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ArtiSential laparoscopic cholecystectomy

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Lecture : Surgeons can take pride in that they perform safe laparoscopic surgery, which can replace traditional laparotomy through a small incision. Patients can fully enjoy the improved quality of recovery after surgery, owing to excellent cosmetic effects, reduced pain, and fast recovery,. However, to perform laparoscopic surgery safely and consistently, surgeons must overcome the disadvantages of a two-dimensional operative view, limited range of motion, fulcrum-effect, and amplified tremors during laparoscopic surgery. In particular, the limited range of motion in laparoscopic surgical instruments is one of the biggest obstacles to effective surgical performance in a convoluted abdominal cavity. Recently, robotic surgery has been developed to overcome this, but due to its high cost, it is difficult for all patients to take great advantage of robotic surgery. The "disposable multi-joint and multi-degree-of-freedom surgical instrument" (product name: ArtiSential®), developed by LIVESMED in Korea, is a high-performance, low-cost, hand-held surgical instrument that all doctors can use directly during the laparoscopic surgery process, with the world's only multi-joint structure of a robotic gripper and intuitive control.

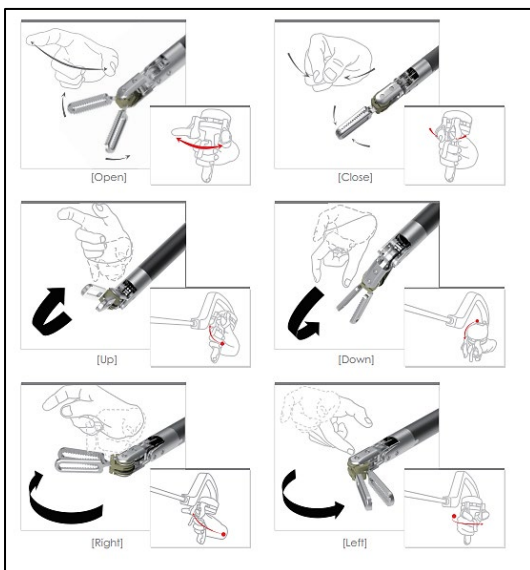


Figure 1

Synchronized interface: ArtiSential® implements movements that synchronize with the user's hand movements by matching the movements of the actuator with those of the user's hand when the user grabs and moves the control unit manually.

Potential usefulness

As expected, since human organs in abdominal cavity are not flat but rather have a curved, three-dimensional space, it is thought that effective surgery can be performed while minimizing damage to the lesion and surrounding tissue using ArtiSential®, which allows for 360-degree and three-dimensional movement of the surgical tool. When using conventional laparoscopic instrument (straight ones), if the access angle to the surgical site cannot be achieved, surgical assistants may have to excessively press on

surrounding tissue or insert additional ports at different locations to facilitate effective access with surgical instruments. However, with Artisential®, surgeons can effectively access the surgical site at various angles without additional ports. Therefore, the clinical utility of Artisential® is expected to increase in surgical procedures where usefulness of robotic surgery is already evident.

Drawbacks

Due to the efficient wrist movements of Artisential®, it is expected that the learning curve for this surgical tool will be short. However, our experiences suggest that it may require a lot of effort and practice for technical fluency regarding Artisential®. The biggest disadvantage of Artisential® is that it combines the principles of fulcrum-effect of laparoscopic surgery and intuitive movements of robotic surgery in one device, making it much more difficult and even uncomfortable for surgeons to manipulate the device during their initial experiences with Artisential®. As Artisential® is primarily designed for laparoscopic surgery; surgeons need to move in the opposite direction to the desired movement of the surgical instrument in the surgical field (fulcrum-effect). Additionally, the movements of the surgical instrument's end part are intuitive, similar to wrist movements of surgeons' hands (intuitive). Therefore, mastering the two special functions of Artisential® requires a certain learning curve, which can only be overcome through consistent practice and training by surgeons themselves.

Clinical application of Artisential® for reduced port (1+1) laparoscopic cholecystectomy

Using the unique characteristics of Artisential®, we have succeeded in standardizing new surgical approach for laparoscopic cholecystectomy that can enhance the cosmetic effect and improve the quality of postoperative recovery. For the umbilical incision, we use a domestically produced globe-port with four channels, arranged in a diamond shape as shown in the figure. The channel at the 9 o'clock position on the patient's right side is used for the laparoscopic camera (green), and the remaining three channels are inserted towards the 12 o'clock, 3 o'clock, and 6 o'clock directions towards the patient's head. Artisential® instruments use fenestrated bipolar forceps in the left hand, a mono-polar hook and a medium-sized clip applier in the right hand. While the principle for safe laparoscopic cholecystectomy remains the same, the use of Artisential®'s unique features has been shown to enable effective and safe laparoscopic cholecystectomy.



Figure 2 ArtiSential Laparoscopic Cholecystectomy

Future perspectives

In the future, the diameter of ArtiSential® is expected to be reduced from 8mm to 5mm, making ArtiSential® easier to use for even small-handed surgeons during conventional laparoscopic surgery. Articulating advanced energy devices are also expected to be developed for even safer and more effective minimally invasive surgery, and we can expect the introduction a second generation of robot-assisted surgical system based on this Korean own industrial technology. Currently, the author is using ArtiSential® Maryland bipolar forceps in the left hand and ArtiSential® precise needle suture in the right hand to perform pancreaticojejunostomy and choledochojejunostomy in the reconstruction phase after laparoscopic resection in laparoscopic pancreaticoduodenectomy. Based on our experience so far, we can carefully conclude that once surgeons pass a certain learning curve, they can perform more effective and safe surgical procedure with ArtiSential®.