



Introducing the Toumai™ system for robot-assisted radical prostatectomy: a prospective feasibility and safety study in a tertiary care center

Hugo Otaola-Arca, MD, PhD^{a,b,*}, Alfredo Aliaga, MD, PhD^a, Clara García-Rayó, MD^c, Renato Souper Moreno, MD^a, Pablo Bernier, MD^a, Rodrigo Pinochet, MD^a, Vipul R. Patel, MD^d, Rafael Coelho, MD^e, Marcelo Orvieto, MD^a

Background: The Toumai™ robotic system (MicroPort® MedBot™) is a multiport platform with CE marking for endoscopic procedures in several surgical specialties. To date, clinical experience with robot-assisted radical prostatectomy (RARP) remains limited to a small number of reported cases, with no large or comparative series available. Transitioning to a new robotic platform presents regulatory, logistical, and financial challenges. Further studies are required to evaluate its safety, efficacy, and surgical performance. We aimed to evaluate the feasibility and safety of RARP with the second-generation Toumai™ (MT1000) and describe its key features for centers considering this technology.

Materials and methods: A prospective case series of RARP in patients with localized prostate cancer was performed using the Toumai™ MT1000 platform. The primary objective was to evaluate the feasibility and safety of the novel robotic system. The secondary objective was to characterize perioperative variables.

Results: Fifty patients were included in the final analysis. All surgeries were completed without conversion or intraoperative complications. One patient experienced a postoperative non-urological complication requiring reoperation, and another developed acute urinary retention. The median age was 65 years (interquartile range [IQR]: 8.5), body mass index was 27.1 kg/m² (IQR: 5.1), and 96% were ASA I–II. Median docking time was 7.5 minutes (IQR: 7), console time 165 minutes (IQR: 50), and total OT 190 minutes (IQR: 65). Median estimated blood loss was 200 mL (IQR: 237), length of hospital stay 2 days (IQR: 1), and catheter duration 7 days (IQR: 1). Seventy percent were pT2, and 30% pT3, with an 18% positive margin rate. Minor issues included rebooting the patient cart in 6% of cases and replacing scissors in 4% of procedures. We analyzed our data by tertiles to assess the learning curve and found no significant changes over time, except for console time, which increased (median of 180, 190, and 220 minutes), and the PSM, which decreased (25%, 20%, and 13.3%).

Conclusions: This study presents an initial, non-comparative, single-center experience with the Toumai™ robotic system for RARP, demonstrating its feasibility and safety in a limited cohort. Additionally, it provides valuable insights to assist medical centers and surgeons interested in adopting this technology.

Keywords: case series, robot-assisted radical prostatectomy, robotic surgery, Toumai MT-1000 robotic system

Introduction

Starting a surgical program with a robotic platform or switching to a different platform is complex. Despite the emergence of various robotic systems over the decades, including single-port

HIGHLIGHTS

- Toumai™-assisted robot-assisted radical prostatectomy is feasible (it permits the completion of surgical procedures without the need to convert to conventional techniques).
- TOUMAI™-assisted robot-assisted radical prostatectomy is safe, with a low rate of intraoperative or postoperative complications.
- We report an overview of perioperative metrics and key features of the robotic platform, which offer valuable guidance for medical centers and surgeons interested in adopting this technology.

^aDepartment of Urology, Clínica Alemana, Santiago, Chile, ^bFaculty of Medicine, Clínica Alemana-Universidad del Desarrollo, Santiago, Chile, ^cDepartment of Urology, Hospital 12 Octubre, Madrid, Spain, ^dDepartment of Urology, AdventHealth Global Robotics Institute, Celebration, USA and ^eUniversidade de São Paulo, Instituto do Câncer do Estado de São Paulo, Brazil

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*Corresponding author. Address: Department of Urology, Clínica Alemana, Avda. Manquehue Norte 1410, Piso 12, Vitacura, Región Metropolitana, Santiago, Chile. Tel.: +56 2 2210 1111. E-mail: hugotaolarca@hotmail.com (H. Otaola-Arca).

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and multiport models, one company still dominates the global market^[1,2].

Evaluating new technologies on patients before purchasing can be arduous. The regulatory landscape for surgical technologies is daunting, as each platform must meet stringent safety and efficacy standards, which vary depending on country-specific regulations. These factors must be considered when assessing the financial implications of acquiring and maintaining new technology.

The ToumaiTM (MicroPort® MedBotTM, Shanghai, China) is a multiport robotic platform with a CE mark for endoscopic surgeries, including urological, general, thoracic, and gynecological procedures. To date, only two small Chinese series have been published on robot-assisted radical prostatectomy (RARP): Pokhrel *et al* ($n = 3$) and Tan *et al*^[3,4] ($n = 5$). El Anzoui *et al* reported the installation of the ToumaiTM at a private hospital in Casablanca, but no data were included^[5]. Web reports mention Prof. Karaznashvili performing a RARP in Georgia, marking the 100th procedure at his center across urology, gynecology, and general surgery; however, no journal publication exists^[6] (Supplemental Digital Content Table available at: <http://links.lww.com/JS9/H518>). Further research is needed to assess its efficacy, safety, reliability, and performance.

