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Role of Triphasic Computed Tomography for Detection of Hepatitis C Virus Consequences: Review Article

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ABSTRACT

Background: Chronic hepatitis-C, a necroinflammatory disease of the liver that leads to liver cirrhosis in roughly 20% to 30% of patients, is caused by hepatitis C virus (HCV) infection. Liver cancer occurs at an average of 3.5 percent every year when cirrhosis has been formed in the liver. Nowadays, computed tomography (CT) scan is considered as a promising screening tools. Triphasic CT often shows enhanced contrast enhancement of the focal lesion during the arterial phase of the test (wash-in) and contrast wash-out during the portal/venous and late equilibrium phases for hepatocellular carcinoma (HCC) radiology.

Objective: To assess possible role of triphasic computed tomography for detection of hepatitis C virus consequences.

Methods: PubMed, Google scholar and Science direct were searched using the following keywords: Triphasic Computed Tomography, Hepatitis C virus and Hepatocellular Carcinoma. The authors also screened references from the relevant literature, including all the identified studies and reviews, only the most recent or complete study between January 2003 and February 2021 was included. Documents in a language apart from English have been excluded as sources for interpretation was not found. Papers apart from main scientific studies had been excluded: documents unavailable as total written text, conversation, conference abstract papers and dissertations.

Conclusion: Using of triphasic CT has been considered as a golden diagnostic imaging technique to detect the incidence of hepatocellular carcinoma as well as its possible complications.

Keywords: Hepatitis C virus, Hepatocellular Carcinoma, Triphasic Computed Tomography.

INTRODUCTION

One of the most common causes of chronic liver disease in the United States is hepatitis C virus, a hepatotropic RNA virus. Hepatocellular carcinoma (HCC) is a potentially lethal or seriously health-damaging consequence of chronic hepatitis C (HCV) infection. Hepatitis C virus (HCV) spreads via blood. Medical equipment, particularly needles and syringes, is a major factor in the transmission of HCV in low-income countries. Unscreened blood and blood products, on the other hand, continue to be a major source of new diseases around the world. The most typical way that HCV is spread in developed countries is through the sharing of injecting equipment. Iatrogenic transmissions, on the other hand, are extremely infrequent [(1)].

This means that 90% of all HCV infections occur in Egypt, making it the country with the highest infection rate worldwide. Males are more likely to have genotype 4 than females, which complicates treatment and raises the risk of chronic hepatitis, liver cirrhosis, and hepatocellular cancer [(2)].

It may take up to 40 years for HCC to develop as a result of HCV infection. When the virus causes cancer, it also causes the host's immune system to respond. Inhibition of cell cycle progression by HCV viral proteins, which can also activate signaling pathways that promote cell growth and division, may occur by blocking anti-tumor suppressor genes and checkpoints. HCV core protein inhibits tumour suppressor genes including retinoblastoma protein and p53. The combination of retinoblastoma and p53 deficiency raises the risk of malignancy. Transforming growth factor-beta is produced by HCV nonstructural protein genes, which activate hepatic stellate cells. Tumor necrosis factor (TNF), interferons (IFNs), and chronic inflammation due to HCV are all factors that contribute to a host-induced immune response [(3)].

Hepatocytes may become cancerous because of the accumulation of mutations that occur during repeated cell divisions. Mutations in the telomerase reverse transcriptase, tumour protein 53, and b-catenin genes are prevalent in HCC patients. Telomeres are threatened and oxidative stress is elevated as a result of these alterations. The most prevalent genesis of HCC is cirrhotic nodules containing hepatocytes with sufficient mutations to reenter the cell cycle, reactivate telomerase, and proceed through cancer checkpoints. HCC growth is exacerbated by the fact that both the virus and the host immune response promote cell death and regeneration [(3)].

Chronic HCV-infected patients who have cirrhosis develop HCC at a rate of 1–4 percent each year once cirrhosis has been established. When it comes to advanced liver scarring (cirrhosis) and an increased risk of liver cancer, HCV infection is a major cause. Those with chronic HCV infection are at an increased risk of developing hepatocellular carcinoma (HCC), which is caused by a variety of conditions, including the presence of obesity and diabetes. The incidence of hepatocellular carcinoma (HCC) in HCV-infected patients is significantly increased by HCV and HIV co-infection [(3)].

