INTRACORPOREAL SOFT TISSUE NAVIGATION SYSTEM FOR MINIMALLY INVASIVE SURGERY

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According to the National Center for Health Statistics, approximately 600.000 hysterectomies are performed annually in the United States, where a third of women can be expected to have a hysterectomy by age 60. In Italy more than 125.000 hysterectomies per year. The advent of minimally invasive traditional and robotic surgery offers the patient and the health system many advantages, but, the risk of potential ureter injuries is high (incidence between 0.2% to 6.0%). The ureter injury is often associated with significant morbidity, the formation of uterovaginal fistulas and the potential loss of kidney function, especially when recognized postoperatively.

AIM

To develop and to test a system to avoid undesired ureters cutting in traditional and robotic laparoscopic surgery.

The goal is to sensorize urologic catheters by means of coils, to insert them in ureters during surgery, and by means of an electromagnetic tracking system to determine ureters path (in the 3D space). By tracking the surgical tip, it is possible to develop a system equipped with graphic user interface (GUI) and acoustic and/or video alarms, which allow the surgeon to avert the hurting of ureters, safeguarding patients and preventing related disorders.

METHODS

Architecture

Localization instrumentation module
Sensorized urinary catheters module
Processing pathway module
Calibration module
GUI + alarms

Validation

In-vitro testing
Ex-vivo testing
Animal trials

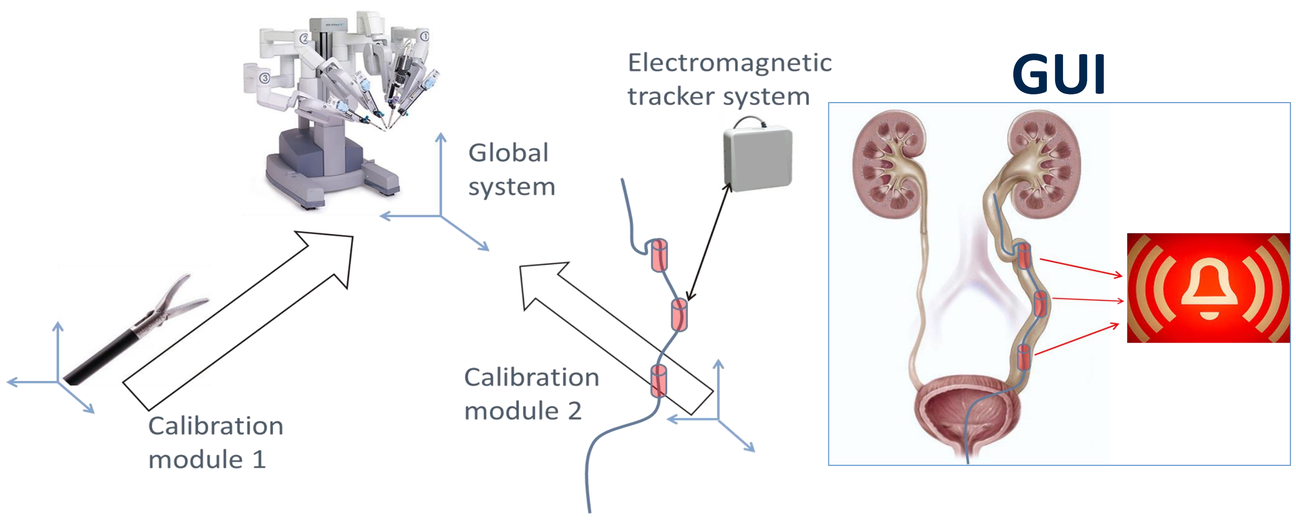

Fig.1 Navigator Architecture: the Electromagnetic system tracks the tip (module 1) and the catheter sensors (module 2). The measures are related to the global system. The real-time pathway of the ureters is calculated starting by the centerline of the ureters. Finally a GUI shows the pathway and it alerts the surgeon in order to preserve the ureters

REQUIREMENTS

To sensorize commercially available (fig. 2) and custom-made (fig. 3) urologic multichannel catheters with electromagnetic sensor coils
To develop the GUI
To perform in-vitro and ex-vivo animal testing
To perform a feasibility study even by means of animal trials

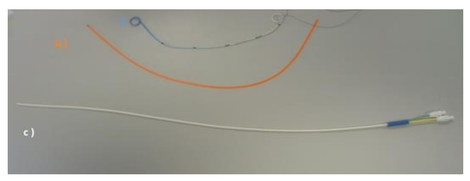

Fig.2 Commercial (a) 5Fr and (b) 7Fr mono lumen catheters
(c) 10 Fr multi lumen catheter

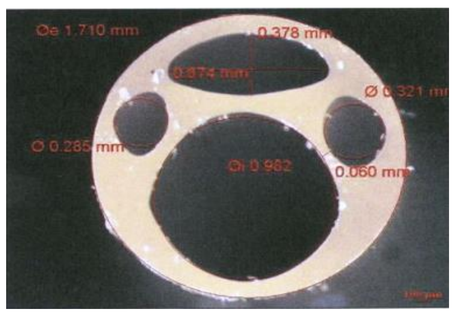

Fig.3 Custom made catheter: external diameter 5Fr with four holes of various measure

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