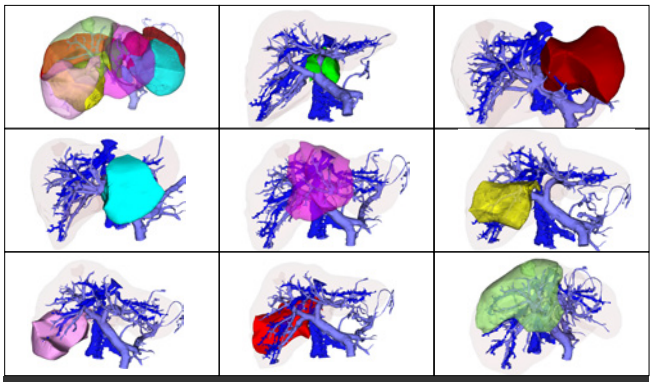
Leaders in digital diagnosis and liver cancer care

Hepatology surgeons at Zhujiang Hospital are pushing TECHNOLOGICAL FRONTIERS for treatment strategies.



'Fang's segmentation' is an innovative, individualized liver segmentation strategy based on blood flow topology.

For the diagnosis and management of primary liver cancer, surgeons used to rely on their experience to transform 2D information from CT or MRI into abstract 3D models in their minds, which can lead to uncertain outcomes. Computer-generated 3D visualization or 3D printed modelling is now an option, intuitively displaying comprehensive information such as variations of intrahepatic blood vessels in greater accuracy and detail. This greatly improves clinical decision-making on everything from liver volume calculation to surgical navigation.

Chihua Fang, the head of Hepatobiliary Division I at the Zhujiang Hospital of Southern Medical University, was among the first researchers and practitioners to use 3D visualization to reduce surgical complications, and improve intraoperative navigation.

"A major focus of my 18 years of basic and transformational research has been advancing 3D visualization and digital intelligent technologies for the diagnosis and management of primary liver cancer," says Fang. "Our studies have improved preoperative diagnostic accuracy and will present new opportunities for enhanced surgical control."

Enhancing precision for 3D visualization

Fang has been developing new theories, technologies and platforms to enable anatomically accurate 3D visualization. This has allowed for detailed classification of hepatic vessels and liver segmentation, known as Fang's segmentation, which has been used in the diagnosis and treatment of primary liver cancer.

According to a multi-centre study from China, the rates of postoperative liver failure and perioperative mortality in patients using 3D visualization were 0.8% and 0.2%, respectively, significantly lower than those without using 3D visualization reported in comparative international literature.

"To allow this technology to mature, we have to standardize the acquisition and use of CT images, which should follow a homogeneous quality control system," Fang says. "We must not hinder evaluation of its application efficacy across different clinical centres."

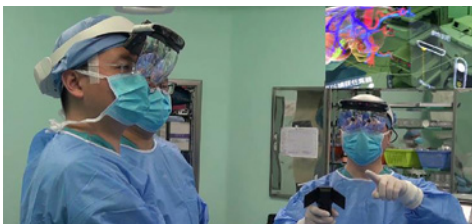
This leads to the compilation and publication of some of the first internationally applicable specifications, operating guidelines and consensus recommendations by Fang. Based on his clinical expertise, his team developed a new 3D visualization system for abdominal medical images, MI-3DVS, and a virtual surgical instrument simulation system. Both have certifications from China's National Medical Products Administration.

Transforming liver disease treatment

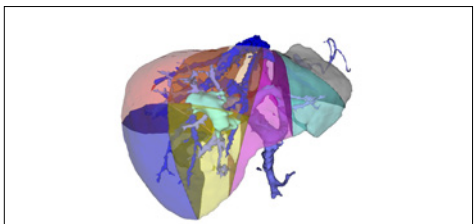
Fang pioneered the use of digital intelligent technology to navigate anatomical, functional, and radical hepatic resection for primary liver cancer, using computer-assisted indocyanine green (ICG) fluorescent imaging. His world-leading technology combining photoacoustic imaging and target-specific molecular probes enables integration of early diagnosis and treatment of experimental liver cancer, and pushes detection and management of liver cancer from morphological to molecular and cellular levels.

To address the issue of intraoperative multimodal non-rigid registration of the liver, Fang's team has developed a novel laparoscopic hepatectomy navigation system, the LHNS. This system blends preoperative 3D models with ICG fluorescence imaging to achieve real-time surgical navigation. It has shown clinical success, with lower intraoperative blood loss and blood transfusion rates, reduced length of postoperative hospital stay, and reduced liver failure rates.

Fang's research results have won him two first prizes and one second prize of Guangdong Science and Technology Progress Awards in 2010, 2019, and 2015 respectively, and the China Industry-University-Research Collaboration Innovation Award in 2014. ■



Virtual reality enhances surgical training and performance.



3D visualization and classification of central hepatocellular carcinoma, a form of liver cancer

南方醫科大學珠江醫院
ZhuJiang Hospital of Southern Medical University
fangch_dr@163.com
+86-13418009319
www.zjyy.com.cn/index.aspx