Our objective was to assess the feasibility and safety of RARP using the ToumaiTM robotic system in a tertiary center. Furthermore, we aimed to describe its key features to guide centers considering this technology.

Materials and methods

Study design and patient selection

This is a prospective case series of RARP with the second-generation ToumaiTM (MT1000) system. The inclusion criteria were the following: scheduled for RARP with histologically confirmed prostate adenocarcinoma on prostate biopsy, clinical stage T1-3N0-1M0, and aged 18–80 years. Exclusion criteria included the inability to cooperate during follow-up. Four experienced robotic surgeons with the da Vinci system (dVS) Xi performed all procedures as part of a well-established robotic team. Patient enrollment was consecutive. Surgeries were performed over 32 working days, with one or two per day. The study was registered on ISRCTN.com^[7]. All participants signed a written informed consent. Following international guidelines^[8], patients underwent preoperative evaluation using magnetic resonance imaging (MRI) and positron emission tomography with computed tomography (PET-CT) with prostate-specific membrane antigen (PSMA) as a radioactive tracer.

Outcomes

The primary objective was to evaluate the feasibility and safety of the novel robotic system. Feasibility was defined as the successful completion of surgical procedures without the need to convert to conventional techniques. Safety was evaluated by documenting intraoperative or postoperative complications. The secondary objective was to characterize perioperative variables associated with this new robotic platform and to describe its key features to assist centers considering this technology. Patients for whom all perioperative information was unavailable were excluded from the analysis.

We assessed the lower urinary tract symptoms using the International Prostate Symptom Score questionnaire, the continence domain using the ICIQ-SF (International Consultation on Incontinence Questionnaire – Short Form), and erectile function using the IIEF-5 (International Index of Erectile Function – 5) at baseline, as well as during the first and third months after surgery.

Nominal variables were described with absolute numbers and percentages; quantitative variables were described with the median and interquartile range (IQR). No formal sample size

calculation was performed. The number of patients included corresponded to all consecutive eligible cases treated. This case series has been reported in line with the STROCSS guidelines^[9].

The ToumaiTM robotic system overview

The ToumaiTM (Shanghai MicroPort® MedBotTM Group Co., Ltd., Shanghai, China) is a multiport robotic platform approved by the Chinese State Food and Drug Administration in January 2022 and the European Union Medical Device Regulation in May 2024.

The surgical platform is a master-slave system composed of three components (Fig. 1A–C)

1. The surgeon console features a 3 dimensional (3D) stereoscopic vision system, providing an immersive first-person perspective via a built-in high-definition (HD) screen. The head-aware auto-lock and safeguarded foot pedal enhance safety against inadvertent activation. Additional console properties include:
 - Armrest with a touchscreen control panel for adjusting ergonomic parameters and other settings.
 - Emergency power/stop button.
 - Two master control arms with hand controls provide surgical instruments with tremor-free and wristed movements, offering seven degrees of freedom and 540° of rotation.
 - Foot pedals (arm swap pedal, master-slave clutch, endoscope control, left and right electric cutting, and coagulating).
2. The vision cart includes a 27" 2-dimensional screen (1920 × 1080), an endoscopic imaging processor (MVS-828), an illuminator (CLS-2000) that provides an adjustable high-intensity light source, and an ERBE VIO 300 D electrosurgical generator.
3. The patient cart is composed of four key components: (1) the base, which provides support for all upper devices and standalone units; (2) the handlebar, which facilitates movement of the cart and houses controls for setting up and positioning the patient platform; (3) an adjustable column, which allows for height adjustment; and (4) the boom, which serves as a rotating support structure featuring four robotic arms. These arms can pivot around the column (right and left) and rotate (clockwise and counterclockwise). Each arm has an individual range of motion, a paired range of motion, and a snake-shaped joint that carries surgical instruments and an endoscope. To maintain a sterile environment, all arms are covered with sterile drapes. Additionally, the system is equipped with advanced features, including force sensors and joint oscillation sensors.

The ToumaiTM features a lightweight 10-mm diameter 1080p full HD electronic endoscope with a 90° field of view, providing precise vision. The endoscopes are equipped with one cable for transmitting cold light and another for capturing images.

During the RARP procedure, 0° optics were primarily used, except when dissecting the posterior aspect of the prostate and the neurovascular bundles, where 30° up optics were used instead. Additionally, we utilized monopolar curved scissors, Maryland bipolar forceps, Cadieere forceps, and two needle drivers.

