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IMAGE-GUIDED PLATFORM FOR THE RADIO FREQUENCY ABLATION OF THE LIVER TUMOURS

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Hepatic cancer is one of the most common solid cancers in the world. Some patients could not be candidates to resection of the liver because of the proximity of tumour to key vascular or biliary structures or in case of presence of multiple liver metastases. Very often the tumour is also associated to a pre-existent cirrhosis that can reduce resection margins. Different approaches could be used and among these we focused our attention on liver Radio Frequency Ablation (RFA), a technique consisting in the placement of a needle inside the liver parenchyma to reach the centre of the tumour lesion.

One problem in using RFA technique is the correct placement of the needle that should reach the tumour lesion. To reduce the complexity of the needle insertion can be used the Augmented Reality technology. With the superimposition of the virtual models of the patient's organs (liver, cancer, etc) exactly where are the real ones, it is possible to provide a sort of X-ray view of the patient's anatomy. In this way the needle placement should be less difficult and the surgery time should be reduced.

We present an image-guided application that can help the surgeon during the needle insertion in liver RFA; the application can also provide a support during the pre-operative surgery planning.

The surgeon can modify the opacity of the organ mesh and set the clipping visualization modality that permits to dissect the 3D model and to study the internal structures in an alternative way from mesh opacity modification.

A "Point View" function permits to select and to visualize the entry and the target points on the slices and on the 3D model of the organs. A line connects these two points in order to simulate the path followed by the needle from the entry point to the target. In this way surgeon can see if the desired path of the needle can touch important vascular structures and can cause bleeding during the needle insertion.

The surgeon can also select the "Active Reslice" function in order to activate the reslicing function: in real time the CT slices are visualized exactly next to the actual position of the surgical instrument.

To achieve a correct augmentation of the surgical scene it is necessary to have an enough precise overlapping between the virtual organs and the real ones by means of a correct and accurate registration phase. The used method is based on fiducial points.

First the developed application has been tested on a dummy in the laboratory. As future work we are planning some tests (also on a pig liver) in order to exactly measure the precision of this image-guided surgical application.