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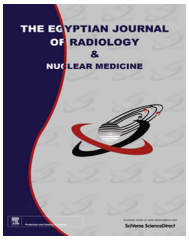

ORIGINAL ARTICLE

Diagnosis of arterioportal shunts in cases of hepatocellular carcinoma using multidetector CT: Impact on clinical management

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KEYWORDS

Multidetector CT;
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Abstract *Purpose:* To study the ability of multidetector CT (MDCT) to diagnose arterioportal shunts (APS) associated with hepatocellular carcinoma (HCC) and its impact on further management of the patient.

Patients and methods: 252 Patients with HCC were examined by triphasic MDCT scanning. Images were analyzed for the presence, locations, types and degrees of APS, being with or without thrombosis. Digital subtraction angiographies (DSA) were performed for 22 patients as a part of further therapeutic management.

Results: MDCT revealed APS in 37 patients including 20 central, 9 peripheral and 8 mixed. According to the degree we had 13 severe, 15 moderate and 9 mild APS. 18 patients had associated portal venous thrombosis. During DSA examinations; APS were demonstrated in 19 out of 22 as 3 mild and peripheral shunts were faint and missed. Embolization of the shunt was performed in 17 patients prior to injection of the cytotoxic drug-lipiodol mixture. In one patient the APS was closed to improve the hepatic status without further chemotherapy and in one patient the shunt was ignored and not closed.

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Conclusion: Good understanding of MDCT findings of APS complicating HCC contributes to the diagnosis and improves the therapeutic outcome of the chemoembolization procedures.

1. Introduction

Arterioportal shunt (APS) is an organic or functional communication between the high-pressure hepatic arterial branch and low-pressure portal veins (1). Hepatocellular carcinoma (HCC) can easily invade the adjacent portal vein to form the direct communication between the hepatic artery or its branches and portal veins, resulting in arterioportal shunt (APS). Hepatic APS may cause or aggravate portal hypertension and consequently, splenomegaly, bleeding from esophageal varices and hepatic encephalopathy, accelerating intra hepatic dissemination and extra hepatic metastasis of tumor cells (2).

One of the most important lines of palliative treatment of HCC is trans-catheter chemo-embolization (3). The formation of HCC-associated APS may bring some difficulty and danger to the procedure, such as cause chemotherapy drug and embolic agent to run-off through shunt path, and result in aberrant embolism (4). The embolic agent will be diverted to branches of the portal vein and delivered to normal areas of the liver instead of being deposited in the tumor, a problem which can be overcome by super selective embolization of the APS using micro catheters if the condition is diagnosed before treatment (5).

Transcatheter hepatic angiography, including digital subtraction angiography (DSA) is the gold standard for diagnosis of HCC-associated APS, but has the disadvantage of being an invasive procedure (2). Multidetector CT (MDCT) could contribute to the diagnosis of hepatic APS complicating HCC due to its fast scanning and improved image resolution and quality (6). CT hepatic arteriography findings in APS have a major impact on planning the way in which chemoembolization treatment could be performed. Findings of this modality may alter treatment plans for the tumor and the shunts involving selective administration of chemo embolic material (7), so understanding of CT diagnostic criteria of hepatic APS complicating HCC is of significant clinical implications.

The aim of this study was to investigate the ability of multidetector CT (MDCT) to diagnose arterioportal shunt (APS) complicating hepatocellular carcinoma (HCC) and the impact of that on further patient's management.

2. Patients and methods

This prospective study was carried out in the Radiodiagnosis Department of Ain Shams University Hospital and in some private centers between February 2011 and January 2013. Multidetector CT was conducted for 252 patients with HCC. They included 214 males and 38 females and their ages ranged between 39 and 75 years. An informed consent was obtained from each patient before the study. The diagnosis of HCC was based on the classical findings of enhancing lesions at the arterial phase with rapid wash out of the contrast at the venous phase, associated with elevated/progressively rising alpha fetoprotein level. Some cases were confirmed by percutaneous needle biopsy.

Helical CT scans were performed using at least 8 slice multi-detector scanners (GE Healthcare, Milwaukee, WI, USA) with a kV of 140, 200–300 mA and 0.8-s gantry rotation time. Most patients were examined after an overnight or 6 h fast, with water (or sometimes gastrografin) being used to mark the stomach and bowel loops. Dynamic CT scans were acquired after the injection of 80–120 cc iodinated contrast medium (Ultravist 300; Schering, Berlin, Germany or Iopamiro 300; Bracco, Milano, Italy) at a pressure of 600 PSI and a rate 4 ml/s using an automatic pump injector (Angiomat 6000; Liebel-Flarsheim) and via an 18- or 20-gauge canula inserted into an antecubital or peripheral upper limb vein. The scans were acquired in the early arterial, late arterial and porto-venous phases after a delay of 15, 25 and 60 s respectively. The patients were not instructed to maintain strict apnea. Instead; they were imaged during gentle shallow breathing.

We used an effective slice thickness of 7 mm and the images were reconstructed at 10 mm intervals to achieve an overlap of 40–50%. The images were then further reconstructed at 1 mm thickness/intervals producing about 150–200 sections per acquisition and sent to workstation (Hp xw 8600, AW Volume share 4, GE medical systems SCS, France) where coronal and sagittal reformats were acquired. Volume rendering techniques were also used particularly the maximum intensity projection (MIP) to demonstrate the small peripheral vessels.

The CT diagnostic criteria for APS were earlier enhancement or stronger opacification of main portal trunk and/or its first-order branches than that of superior mesenteric or the splenic vein; or earlier enhancement or stronger opacification of the second-order and smaller branches of portal veins than that of the main portal trunk (8).

Depending upon the location of shunt, APS were classified into three types: The ***central*** type was the shunt located at the porta hepatis with earlier enhancement and/or stronger opacification of the main portal trunk and/or the first-order branches at the hepatic arterial phase. The ***peripheral*** type was the shunt located in the peripheral liver parenchyma with earlier enhancement and/or stronger opacification of the second order and smaller branches of the portal vein, or transient patchy or wedge-shaped enhancement peripheral to HCC foci at the late hepatic arterial phase. The ***mixed*** type showed both central and peripheral criteria (2).

According to the time of appearance of APS on images, APS were divided into three degrees. The ***severe*** APS showed opacification of the main portal trunk and/or the first-order branches with enhancement of the hepatic artery and its branches at the early hepatic arterial phase, with no or mild enhancement of HCC foci. The ***moderate*** APS demonstrated