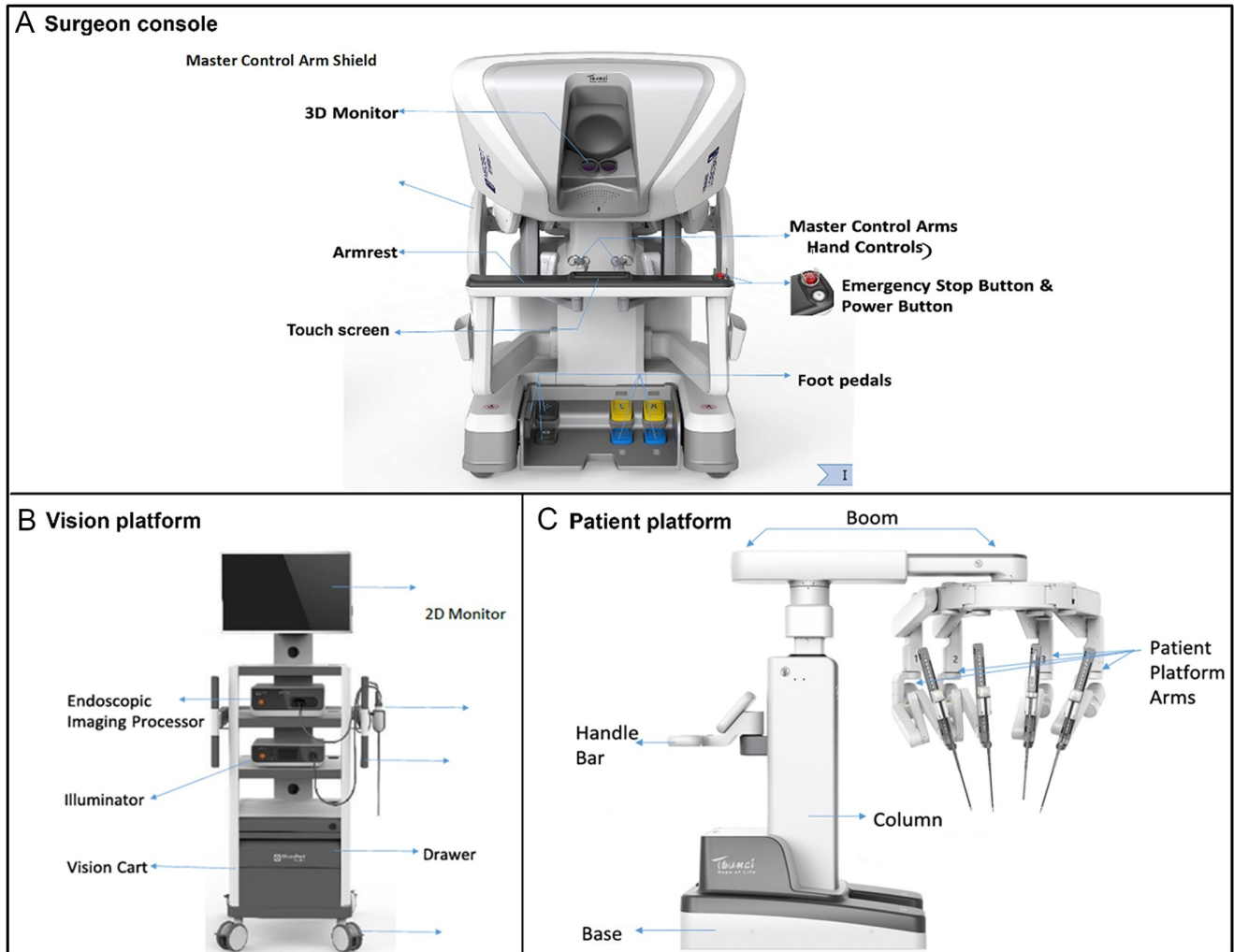


Figure 1. System component overview of the Toumai™ (MicroPort® MedBot™) system. (A) Surgeon console. The Toumai™ console provides an ergonomic and immersive 3D high-definition view, enabling precise instrument control with motion scaling and tremor filtration—features particularly advantageous for the delicate dissection of the neurovascular bundle and urethrovessel anastomosis during radical prostatectomy. (B) Vision platform. The integrated vision cart delivers high-resolution imaging and real-time synchronization between the console and patient cart, ensuring consistent visual fidelity throughout the procedure. (C) Patient platform. The patient cart features four robotic arms with an enhanced range of motion and stable instrument control, facilitating precise movements within the confined pelvic space and improving accuracy and safety at all stages of RARP.

Procedure

Patients were positioned supine with a 23° Trendelenburg position. Two grams of ceftriaxone were administered during induction. After creating pneumoperitoneum with a Veress needle, ports were placed as follows: a 10-mm endoscope port located 3–4 cm above the umbilicus; three 8-mm robotic ports were placed under vision (two at the umbilicus level and one on the right flank, 3 cm above and medial to the anterior superior iliac spine for the fourth arm); and two additional laparoscopic ports for the assistant (a 12-mm AirSeal® port and a 5-mm port) (Fig. 2). The vision cart was positioned near the patient's feet, with the assistant working on the left side. The patient cart was placed on either side, with the scrub nurse on the opposite side.

RARP was performed using a transperitoneal anterior approach, as previously described^[10]. The procedure involved an extended pelvic lymph node dissection (ePLND) for patients identified as having a high risk of nodal involvement, as

determined by Briganti's nomogram score $\geq 7\%$ ^[11]. An 18-French urethral catheter was placed and removed on the seventh postoperative day. The patient is usually discharged the day after surgery. Our thromboprophylaxis protocol includes pneumatic stockings during surgery and until ambulation, elastic stockings until discharge, 0.5 mg/kg enoxaparin from 6 hours post-surgery until discharge, and 10 mg/day rivaroxaban for 10 days after discharge.

