The Promise of Virtual Reality in IR

M M. ABDELRAZEK, MOHAMED KHALAF, DAVID WANG AND NISHITA KOTHARY
Interventional Radiology, Stanford School of Medicine, Stanford, CA

LEARNING OBJECTIVES

- Interactive virtual reality (VR) represents the next generation of imaging technology.
- This pictorial report illustrates the potential of VR in procedural planning for endovascular procedures.

BACKGROUND

- Current imaging technologies acquire volumetric data, but are limited by the flat, two-dimensional (2D) viewing of complex three-dimensional (3D) data.
- VR allows the operator to manipulate 2D images in an open 3D space, as if it were a real physical object. The ability to view, rotate, segment and manipulate the anatomical area of interest in a three-dimensional space thus provides unequivocal spatial orientation.

CLINICAL FINDINGS / PROCEDURE DETAILS

- We illustrate the role of VR in Interventional Radiology (IR) vis-à-vis three commonly performed procedures, including endovascular repair of a visceral aneurysm, transarterial chemoembolization of a liver tumor and a transjugular intrahepatic portosystemic shunt (TIPS).
- Using a VR medical visualization software system (True 3D, Echopixel Inc., Mountain View, CA), VR images are reconstructed using pre-procedural contrast-enhanced computed tomography (CT), CT angiography (CTA) and intraprocedural cone-beam CT (CBCT).

Fig 1.1 Fig 1.2 Fig 1.3

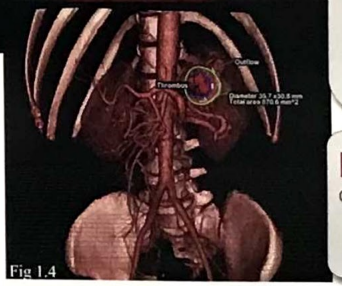

Fig 1.4

Figures (1.1-1.4): CTA and VR images of a complex splenic artery aneurysm. CTA and reconstructed VR images demonstrate two tandem aneurysms (Fig 1.2-1.3), each with a single afferent artery and two efferent arteries. The complex spatial relationship between afferent and efferent arteries relative to the aneurysms are demonstrated. In a different patient, VR provides further insight by illustrating a partially occlusive, adherent thrombus as well as volume of aneurysm (fig 1.4).

TEACHING POINTS

- When planning for complex endovascular procedures, tortuous vascular anatomy is often difficult to elucidate on 2D imaging.
- By displaying the information presently buried in 2D display systems as a three dimensional life size model, the VR environment presents a unique solution, one that will could prove to be valuable in the IR suite.

CONTACT

COI: Dr, Kothary is a scientific advisor for EchoPixel Inc. For more information please contact abdrazek@stanford.edu

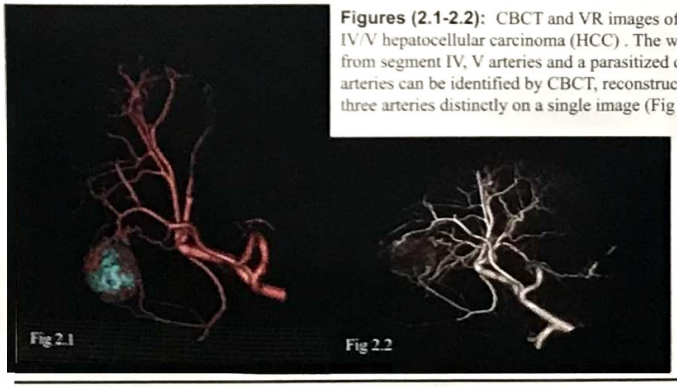

Fig 2.1 Fig 2.2

Figures (2.1-2.2): CBCT and VR images of 3 cm Couinaud segment IV/V hepatocellular carcinoma (HCC) . The watershed tumor is supplied from segment IV, V arteries and a parasitized cystic artery. While the arteries can be identified by CBCT, reconstructed VR images depict all three arteries distinctly on a single image (Fig 2.1).

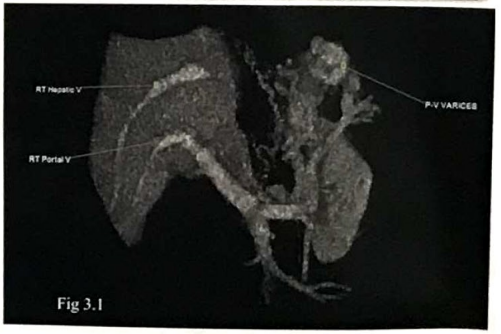

Fig 3.1

Figures (3.1): Application of VR in pre-procedural planning of a transjugular intrahepatic portosystemic shunt (TIPS) and sclerosis of gastric varices. VR images reconstructed from a pre-procedural, contrast-enhanced CT, demonstrates the spatial relationship between the right hepatic vein and the right portal vein as well as the gastric varix.

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