

# ArtiSential™ Revolutionizes Traditional Laparoscopy in Urology by Introducing the Dexterity of a Robotic System to a Laparoscopic Instrument

—First Experiences in Urology in Europe by the Ukrb in Neuruppin

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## Abstract

We describe the first two conventional, laparoscopic renal operations with a new multi-degree of freedom articulated single-use laparoscopic instrument (ArtiSential™). The two patients underwent different laparoscopic interventions at Ukrb University (Neuruppin, Germany): nephrectomy and Anderson-Hynes-pyeloplasty. All procedures were completed, with no need for conversion or placement of additional ports. No intraoperative complications or technical failure of the instrument was recorded. The mean operative time was 180 min median length of stay was 11.5 d. The instrument could be opened out of the sterile packaging and used at once when it was needed, because it is a single-use instrument. There was real haptical feedback and the costs are minimal compared to robot surgery. The use was straightforward and rapid processes after an intensive training of 4 h in a dry lap. Awaiting future investigations in larger series, this study proves the safety and feasibility of renal surgery with ArtiSential™ and provides relevant data that may help early adopters of this surgical instrument.

## Keywords

Renal Cancer, Renal Surgery, Laparoscopic Surgery, New Multi-Degree Instrument, Single-Use

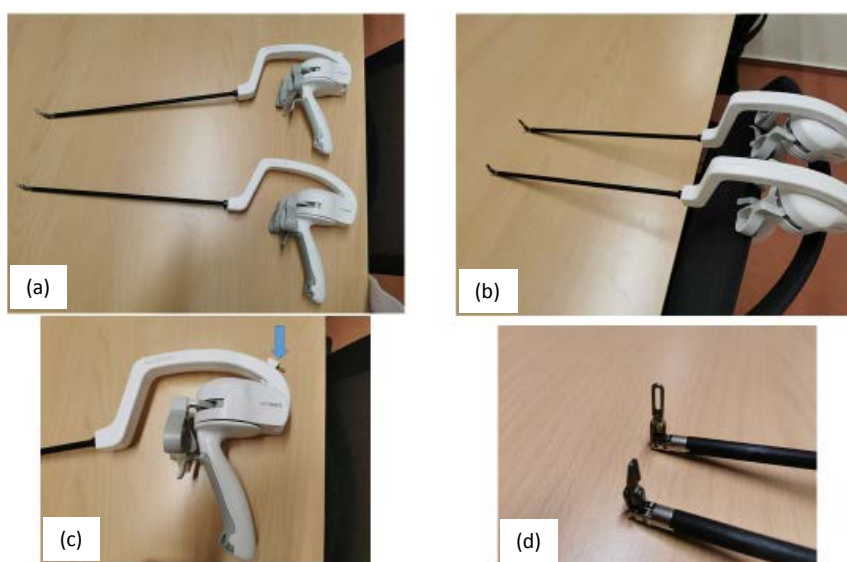
## 1. Introduction

In the late 1970s, Kurt Semm founded the laparoscopic surgery in Kiel/Germany

[1] [2]. A normal laparoscopic device consists of a straight shaft and sometimes with a jaw-like tip which can open and close. The laparoscopic surgeon uses the “fulcrum effect”. This means that the tip of the device moves opposite from the handle reducing the degrees of freedom compared with the movement of the human hand [3]. The advantages of the robot surgery (e.g., da Vinci® surgical system) were increased dexterity, degrees of freedom and elimination of the fulcrum effect [4]. However, the very high cost of the surgical robot, hygienically problems of a non-disposable instrument and the loss of the real haptical feedback triggered an interest in development of a “wristed” instrument for conventional laparoscopy which can be sterile opened in the theatre just in time when it is needed.

Many mechanical or partly motorized instruments have been developed. Yet none of these instruments have so far managed to play a major role in laparoscopic operations [5]. In 2019, ArtiSential™ (Figure 1) was introduced by LIVSMED, Seongnam/Republic of Korea and registered as a Class I medical device with the Food and Drug Administration [6]. The instrument uses two joints to enable full 360° wristed capability similar to the da Vinci® surgical system [7]. It is the first articulating laparoscopic device with the widest-angle motion of 360 degrees.