Results

Table 1 summarizes the characteristics of the 50 patients included in this case series. Supplemental Digital Content Figure 1, available at: <http://links.lww.com/JS9/H517> offers a flow diagram of the included patients. All procedures were completed without the need for conversion or additional port placement. No intraoperative complications were recorded. Two postoperative complications

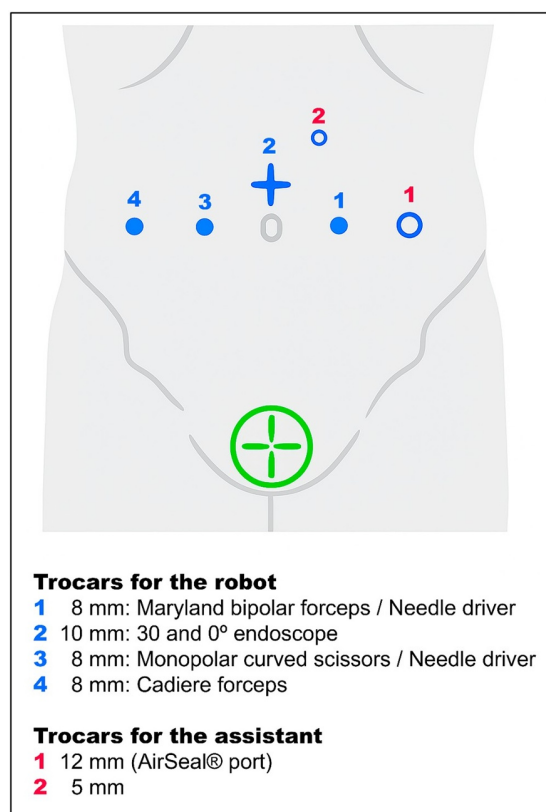


Figure 2. The disposition of trocars in the abdomen. Numbers 1–4 in blue correspond to the robotic arm trocars, and numbers 1–2 in red correspond to the assistant trocars.

occurred (4%). One patient with high-risk prostate cancer and recent episodes of diverticulitis showed signs of abdominal sepsis on the second day post-surgery. A CT scan revealed an air-fluid collection near the site of the last diverticulitis episode. Laparoscopy found no intestinal injury, and intensive lavage was performed. The patient was discharged after 1 month (including ICU stay) (Clavien IV complication). After removal of the Foley catheter on day seven post-surgery, one patient experienced acute urinary retention, which was treated with 5 more days of catheterization (Clavien I). No readmissions occurred.

The median age was 65 years (IQR: 8.5), the median body mass index was 27.1 kg/m² (IQR: 5.1), and 48 patients (96%) were grade I-II on the American Society of Anesthesiologists (ASA) classification. The median preoperative prostate-specific antigen (PSA) level was 5.3 ng/mL (IQR: 3.3), and six (12%) patients had a suspicious digital rectal examination.

On preoperative MRI, the median prostate volume was 46.7 mL (IQR: 25.2). Four patients (8.8%) were suspected of extracapsular extension (ECE), and none of them were suspected of seminal vesicle invasion. According to the PI-RADS classification, 7 patients (15.6%) were PI-RADS 2-3, and 38 patients (84.4%) were PI-RADS 4-5. When performed, PET-CT PSMA identified all cases as non-metastatic. Seven patients (14%) had an International Society of Urological Pathology (ISUP) grade group 1 tumor on transrectal prostate biopsy, 32 (64%) had an ISUP grade 2-3, and 11 (22%) had an ISUP grade 4-5. According to the D'Amico classification, seven patients (14%) had low-risk disease, 30 (60%) had intermediate-risk disease, and 13 (26%) had high-

Table 1

Baseline characteristics and perioperative description.

	Patients <i>n</i> = 50
Age (yr), median (IQR)	65 (8.5)
BMI (kg/m ²), median (IQR)	27.1 (5.1)
ASA, <i>n</i> (%)	
I	4 (8)
II	44 (88)
III	2 (4)
Preoperative PSA (ng/mL), median (IQR)	5.3 (3.3)
Digital rectal examination, <i>n</i> (%)	
Normal	44 (88)
Suspicious	6 (12)
Prostate volume on MRI (mL), median (IQR) ^a	46.7 (25.2)
Extracapsular extension on MRI, <i>n</i> (%) ^a	
No	41 (91.1)
Yes	4 (8.8)
Seminal vesicle invasion on MRI, <i>n</i> (%) ^a	
No	45 (100)
Yes	0 (0)
PI-RADS score on MRI, <i>n</i> (%) ^a	
PI-RADS 2	1 (2.2)
PI-RADS 3	6 (13.3)
PI-RADS 4	19 (42.2)
PI-RADS 5	19 (42.2)
ISUP on prostate biopsy, <i>n</i> (%)	
ISUP 1	7 (14)
ISUP 2	22 (44)
ISUP 3	10 (20)
ISUP 4	4 (8)
ISUP 5	7 (14)
Clinical T stage, <i>n</i> (%)	
cT1a	1 (2)
cT1c	39 (78)
cT2a	5 (10)
cT2b	1 (2)
cT3a	3 (6)
cT3b	1 (2)
Clinical N stage, <i>n</i> (%)	
cN0	48 (96)
cN1	2 (4)
D'Amico classification, <i>n</i> (%)	
Low risk	7 (14)
Intermediate risk	30 (60)
High risk	13 (26)

ASA, American Society of Anesthesiologists; BMI, Body Mass Index; IQR, interquartile range; ISUP, International Society of Urological Pathology; MRI, magnetic resonance imaging; PI-RADS, Prostate Imaging Reporting and Data System; PSA, prostate-specific antigen.

