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Awake Da Vinci robotic partial nephrectomy: First case report ever in a situation of need

Paolo Gontero [a,*], Marco Oderda [a], Giorgio Calleris [a], Marco Allasia [a], Roberto Balagna [b], Fabio Gobbi [b]

[a] Division of Urology, Città Della Salute e Della Scienza di Torino, Molinette Hospital, University of Turin, Corso Bramante 88, 10126, Torino, Italy
[b] Department of Anesthesiology, Città Della Salute e Della Scienza di Torino, Molinette Hospital, Corso Bramante 88, 10126, Torino, Italy

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ABSTRACT

We report a unique case of a robotic partial nephrectomy performed under continuous spinal anesthesia (CSA). A 63-year-old woman, active smoker with mild obesity and previous right pneumonectomy, was diagnosed with a growing 5.5-cm renal right cystic tumor. Being at high risk for general anesthesia, a loco-regional approach was indicated. Therefore, after multidisciplinary discussion, a robotic-assisted partial nephrectomy under CSA was considered mandatory. After T4-T5 sensory and motor block, retroperitoneoscopic robot-assisted surgery was successfully performed. Postoperative period was uneventful, with optimal pain control. This unique case demonstrates the feasibility of robotic surgery under CSA, for imperative indications.

1. Introduction

Major laparoscopic procedures are commonly performed under general anesthesia (GA). In the last years, regional anesthesia has been proposed as an alternative in selected patients for diagnostic micro-laparoscopy or for minor gynecologic surgeries, to avoid airway manipulation and to enhance recovery.[1,2] Robotic surgery has almost replaced laparoscopy for major urological procedures such as radical prostatectomy and complex partial nephrectomies. GA is typically required for robotic surgeries given that robotic arms are docked to the patient.[3] We present the first case of awake robotic partial nephrectomy performed on a patient unfit for GA, harboring a complex cystic kidney tumor.

2. Case presentation

A 63-year-old women presented with a 5.5-cm cystic right renal tumor (Bosniak IV, PADUA score 9) showing a significant growth (+1 cm/year). Partial nephrectomy was feasible (Fig. 1A) and recommended (eGFR 80 ml/min); active surveillance was abandoned due further growth risk and patient preference. She was heavy smoker, mildly obese (BMI 30), having a history of right pneumonectomy for lung cancer (2012) and subsequent severe restrictive respiratory syndrome. At admittance, vital signs and routine lab exams were normal. Ejection fraction (EF) was 60% with no signs of pulmonary hypertension. Lung function tests revealed a forced expiratory volume over 1 second (FEV1) of 0.86 L (40% predicted), a forced vital capacity (FVC) of 0.98 L (38% predicted) and diffusion lung carbon monoxide (DLCO) (36% predicted). The American Society of Anesthesiologists (ASA) score was grade 4. The risk associated with GA was deemed too high and only partially evaluable through standard risk scales and the patient had been refused surgery in other tertiary cancer centers. After multidisciplinary meeting, we opted for a robot-assisted surgery under continuous spinal anesthesia (CSA): the reasons are reported in the discussion. After a thorough informed consent, the patient accepted to undergo surgery.

2.1. Preoperative and intraoperative anesthesia

On arrival in the operating room, vital signs were normal. Peripheral venous, central venous, and arterial lines were obtained. With the patient in lateral decubitus, aided by a spine ultrasound, the subarachnoid space was identified in the T8-T9 interspace with a 20-G Tuohy needle (SpinoLong Tuohy 20-G x 90 mm,Temena). A 24-G spinal catheter (SpinoLong Tuohy Kit, Temena) was positioned with the 10 cm mark at the skin. A subarachnoid T4-T5 sensory and motor block was achieved with 1 mL 0.5% isobaric levobupivacaine within 15 minutes. Target-controlled conscious sedation (Bispectral Index value between 70 and 85) was achieved through propofol, remifentanil and ketamine

* Corresponding author.
E-mail address: paolo.gontero@unito.it (P. Gontero).

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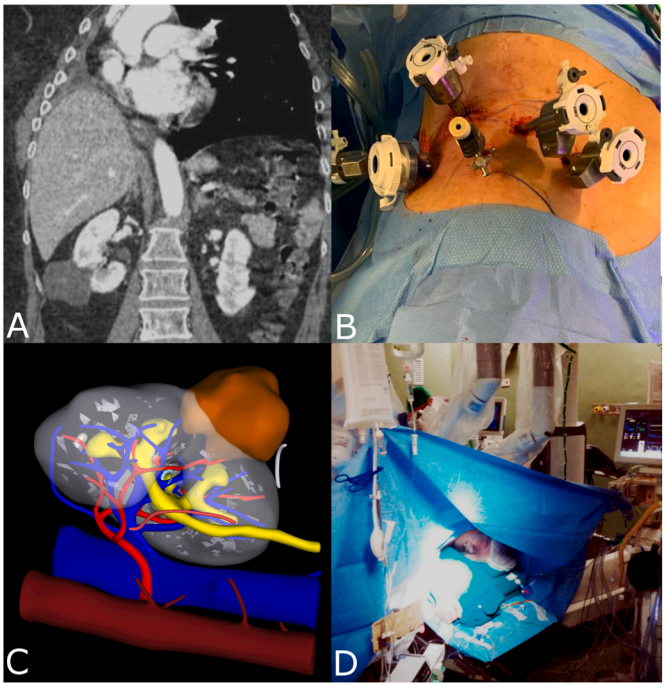

Fig. 1. A: Preoperative CT-scan; B: Port placement; C: 3D reconstruction of the right kidney and of the tumor mass; D: Awake patient during the procedure (left decubitus position).

infusions. Hypotension required intravenous noradrenaline (0,1 mcg/kg/min) for the first 30 minutes; hemodynamics remained then stable. Anesthetic boluses and vital signs during the operation are recorded in Table 1.

