





NOVEL SINGLE-PORT ROBOTIC PLATFORM FOR BILATERAL INGUINAL HERNIA REPAIR

[1]E Parra-Davila, MD, FACS, FASCRS; [2]MA Conditt, PhD; [3]C Lightcap, PhD; [3]H Yaghini, MSc; [2]MT McKittrick, MBA

[1]Tenet Florida Physician Services, [2]Momentis Surgical, [3]KCL Robotics



PURPOSE:

Every year ~20 million inguinal hernia repairs are completed worldwide. The increased demand for less invasive techniques driven by better clinical and aesthetic outcomes has expanded interest in a single port approach. **The main technical issues with current single port surgeries are the loss of instrument triangulation and the collision of instruments.**

A robotics platform with a novel approach to articulation and reach may obviate these issues. It is important to understand that robotic functionality is more than just the extent of the workspace that the end effectors can reach, but also the dexterity of the end effectors at every reachable point in that workspace.

MATERIALS AND METHODS:

A robotics platform has been developed that allows all instrument articulation to occur inside the abdomen by 2 flexible instrument arms inserted through a single incision that can be made transabdominally for male patients and transvaginally for female patients. This system features:

- **Miniature humanoid-shaped robotic arms that provide human level dexterity, multi-planar flexibility and 360 degrees of articulation for various access configurations.**
- Biomimetic instruments are designed to replicate the motions and capabilities of a surgeon's arms, with shoulder, elbow, and wrist joints.
- After insertion while extended, the two robotic arms then retroflex towards the anterior abdominal wall.
- **Both inguinal canals can be reached from a single-entry point, either transabdominally or in the preperitoneal space.**

This study measured the manipulability of this new robotic platform throughout its entire reachable workspace in the abdomen through either a transvaginal, umbilical or Pfannenstiel single port insertion site. [1]

RESULTS:

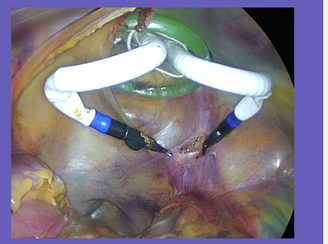
The results show that, due to the shoulder, elbow and wrist joints of the arms that perform all of their articulation after entry, the reachable workspace encompasses the entirety of the average male and female abdomen from the para-aortic nodes to the pelvic floor, across from abdominal sidewall to sidewall and from the abdominal wall to vertebrae.

Because the wrist joints have unlimited rotation, and the shoulder and elbow joints allow the arms to function as they cross over each other, manipulability index remains high (high usability) with all three single port insertion sites able to reach the abdominal cavity and other critical anatomic structures

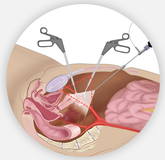
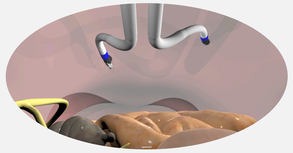
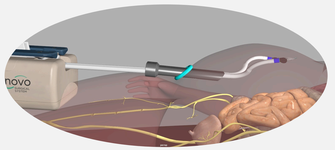
- **Instruments arms and end effectors easily reach the deep inguinal ring, external oblique fascia, ilioinguinal nerve, spermatic cord and the pubic tubercle**
- **Enable and allow tissue manipulation, traction, countertraction, fine dissection and triangulation in a large as well as a constrained workspace, thus improving visualization**



Novel Single-Port Robotic Abdominal Access Point



Triangle of Doom

Current Robotic Systems		
	Triangulation	Reach
ANOVO SURGICAL SYSTEM		

CONCLUSION:

The design of this new robotic technology has the potential to realize the **clinical benefits of a single port approach while providing unprecedented triangulation and manipulability for either unilateral or bilateral inguinal hernia repair via a transabdominal or extraperitoneal approach.** In addition, while traditional multiport robotics remains expensive and time consuming related to setup[2], **this new novel single port robotic technology has the ability drive costs to be more in line with traditional laparoscopic approaches.**