^aFive patients did not have a preoperative prostate MRI.

risk disease. According to Briganti's score, ePLND was performed in 31 (62%) patients.

The median docking time was 7.5 min (IQR: 7), the console time was 165 min (IQR: 50), and the total operative time (TOT) was 190 min (IQR: 65) (Table 2). The median estimated blood loss (EBL) was 200 mL (IQR: 237.5). The length of hospital stay (LOS) was 2 days (IQR: 1), and the duration of bladder catheterization was 7 days (IQR: 1). No acute urinary retention occurred after catheter removal. The median PSA at 6 weeks was 0.01 ng/mL (IQR: 0.05). The median follow-up duration was 4 months (IQR: 4.5), with all patients observed for more than 3 months and 21 patients (42%) followed for over 6 months.

Table 2
Intra and postoperative outcomes.

	Patients n = 50
Intraoperative	
Docking time (min), median (IQR)	7.5 (7)
Console time (min), median (IQR)	165 (50)
Total operative time (min), median (IQR)	190 (65)
Estimated blood loss (mL), median (IQR)	200 (237.5)
Conversion to open surgery, n (%)	
No	50 (100)
Yes	0 (0)
Additional port placement, n (%)	
No	50 (100)
Yes	0 (0)
Intraoperative complications, n (%)	
No	50 (100)
Yes	0 (0)
System failures, n (%)	
No failure	45 (90)
Instrument failure	2 (4)
Platform failure	3 (6)
Postoperative	
Length of hospital stay (days), median (IQR)	2 (1)
Urinary catheter time (days), median (IQR)	7 (1)
Extracapsular extension, n (%)	
No	38 (76)
Yes	12 (24)
Seminal vesicle invasion, n (%)	
No	45 (90)
Yes	5 (10)
ISUP on specimen, n (%)	
ISUP 1	0 (0)
ISUP 2	24 (48)
ISUP 3	14 (28)
ISUP 4	3 (6)
ISUP 5	9 (18)
Surgical margin status, n (%)	
Negative	41 (82)
Positive	9 (18)
Size of the surgical margin, mm (IQR)	1(4.5)
Pattern at the surgical margin, n (%)	
Pattern 3	3 (33.3)
Pattern 4	6 (66.7)
Type of surgical margin, n (%)	
Monofocal	4 (44.4)
Bifocal	5 (55.6)
Location of the surgical margin, n (%)	
Apex, anterior	2 (22.2)
Apex, lateral	1 (11.1)
Apex, posterior	2 (22.2)
Middle third, anterior	1 (11.1)
Middle third, posterior	1 (11.1)
Base, lateral	2 (22.2)
Pathological T stage, n (%)	
pT2	35 (70)
pT3a	10 (20)
pT3b	5 (10)
Total lymph nodes removed, (number), median (IQR)	20 (13)
Pathological N stage, n (%)	
pNx	19 (38)
pN0	26 (52)
pN1	5 (10)

(Continues)

Table 2
(Continued).

	Patients n = 50
Postoperative complications, n (%)	
No	47 (94)
Clavien I–II	1 (2)
Clavien III–IV	1 (2)
Re-admission, n (%)	
No	50 (100)
Yes	0 (0)
Re-operation, n (%)	
No	48 (96)
Yes	1 (4)
PSA at six weeks (ng/mL), median (IQR)	0.01 (0.01)
Follow-up (mo), median (IQR)	4 (4.5)

IQR, interquartile range; ISUP, International Society of Urological Pathology; PSA, prostate-specific antigen.

In surgical specimens, 38 patients (76%) had ISUP 2-3 tumors, and 12 (24%) had ISUP 4-5 tumors. Twelve patients (24%) exhibited ECE. According to the pathological stage, 35 patients (70%) were classified as pT2, 10 (30%) as pT3a, and 5 (10%) as pT3b. Five patients (10%) among those subjected to ePLND had positive lymph nodes on final pathology. Nine patients (18%) had a positive surgical margin (PSM) (all in pT3 disease, and no pattern five was found).

Functional outcomes are summarized in Table 3. Notably, 11.1% (5 patients) and 59.1% (26 patients) had some preoperative urinary incontinence or erectile dysfunction. Additionally, 24.4% (11 patients) and 35.6% (16 patients) were completely dry at the first and third months, respectively. About 21% had normal sexual potency at those follow-ups.

