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BIOENGINEERING INITIATIVE AT CHILDREN'S NATIONAL MEDICAL CENTER: A COLLABORATION BETWEEN ENGINEERS AND PHYSICIANS TO ADVANCE PEDIATRIC SURGICAL CARE

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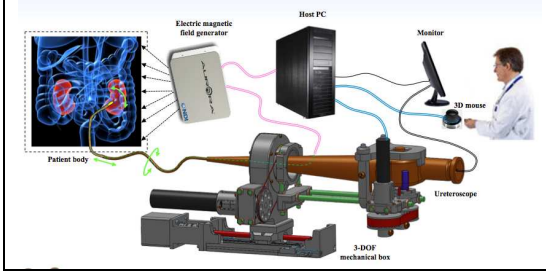
This presentation will focus on technology developments and clinical applications in the recently established Bioengineering Initiative in the Sheikh Zayed Institute for Pediatric Surgical Innovation at Children's National Medical Center, Washington, DC, USA. The technology developments include medical robotics, image registration and fusion, molecular imaging, and image-guided navigation for pediatric interventions. The clinical applications include laparoscopic abdominal surgery, knee arthroscopy, craniosynostosis, ureteroscopy, tumor resection, and cochlear implant surgery. The institute includes engineers, scientists, radiologists, and surgeons that are dedicated to improving the precision and decreasing the invasiveness of pediatric procedures. By physically locating this interdisciplinary team in newly renovated research space on the top floor of the hospital, both formal and informal interactions are facilitated, with the goal of accelerating translational research from the laboratory to patient care.

Several projects in particular will be described. For navigated endoscopy, we are developing a power steering mechanism to control a flexible ureteroscope for kidney operations. A prototype system has been constructed, and phantom experiments have begun. In medical robotics, we are exploring robotic NOTES (natural orifice transluminal endoscopic surgery) as a novel minimally invasive technique. A system architecture has been developed and a wireless communication protocol for robotic control has been created using Zigbee. Other robotic projects including automating intestinal anastomoses and performing cochlear implant surgery using a robotically controlled drill.

Image-guided navigation is an enabling technology for applications that avoid the growth plate in pediatric ACL surgery. The registration of pre-operative MRI imaging with intraoperative fluoroscopy will enable better visualization for the surgeon in the operating room for this procedure. Quantitative imaging will be pursued for applications such as craniosynostosis and hydronephrosis to advance surgical diagnosis and planning. Finally advanced diagnostics such as molecular imaging of fluorescent markers to pinpoint neuroblastoma will be investigated with the goal of developing tumor specific contrast agents to enable more complete resection.



Robotically assisted endoscopy (ureteroscopy) for minimally invasive exploration of the kidney	**da Vinci robotic surgery in the new operating rooms at Children's National Medical Center**