There are several different types of liver damage that can result in chronic liver cirrhosis, including metabolic (alcohol, steatohepatitis, hemochromatosis, and Wilson disease), infectious (chronic hepatitis B or C), and inflammatory (primary biliary or primary serositis). Cirrhosis is characterised by fibrosis and an

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uncoordinated attempt at regeneration. Micronodular cirrhosis is more commonly caused by metabolic factors than other forms of the disease. While macronodular cirrhosis is almost always the result of viral infection (hepatitis B or C). An early marker of cirrhosis is an increase in the fat that is found anterior to the right major portal vein, and the caudate lobe enlargement is an obvious sign. If the caudate-to-right-lobe size ratio is more than 0.65, cirrhosis is almost certainly present. It induces compensatory caudate hypertrophy because the caudate does not go via the hepatic veins before reaching the inferior vena cava (IVC). Consequences of cirrhosis include the following: All of these signs of portal hypertension can be found in patients with splenomegaly [(4)].

Slight atrophy in the posterior right lobe (VI and VII), caudate lobe hypertrophy I, as well as left lobe side hypertrophy I are all signs of advanced liver disease (cirrhosis) (II and III). As a result of abnormalities in hepatic blood flow dynamics, including increased total hepatic blood flow (owing to intrahepatic arteriovenous shunts), there are places where blood flow is reduced (due to increased intrahepatic vascular resistance). In extreme cases, cirrhosis can result in HCC (which accounts for 10% of cases) and portal hypertension (which can cause variceal hemorrhage) [(5)].

HCC development:

Every year, hepatocellular carcinoma (HCC) kills more people than any other liver disease in the globe. Hepatocellular carcinoma is the fifth most common cancer in the world and the second most common cancer-related death [(3)]. The most frequent type of primary liver cancer is hepatocellular carcinoma. About 85% of all primary hepatic malignant tumours are caused by this [(6)]. Chronic inflammation can lead to hepatocellular carcinoma, a cancer of the liver. Lifestyle variables, such as smoking, drinking, and coffee use, are also connected to an increased chance of developing hepatocellular carcinoma (HCC). HCV patients who consume alcohol and smoke are more likely to develop hepatocellular carcinoma (HCC) than those who do not, possibly due to increased oxidative stress [(3)].

Triphasic CT in hepatitis C virus:

Imaging techniques such as ultrasound and computed tomography (CT) are still the first imaging tests used to detect and characterize the vast majority of individuals with liver cancers [(7)].

With a multi-detector helical scanner and 600 mL of tap water as an oral contrast agent before CT scanning, we use triphasic CT (arterial, portal vein, and delayed phases). A power injector was used to administer intravenous nonionic contrast material to each patient at a rate of 5 mL/sec [(8)].

HCV-infected patients typically have a normal CT scan on their way to a diagnosis of hepatitis. Gallbladder wall thickening or periportal edema may be signs of viral hepatitis (fluid on both sides of the portal veins) [(4)].

Numerous localized nodular lesions develop as a result of cirrhosis or severe fibrosis. These nodules gradually dedifferentiate as a result of the accumulation of cytological abnormalities, resulting to the development of HCC. From benign regenerative nodules (RN) and low and high-grade dysplastic nodules (DN) through early HCC as well as evident HCC, various papers have been documented. Hepatocarcinogenesis is characterized by a number of significant alterations. It all starts with small changes in the blood vessels, such as an increase in the number of narrowed or a lack of portal veins and a full blockage of arteries are both signs of this condition. Contrast-enhanced, multiphasic computed tomography and magnetic resonance imaging show an enhancing pattern in HCC that combines arterial phase hyperenhancement with washout on portal venous and/or delayed phases with background liver (MRI) [(9)].

Patients with cirrhosis or chronic hepatitis who have a hypervascular liver mass are presumed to have HCC until otherwise established. The typical imaging feature of HCC is arterial phase enhancement. Approximately 10% to 20% of HCCs are hypovascular and consequently modestly under-enhanced on arterial phase imaging compared to the surrounding liver. As a result of its local invasiveness, HCC often spreads into the portal veins, IVC, and bile ducts. Locally invasive metastases, on the other hand, are substantially less common in liver metastases. It's the typical CT image of HCC, which is an encapsulated mass that enhances on arterial phase and washes out on portal vein phase. If you use a non-contrast or a portal venous phase CT, it may be difficult to find it [(4)].

While HCC is assumed to develop sequentially in the context of cirrhosis, regenerative and dysplastic nodules are also seen. Imaging cannot consistently distinguish between regenerative and dysplastic nodules, and high-grade dysplastic nodules from low-grade HCC [(4)].