We analyzed our data by tertiles to assess the learning curve. We found no significant changes over time (Table 4), except for TOT (median of 180, 190, and 220 min), which increased primarily due to the increment in console time, and the PSM, which decreased over time (23.5%, 17.6%, and 12.5%).

We replaced scissors in two (4%) procedures due to pulley failure before reaching their lifespan. In three (6%) cases, we had to restart the patient cart (approximately 5 minutes) due to image lag at the start of surgery. Table 5, Figures 3, 4A–B, and 5 detail the objectives we set for successful docking, the problems we encountered, and the solutions we developed.

Discussion

This study reports the largest prospective clinical series of RARP performed with the Toumai™ robotic system to date. Feasibility was demonstrated by the successful completion of all RARP procedures using the Toumai™ platform, without conversion or unplanned port placement, despite this being the first clinical experience at our institution. No intraoperative complications were recorded, and the overall postoperative complication rate was low. One patient experienced acute urinary retention

Table 3
Functional results during the follow-up period.

	Baseline	1st mo	3rd mo
LUTS categories according to the IPSS questionnaire			
Without LUTS (0 points), <i>n</i> (%)	6 (13.3)	0 (0)	0 (0)
Mild LUTS (1–7 points), <i>n</i> (%)	21 (46.6)	20 (44.4)	32 (71.1)
Moderate LUTS (8–19 points), <i>n</i> (%)	15 (33.3)	23 (51.1)	11 (24.4)
Severe LUTS (20–35 points), <i>n</i> (%)	3 (6.6)	2 (4.4)	2 (4.4)
UI categories according to the ICIQ-SF questionnaire ^a			
Without UI (0 points), <i>n</i> (%)	40 (88.8)	11 (24.4)	16 (35.5)
Mild UI (1–5 points), <i>n</i> (%)	2 (4.4)	9 (20.0)	16 (35.5)
Moderate UI (6–12 points), <i>n</i> (%)	3 (6.6)	19 (42.2)	12 (26.6)
Severe UI (13–18 points), <i>n</i> (%)	0 (0)	5 (11.1)	0 (0)
Very severe UI (19–21 points), <i>n</i> (%)	0 (0)	1 (2.2)	1 (2.2)
ED categories according to the IIEF-5 questionnaire ^{ab}			
No ED (22–25 points), <i>n</i> (%)	18 (40.9)	8 (21.6)	9 (21.4)
Mild ED (17–21 points), <i>n</i> (%)	14 (31.8)	10 (27.0)	14 (33.3)
Mild-Moderate ED (12–16 points), <i>n</i> (%)	5 (11.3)	2 (5.4)	6 (14.2)
Moderate ED (8–11 points), <i>n</i> (%)	2 (4.5)	2 (5.4)	2 (4.7)
Severe ED (1–7 points), <i>n</i> (%)	5 (11.3)	15 (40.5)	12 (28.5)

ED, Erectile Dysfunction; ICIQ-SF, International Consultation on Incontinence Questionnaire – Short Form; IIEF-5, International Index of Erectile Function-5; IPSS, International Prostate Symptom Score; LUTS, Lower Urinary Tract Symptoms; UI, Urinary Incontinence.

^aOnly 45 out of 50 patients completed the questionnaires.

^bSome patients were sexually inactive for reasons other than erectile dysfunction (1, 8, and 2 patients at baseline, 1 month, and 3 months, respectively).

(Clavien I), and one patient had a postoperative non-urological complication, which required reoperation and ICU admission (Clavien IV). The single major complication observed was non-urological and unrelated to the robotic platform. Overall complication rates were comparable to those in contemporary RARP series using both emerging and established robotic systems, in which major complication rates typically range from 0% to 10%^[12–15].

In our series, the median console time and TOT were 165 and 190 minutes, respectively. The median EBL was 200 mL, and the median LOS was 2 days. Other innovative multiport robotic

platforms have shown similar outcomes for RARP. For example, Bravi *et al*^[16] reported a median TOT of 180 minutes, an EBL of 400 mL, and an LOS of 3 days. Shen *et al*^[15] found a median console time of 116.9 minutes, a TOT of 177.5 minutes, and an EBL of 100 mL with KangDuo. Miyake and Fujisawa^[13] documented a median console time of 165 minutes and an EBL of 162.5 mL with the Hinotori.

We performed ePLND in 62% of patients according to the Briganti nomogram. Some authors perform more cautious surgeries when introducing new platforms to avoid complications. For example, in a trial comparing RARP with KangDuo versus

Table 4
Operative and perioperative results across learning curve terciles.