2.2. Robot-assisted partial nephrectomy

Patient was placed in left decubitus position, with a mild scissoring. The retroperitoneum was accessed at the apex of the XII rib and developed with a dedicated balloon. Trocars disposition is shown in Fig. 1B. Pneumo-retroperitoneum of 8 mmHg was achieved with Air Seal (ConMed, Milford, Connecticut, USA). Da Vinci Xi robot was then docked. Surgery was guided by 3D reconstructions of the kidney (Medics Srl, Moncalieri, Italy, Fig. 1C), displayed by the Tile-Pro function. After renal artery clamping, partial nephrectomy of the renal mass was performed. Warm ischemia time was 25 minutes. The patient remained perfectly still during the entire procedure, which lasted 2h45 (Fig. 1D).

2.3. Postoperative management

During Intensive Care Unit (ICU) monitoring, analgesia was provided by paracetamol 1 g every 8 hours in addition to 0.16% levobupivacaine at 0.5 mL/h through the spinal catheter. The Visual Analogue Scale score for pain was never higher than 1. On post-operative day 3, the spinal catheter and surgical drain were removed. A mild airway infection was treated with piperacilline/tazobactam and respiratory physiotherapy. The patient was discharged on day 9 in stable conditions, with blood creatinine of 0.64. Pathologic examination revealed a pT1bG1R0 clear cell renal carcinoma.

3. Discussion

Several recent reports suggest that regional anesthesia may be an alternative to GA for laparoscopic surgery, entailing reduced surgical stress, avoidance of airway instrumentation, less emesis, early ambulation and faster recovery with possibly shorter hospital stay. On the other hand, there are risks of hypotension due to sympathetic blockade, hyperesthesia, pain, and also increased surgical time due to the limitation of intra-abdominal pressure.[1] The awake laparoscopy has been used in minor surgeries, such as diagnostic procedures in case of penetrating abdominal wounds, gynecological surgeries including endometriosis ablation, salpingo-oophorectomy, hysterectomy or sleeve gastrectomies[2,4]

In our case, the choice of a regional anesthesia was imperative, given the very high risk linked to the use of GA. In our opinion, a pure laparoscopic approach would have been unsuitable, due to the high PADUA score and the risk of rupture of the cystic mass, with possible tumor seeding. Open surgery via lumbotomy was unfeasible under regional anesthesia. Therefore, after careful multidisciplinary evaluation and hospital Risk Management permission, we chose to use multiport Da Vinci Xi. To our knowledge, no previous report of a robotic Da Vinci procedure under spinal anesthesia exists and this was confirmed by the manufacturer. 3D kidney reconstructions were adopted to guide excision. The constant communication between anesthesiologists and surgeons was paramount. The retroperitoneal approach was preferred firstly due to posterior, lower pole location of the tumor and also to minimize the peritoneal stretching and the phrenic nerve irritation.

The choice of CSA was due to the predicted duration of surgery. Compared to single-shot spinal anesthesia and continuous epidural anesthesia, CSA allows to use small incremental and titrated doses of local anesthetics, avoiding the hemodynamic effects of a lasting block. Many complications of CSA have been reported, including post-dural puncture headache, bleeding and epidural hematoma, infection, inadvertent catheterization of the subdural space, inadequate anesthesia and catheter breakage during removal.[5] In our case, none of these complications occurred. We acknowledge that the choice of an awake robotic surgery is hardly generalizable.

4. Conclusions

The present case is the first report showing that the use of CSA allows the use of the Da Vinci robot on an awake patient with sufficient safety during a complex procedure like a partial nephrectomy.

Table 1
Intraoperative parameters and timing of spinal boluses of isobaric levobupivacaine.

Time after spinal block	SBD/DBP (mmHg)	HR (beats/min)	SpO_2 (%)	PaO_2 (mmHg)	$PaCO_2$ (mmHg)	Levobupivacaine 0.5% (mg)
10 min	100/50	51	97			
30 min	120/61	52	97	115	46	2.5
60 min	130/65	50	96	157	42	2.5
70 min	143/70	53	97			2.5 + 15 mcg fentanyl
90 min	130/72	56	97	139	52	2.5
120 min	142/65	54	96	123	55	2.5
150 min	123/75	57	96	135	53	
180 min	140/75	63	98	90	48	
At ICU	133/60	62	98	93	42	

DBP diastolic blood pressure, HR heart rate, ICU intensive care unit, PaCO2 partial pressure of carbon dioxide in arterial blood, PaO2 partial pressure of oxygen in arterial blood, SpO2 oxigen saturation, SBP systolic blood pressure.

Consent

A full written consent for publication of this case report was obtained from the patient.

Ethics

The procedures performed in this report were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Authors' contribution

PG and FG conceived the medical procedure; MO and FG wrote the manuscript with support of GC and PG; all the Authors discussed the results, contributed to the discussion and approved the final manuscript.

Supporting data

Supporting data and further information can be requested to the corresponding author (paolo.gontero@unito.it).

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Declaration of competing interest

The authors declare that they have no competing interests.

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List of abbreviations

ASA	American Society of Anaesthesiologists
BP	blood pressure
CSA	continuous spinal anesthesia
DLCO	diffusion lung carbon monoxide
EF	ejection fraction
FEV1	forced expiratory volume over 1 second
FVC	forced vital capacity
GA	general anesthesia
HR	heart rate
ICU	Intensive Care Unit
SpO2	oxygen saturation

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