Left Hepatic Artery.**

**LOH : Loss of Heterogenesity.**

**MA : Mainly Arterial .**

**MHA : Middle Hepatic Artery.**

**MRI: Magnetic Resonance Image :**

**NCI : National Cancer Institute .**

**NFK : Nuclear Factor Kappa.**

**OLT : Orthotropic Liver Transplantation.**

**PPAR : Peroxime Proliferators Activated Receptor.**

**PDUS : Pulsed Doppler Ultra-Sound .**

**PEI : Percutaneous Ethanol Injection .**

**PI : Pulsatility Index .**

**PRF ; Pulsed Repetition Frequency .**

**PTLD: Post Transplant Lymphoproliferative Disorders**

**PTT : Partial Thromboplastine Time .**

**PV : Portal Vein .**

**RFA : Radio Frequency Ablation .**

**RHA : Right Hepatic Artery.**

**RNA : Riboxynucleic acid .**

**SD : Standered Deviation .**

**SMA : Superior Mesenteric Artery.**

**STAT -3 :Signal transducer and activator of Transcription-3**

**TAE : Trans-Arterial Embolization.**

**TAFs : Tumor Angiogenetic Factors.**

**US : Ultrasound .**

**USA : United States of America .**

**WHO : World Health Organization .**

# ANATOMY OF THE LIVER

The liver is the largest gland of the body, its Weight is about 1.5Kg, lies in the upper abdomen, predominantly on the right side . It has an overall wedge shape, tapering from right to left with domed upper surface that fits under the copula of the right diaphragm ***(Gelfand DW.,1980) .***

Inferiorly the under surface of the liver is concave and slopes downword to form a sharp border. The liver measures 17 to 18cm in its craniocaudal measurement considerable individual variation in the normal size and shape ***(Bismuth., 1988) .***

The right lobe of the liver is larger than the left one . Its superior and right margins are convex, whereas its inferior extent assumes a more anterior position being indented posteriorly by the content of the right renal fossa. Reidl's lobe is an infrequently caudal extension of the right lobe.The left lobe is inconsistent in size and shape, extends across the midline to a varying degree ***(Giovannelli and Friedman,1987) .***

The superior surface of the liver is relatively featurless but, by contrast , the visceral surface is complex because it contains the liver hilum (the porta hepatis) and also it is indented by shallow fossae that accommodate the organs that are indirect contact with the liver ***(Gelfand DW,1980) .***

Most surfaces of the liver are coverd by peritoneal reflections (Figure 1 & 2) with exceptions of the gall bladder , inferior vena cava (IVC), the bare area of the liver where the liver comes indirect contact with the diaphragm ***(Giovennelli and Friedman ,1987).***

## Diaphragmatic surface of the liver:

It is coverd with peritonium ,which peels off in places to join the diaphragm. the anterior surface is triangular and related to the diaphragm and plura, to ribs and costal cartilages 6-10 on the right and to the costal cartilages 6&7 to the left . Part of the liver lies behind the subcostal angle & covered by the anterior abdominal wall of the epigastrium. Over this surface, the falciform ligament is attached from the center down to the ligamentum teres in the lower border to the left of the fundus of the gall bladder.

The upper part of attachement of the falciform ligament sweeps to the left along the upper surface of the liver as the left triangular ligament . The right part of the ligament sweeps to the right over the right dome to become the upper layer of the coronary ligament The superior surface with its central cardiac impression lies against the diaphragm with above it the pericardium and the heart centrally and the pleura and lung on each side **. (*Couinaud,1957).***

## Visceral surface of the liver:

When viewing the liver from behind ,the visceral and posterior surface can be more described . Their main feature is an H-shaped pattern of structures. The crosspiece of the H is represented by the porta hepatis & the hilum of the liver . The right limb which is incomplete is made by the inferior vena cava (IVC) on the posterior surface and the gall bladder on the inferior surface both are separated from the caudate process, while the left limb is made by the continuation of the grooves of the ligamentum venosum and ligamentum terers . To the right of the inferior vena cava is the triangular bare area of the right lobe with the veva cava at the base of the triangle and the sides are formed by the upper and lower layers of the coronary ligament. The vena cava is to the right side of the caudate lobe, to the left of the caudat lobe is the groove for ligamentum venosum (the left limb of the H),which passes around the caudat lobe to meet the vena cava .

More towards the left the posterior surface tapers to the esophagus, upper part of the stomach and the tuber omentale of the pancreas. The porta hepatis is a transverse slit perforated by the right and left hepatic duct and right and left branches of the hepatic artery and portal vein ***(Michels,1996)*** **.** From the right end of the porta hepatis the gall bladder lies in a shallow fossa . From the left end extends the groove for ligamentum teres. In between these two structures, is the quadrate lobe.

## Relations of the liver :

Beneath the right lobe of the liver, from anterior to posterior , lies the hepatic flexure of the colon and the right kidney. Medial to these structures, lies the gall bladder anteriorly and the duodenum posterirly.The lesser curvature and the anterior wall of the stomach lies adjacent to the inferior surface of the left lobe of the liver.The superior surface of the liver lies below the right lung and posterior to the anterior abdominal wall. The left lobe lies partially below the heart and left lung ***(Williams and Warwick,1980).***

## Hepatic lobar and Segmental anatomy of the liver:

The outer surface of the liver does not have adequate and anatomical landmarks to divide the liver into lobes or segments, except the falciform ligament and the fissures at its inferior surface. These landmarks do not describe internal organization of the blood vessels and bile ducts to allow clinical application particularly for liver resection ***(Chusilp Charnasangavej,1998 ).***

An understanding of the segmental anatomy of the liver is critical for localization and management of hepatic neoplasms.The system proposed by Goldsmith and Woodbourne does not provide a level of detail adequate for the surgical planning subsegmental hepatic resection.That proposed by Couinaud (Fig.3 ) and later modified by Bismuth (Fig .4 )

provide the surgically relevant imaging techniques and is easily applicable to sectional imaging techniques. ***(Jay Heiken,1998 ).***

The system of Goldsmith and Woodburne is the most basic and divides the liver into right and left lobes, with each lobe having two segments. The right lobe consists of anterior and posterior segments whereas the left consists of medial and lateral segments. The right and left lobes are divided by a vertical plane passing from the gall bladder fossa inferiorly to the middle hepatic vein superiorly. The plane is oriented obliquely from the fundus of the gall bladder anteriorly to the IVC posteriorly. The anterior and posterior segments of the right lobe are divided by a vertical plane through the right hepatic vein. The medial and lateral segments of the left lobe are divided by a vertical plane through the fissure for ligamentum teres inferiorly and the left hepatic vein superiorly. The main hepatic veins run between hepatic segments, and vertical planes drawn through the main hepatic veins divide the major hepatic segments. An important small, additional segment of the liver is the caudate lobe, which is a finger like extension from the upper posterior part of the right lobe. It derives its arterial supply from both right and left hepatic arteries and its venous blood supply directly into IVC**. *(Goldsmith and Woodburne, 1957)***

Because of new surgical techniques allowing for subsegmentectomy, it was important to distinguish the hepatic subdivisions for more precise lesion localization. In the