	1st tertile (<i>n</i> = 17)	2nd tertile (<i>n</i> = 17)	3rd tertile (<i>n</i> = 15)
Docking time (min), median (IQR)	6 (12.5)	6 (4.5)	9 (5)
Console time (min), median (IQR)	150 (47.5)	175 (55)	180 (82.5)
Total operative time (min), median (IQR)	180 (50)	190 (70)	210 (86.25)
Estimated blood loss (mL), median (IQR)	200 (225)	200 (150)	300 (275)
Length of hospital stay (days), median (IQR)	2 (1)	1 (1)	2 (0)
Urinary catheter time (days), median (IQR)	7 (1)	7 (1)	7 (0)
Lymphadenectomy, <i>n</i> (%)			
No	10 (58.8)	4 (23.5)	5 (31.3)
Yes	7 (41.2)	13 (76.5)	11 (68.7)
Surgical margin status, <i>n</i> (%)			
Negative	13 (76.5)	14 (83.4)	14 (87.5)
Positive	4 (23.5)	3 (17.6)	2 (12.5)
Postoperative complications, <i>n</i> (%)			
No	17 (100)	16 (94.1)	15 (93.8)
Clavien I–II	0 (0)	0 (0)	1 (6.2)
Clavien III–IV	0 (0)	1 (5.9)	0 (0)
PSA at 6 weeks (ng/mL), median (IRQ)	0.01 (0.01)	0.01 (0.01)	0.01 (0.01)

IQR, interquartile range; PSA, prostate-specific antigen.

Table 5
Objectives, problems, and solutions for successful robot docking.

	Arm arrangement	Assistant's vision of the screen
Objective	<ul style="list-style-type: none">● Avoid collisions between the robot's arms● Avoid collisions between the robot's arms and the patient's legs	<ul style="list-style-type: none">● Allow the assistant to see the vision cart screen.
Problems	<ul style="list-style-type: none">● The arms cannot rotate on their longitudinal axis (like the daVinci's "patient clearance" system) to achieve more space between the arm and other structures (like another robotic arm or the patient's leg, for example)	<ul style="list-style-type: none">● The vision cart screen has limited mobility (Fig. 4) due to the design of its articulated arm, which consists of a straight rigid section and two joints, unlike other laparoscopic or robotic towers that have two rigid sections and three joints.
Solutions	<ul style="list-style-type: none">● Maintain a fist-width distance between the robotic arms.● Check the tilting angles of each arm once secured to the trocar and before use to detect possible collisions, particularly during maximum lateral tilts.● Ensure that arm 3 achieves a good lateral tilt by verifying that it can slide medially to arm 4 (Fig. 3), to ensure the greatest range of lateral movement (especially important if a lymphadenectomy is planned).● Position the endoscope arm (arm 2) between the legs.	<ul style="list-style-type: none">● We did not achieve a good view of the screen included in the vision cart (Fig. 5), so we used an auxiliary screen to the left of the vision cart.

dVS, they performed less ePLND (15% vs. 38.5%). We were able to perform the planned surgery for each patient, including neurovascular bundle preservation and lymph node dissection, without platform limitations, redocking, or needing to change the docking tip (see Fig. 3), with a median harvest of 20 lymph nodes per patient.

Our overall PSM rate was 18%, all in pT3 tumors. Additionally, we observed a decrease in PSM across the tertiles (23.5%, 17.6%, and 12.5%). In the literature, the PSM rate in pT2 tumors is usually lower (12–17%) than in those with ECE (pT3) (28%)^[17–21]. Initial experiences with other novel robotic platforms showed similar rates (9%–25% with Hugo RAS^[14,22], 45% with KangDuo^[15], 10%–47.2% with Hinotori^[13,23]).

Although functional outcomes weren't the primary focus, early recovery of continence and erectile function aligned with previous RARP data from high-volume centers^[18]. Due to limited follow-up and a non-comparative design, interpret these findings cautiously and as a preliminary hypothesis-generating study.

Before our first human procedure, the entire surgical team (by role) received formal training from the company (dry lab),

familiarizing us with the platform and workflow. Since the docking process is quite similar between Toumai™ and dVS Xi – used in over 2000 surgeries – adapting was quick. The company's technical staff also provided support during surgeries.

Most variables remained stable across tertiles in our analysis, except for total operating time, which increased mainly due to longer console time. This correlates with more lymphadenectomies in the higher tertiles and an early focus on optimal console times during the Toumai™ system's initial use, possibly impacting dock and console durations. Overall, switching from dVS to Toumai™ was smooth, with experienced surgeons quickly adapting without a steep learning curve, similar to other robotic systems like the Hinotori system^[24].

Previous publications on new platforms lack detailed technical event descriptions^[14,15,22,23]. Miyake and Fujisawa^[13] reported 13.3% recoverable errors with Hinotori. In our series, 4% of procedures required instrument replacement due to premature pulley failure, which was resolved by reinforcing preoperative checks and maintaining communication with the manufacturer. System image lag necessitated rebooting the patient cart in 6% of cases, without affecting critical steps. Rebooting is quick and doesn't require undocking. The Toumai™ platform has two backup batteries for independent operation; if one battery restarts, the image remains unaffected, unlike other platforms that lose vision. Additionally, when the robot restarts, the patient cart calibrates its arms, skipping calibration for any arm with a sterile drape.

It is worth mentioning some features of this new robotic platform. The Toumai™ is approved for use in urology, thoracic surgery, general surgery, gynecology, nail and breast surgery, and pediatric surgery. In contrast, platforms like CMR, Revo-I, and Hugo RAS lack approvals for pediatric or nail and breast surgery. The latest Toumai™ version features fluorescence with indocyanine green dye and a hybrid mode that combines normal and near-infrared vision. The surgical team can use picture-in-picture technology on both displays (the assistant's and the surgeon's) to show static images, such as CT slices, alongside real-time visuals from ultrasound. A helpful feature for novices is the on-screen display of instrument rotation. Additionally, vision quality can be improved by digitally eliminating smoke using AI.