We describe the first two conventional, laparoscopic renal operations with a new multi-degree of freedom articulated single-use laparoscopic instrument (ArtiSential™) in Europe. These two patients underwent different laparoscopic interventions at Uker University (Neuruppin, Germany): nephrectomy and Anderson-Hynes-pyeloplasty. This paper is designed to share our preliminary experience and first impressions to make urologic surgeons aware of this novel technology.



**Figure 1.** (a) View from the side of two wristed instruments: above the Forceps and below the Needle holder. (b) View from above (c) The Arrow shows the connection for the bipolar coagulation (only for the Forceps available). (d) Forceps and Needle holder.

## 2. Patients and Methods

Before using the ArtiSential™-Instruments the operating surgeon has to go through an advanced training in dry lap in which LIVSMED provided a training kit. Ibahim Darwich *et al.* explain this peg-transfer task of 4 hours with a Fenestrated Forceps [8]. After this initial training on the training kit, we start suturing in the Dry Lap with the Needle Holder of ArtiSential™.

Medical data of patients who underwent laparoscopic surgery on the kidney with ArtiSential™ (nephrectomy and pyeloplasty) from September 2022 to November 2022 at a single tertiary centre were retrospectively analysed.

All patients were placed on the kontralateral Side of the Kidney of interest.

We used multiport technique, with one 12 mm port near the umbilicus for the camera, one 5 mm port near the thorax in the medioclavicular line and one 12 mm port 20 cm distal in the medioclavicular line (Figure 2). Sometimes we had to use another 5 mm port near Xyphoid for the right kidney to retract the liver.

Because of this port technique, the ArtiSential™ instrument was used with the right Hand for the left kidney and with the left hand for the right kidney. The surgeons were trained on his dominant and non-dominant hand.

## 3. Results

During the renal surgery, articulated instrument with forceps was useful for dissection, traction and counter traction around adhesions, Colon, Duodenum, ureter and hilum of the kidney. It was very helpful in preparing tumours in the kidney and resecting them (Figure 3).

Bleedings in the ground of the tumor could easily be coagulated, with the bipolar option of the fenestrated forceps (Figure 1(c)).

When it comes to reconstruction by a suture, we used the articulated instrument with a needle holder (Figure 4). The suturing was fast, precise, ergonomic and with a real haptical feedback.

All procedures were completed, with no need for conversion or placement of additional ports. No intraoperative complications or technical failure of the instrument was recorded. The mean operative time was 180 min Median length of stay was 11.5 d. The instrument could be opened out of the sterile packaging and used at once when it was needed, because it is a single-use instrument.

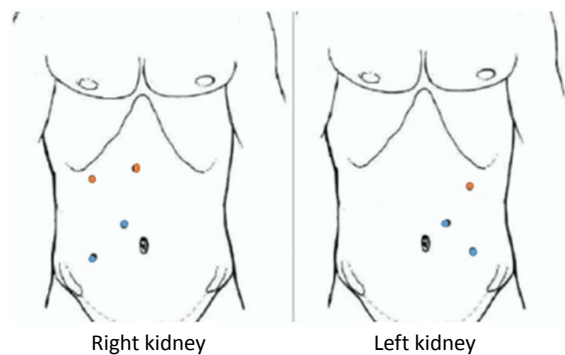
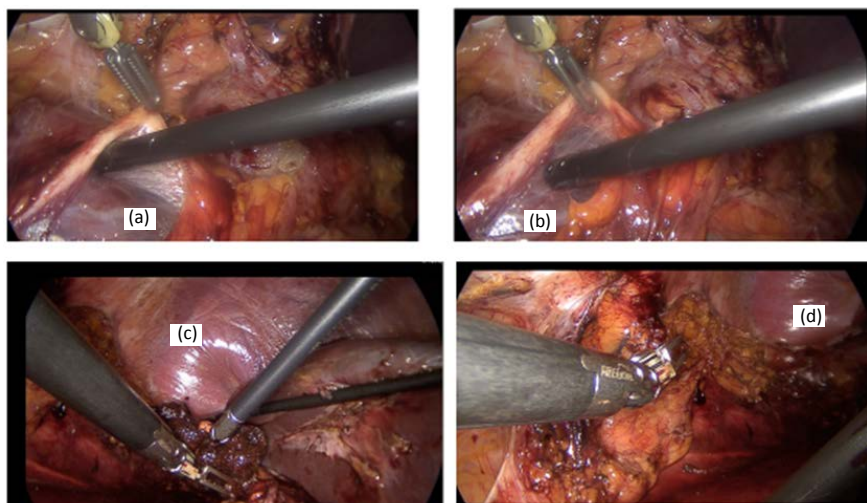
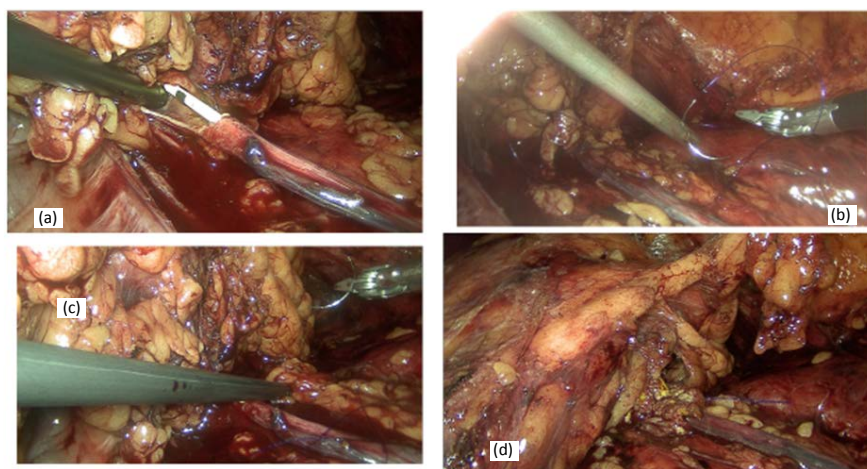