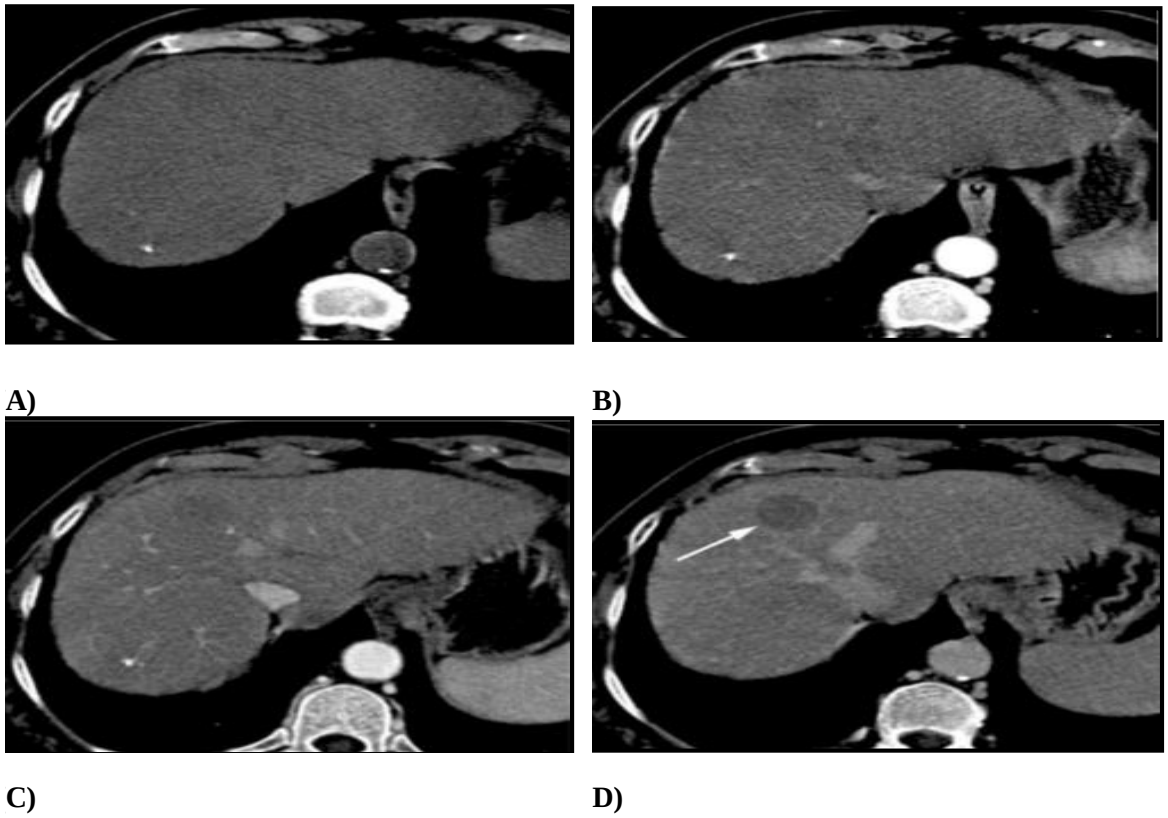

Figure (1): A 67-year-old woman's transverse CT scans revealed a 20-mm HCC nodule. (a) In the pre-contrast phase, there is no specific lesion to be found, but segment VIII does have a modest intraparenchymal calcification. (b) Hepatic arterial phase, (c) Scan results from the portal venous phase are inconclusive. (d) Segment IV is clearly shown to have a hypoattenuating nodule in the delayed phase imaging [(8)].

Direct acting antivirals (DAA):

HCC incidence was unaffected by the timing of DAA beginning, suggesting that the drug does not raise the risk of the disease. Patients having a history of HCC, on the other hand, were at an elevated risk of developing the cancer again. AFP and hepatic imaging should be performed at least every three months to monitor for HCC [(10)].

HCV infection must be eradicated to: (I) avoid liver and extra-hepatic disease complications caused by HCV infection, such as necroinflammation of liver tissue and the progression of cirrhosis; (II) enhance quality of life and remove social stigma; and (III) prevent the spread of the virus to others [(11, 12)].

The danger of developing hepatocellular carcinoma (HCC) is still there in patients with cirrhosis who have successfully eliminated HCV, however this risk is significantly reduced compared to untreated or unsatisfactory SVR patients. Patients with severe fibrosis or cirrhosis who obtain an SVR will remain on HCC surveillance indefinitely. Patients at risk for reinfection should be made aware of the dangers of reinfection and encouraged to make good behavioural changes. After three months, individuals at risk should be checked for reinfection and treated if they are found to be infected again, in order to determine whether or not they can recover from infection on their own [(11)].

CONCLUSION

Using of triphasic CT has been considered as a golden diagnostic imaging technique to detect the incidence of hepatocellular carcinoma as well as its possible complications.

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