Figure 3. Maximizing the lateral tilt of arm 3. The figure shows how arm 3 (red line) achieves maximum lateral tilt by sliding medially to arm 4 (yellow dotted circle).

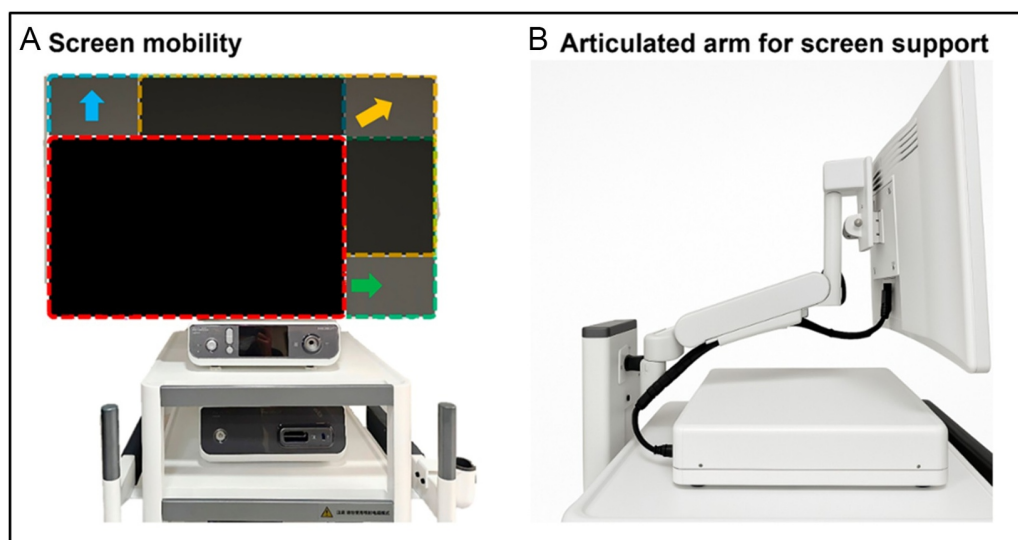


Figure 4. The mobility of the cart's screen. (A) The red dotted line represents a possible initial position of the vision cart screen, while the blue, yellow, and green arrows, along with their respective dotted lines, represent the maximum range of motion allowed due to the structural characteristics of the arm supporting the screen. (B) An articulated arm composed of one straight rigid section and two joints.

The surgical team highlighted several downsides of the Toumai™ robotic system. First, the 10-mm trocar for the endoscope is the only one with a gas access valve, limiting its use in complex cases where umbilical placement is infeasible. Second, the system doesn't allow simultaneous use of cautery devices and camera maneuvering, unlike other platforms such as dVS, which facilitate quick repositioning. Third, the vision cart's generator has only one monopolar connection port; however, RARP usually requires two monopolar devices – one handheld and one robotic – requiring staff to switch connections at the start and end of surgery. Fourth, the platform lacks automatic arm and boom deployment, which may slow docking, although it's usually straightforward for trained teams. Fifth, the touchscreen enables pedalboard adjustments, unlike other ergonomic settings that rely on buttons, which can potentially delay changes. Lastly, the communication system

between the surgeon and the patient-side assistant has technical issues, including audio delays.

The study's strengths include its prospective design, standardized data collection, and performance by an experienced robotic team, which allow for an accurate assessment of platform-related factors. Limitations include the single-institution design and short-term follow-up, which may miss some potential outcomes and late complications. Despite these limitations, our findings provide valuable insights that support the development of innovative robotic systems in urology.

Conclusions

This study presents an initial, non-comparative, single-center experience with the Toumai™ robotic system for RARP, demonstrating its feasibility and safety in a limited cohort. The report provides a preliminary overview of perioperative metrics and key features of the robotic platform, offering valuable guidance to medical centers and surgeons considering adoption. The report also highlights minor technical challenges and suggests practical solutions for optimal docking and workflow. In addition, it includes promising early functional and oncological data from the platform in urological surgeries, although long-term confirmatory studies are needed.

Ethical approval

The study was approved by the institution's Scientific Ethics Committee prior to recruitment.

Consent

All participants signed a written informed consent.

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Figure 5. The assistant's view of the cart's screen. The view of the screen through the bars is fragmented, resulting in an incomplete view.

Author contributions

Study concept or design: H.O.-A.; data collection: H.O.-A., A. A., C.R.; data analysis or interpretation: H.O.-A.; writing the paper: H.O.-A.; reviewing the manuscript: H.O.-A., A.A., C.R., R.S., P.B., R.P., V.P., R.C., M.O.

Conflicts of interest disclosure

The authors declare that they have no conflicts of interest.

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Use of artificial intelligence

The authors declare that they did not use artificial intelligence in the development of this work.

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