Figure 2. Blue dot: 12 mm port, orange dot 5 mm port.



**Figure 3.** Usage during Nephrectomy. (a) + (b) traction and grabbing of the ureter. (c) Positioning of tabotamp under the liver on the hilum. (d) Repositioning of the colon ascendence.



**Figure 4.** Usage during Pyeloplasty. (a) Spatulated ureter with DJ. (b) + (c) Usage of the needle holder with the right hand, a straight needle holder on the left hand and a barbed suture. (d) Completed suture.

#### 4. Discussion

Robotic systems have several advantages like increased dexterity, degrees of freedom and elimination of the fulcrum effect [4]. Unfortunately, the very high cost of the surgical robot [9], hygienically problems of a non-disposable instrument and the loss of the real haptical feedback limit its use in urology. The usage of surgical energy devices is also limited in robot surgery.

The new ArtiSential™ could fill this gap between conventional laparoscopy and robot surgery. It's intuitive usage just ergonomic like a robot system and it's affordability and computer or motor absence making this instrument valuable for all countries. The learning curve is quick on a steady plateau. After 4 hours of training, one can start with the first cases, when there is laparoscopic expertise

[8].

There is no long docking manoeuvre like in robot surgery. The instrument is pulled out the sterile package in seconds, just when it's needed.

Hygienically standards are steadily rising and wristed instruments have complicated cleaning and sterilisation procedures, because of the complexity of the instruments. This problem is absent in a single-use, sterile Instrument like ArtiSential™.

Haptical feedback is very important when it comes to intraoperative traction and counter traction. In reconstructive surgery with suturing e.g., the ureter to the renal pelvis it is essential. Min *et al.* evaluated the performance of suturing tasks between ArtiSential™ and a robotic system. They reported that experienced laparoscopic surgeons could achieve the same result with ArtiSential™ [7].

We encourage multicentre randomized case-control studies to endorse the adoption of this robot-inspired device with stronger scientific evidence.

## 5. Limitations

An important limitation of this study is its retrospective design. Other limitations of the study include its single centre nature and the performance of the procedures by a single surgeon; further studies involving more surgeons are needed.

In addition, future studies with larger number of patients may be necessary. Lastly, this study just focused on early postoperative complications.

## 6. Conclusion

Awaiting future investigations in larger series, this study proves the safety and feasibility of renal surgery with ArtiSential™ and provides relevant data that may help early adopters of this surgical instrument. It is a safe and feasible option that does not increase operation time, length of hospital stay and intraoperative bleeding.

## Ethical Statements

This study was in accordance with the Helsinki declaration. Informed consent was obtained from all patients after a thorough verbal explanation.

## Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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