Research Square

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Comparison of Short-Term Oncological and Functional Outcomes Between the da Vinci and Toumai Platforms in Robotic Radical Prostatectomy

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Abstract

Purpose

Robot-assisted radical prostatectomy (RARP) is a standard treatment for localized prostate cancer (PCa). As new, lower-cost robotic platforms reach Latin America, comparative evidence remains scarce. We compared complications, and short-term oncological and functional outcomes between the da Vinci and the new Toumai platforms in RARP.

Materials and methods

Single-center, prospective, non-randomized study of patients older than 40 years with localized PCa undergoing RARP between March 2025 and March 2026, allocated 3:1 (da Vinci vs Toumai) according to operating-room and platform availability. Salvage RARP was excluded. Perioperative variables, Clavien-Dindo complications, pathological outcomes, positive surgical margins (PSM), undetectable PSA (< 0.1 ng/mL) and continence (pads/day) at one and three months were analyzed.

Results

Two hundred patients were analyzed (150 da Vinci vs 50 Toumai) with comparable baseline characteristics. Operative (220.2 vs 196.5 min) and console time (198.2 vs 170.5 min) were longer with Toumai (p = 0.001), which underwent more extended pelvic lymphadenectomies (24% vs 4.7%; p = 0.001). Hospital stay (1.6 days; p = 0.902), catheter duration (10.7 days; p = 0.689), overall complications (22% vs 12%; p = 0.132), PSM (26% vs 24.7%; p = 1.0) and undetectable PSA (96% vs 94%; p = 0.716) were similar. Continence (no pads) was 84% vs 69.3% at one month (p = 0.066) and 88% vs 86.7% at three months.

Conclusions

In a high-volume center, the da Vinci and Toumai platforms showed equivalent short-term oncological, functional, and complication outcomes.

Introduction

The second most common disease in males globally, prostate cancer (PCa) represents a significant public health burden [1]. Early diagnosis using prostate-specific antigen (PSA) and digital rectal examination (DRE) has played a pivotal role in the diagnostic process; the correct interpretation of data and management through risk-adapted strategies are essential to avoid overdiagnosis and overtreatment [2].

Radical prostatectomy has been a cornerstone of treatment for localized prostate cancer since it was first described in the early 1900s, evolving from an open approach to laparoscopic and, ultimately, robotic surgery. Three-dimensional visualization, a greater range of articulated motion, and improvements regarding postoperative pain, length of hospital stay, and blood loss have made robot-assisted radical prostatectomy (RARP) one of the most preferred options today [3–5].

The industry leader and standard for robotic development and quality assurance is the da Vinci robotic surgical platform (Intuitive Surgical, Inc., Sunnyvale, CA, USA). However, high acquisition and maintenance costs have hindered its growth in underdeveloped nations, limiting access to robotic surgery in many regions of the world [6, 7]. Following regulatory approval, a number of innovative multiport systems, including as Versius, Avatera, Hinotori, Toumai, and Hugo, have entered clinical practice during the last ten years and are starting to spread throughout the world [8, 9]. To determine the true impact and possibility for widespread use of novel robotic platforms in urology, it is crucial to assess the development of clinical research on these platforms.

Recently, the Toumai® surgical robot (Shanghai MicroPort MedBot (Group) Co., Ltd., Shanghai, China) made its way to South America. Although comparable perioperative results have been documented in other specialties, such as thoracic lobectomy [10], and early comparative RARP experiences have just surfaced [7, 11], it is still unclear whether its oncological and functional outcomes match those of the da Vinci platform in RARP. Establishing equivalency requires comparative series from seasoned, high-volume locations, but these data are still hard to come by, especially from Latin America. In order to compare perioperative parameters, complication rates, and short-term oncological and functional results between the Toumai and da Vinci platforms in RARP, we carried out a prospective study.

Materials and methods

Study design and setting

This was a single-center, prospective, non-randomized comparative (observational) study conducted at the Urology Department of Hospital Italiano de Buenos Aires, Argentina. The study was performed in line with the principles of the Declaration of Helsinki and was reviewed and approved by the Institutional Review Board / Ethics Committee for Protocol Evaluation (CEPI) of Hospital Italiano de Buenos Aires (Protocol No.10193). Written informed consent was obtained from all participants prior to inclusion.

Participants and allocation

All patients older than 40 years with localized PCa scheduled for elective RARP between March 2025 and March 2026 were consecutively included, and a standardized pre- and postoperative questionnaire was administered. Patients undergoing salvage RARP were excluded. Because the Toumai platform was newly introduced and available on selected operating days, patients were allocated 3:1 (da Vinci vs

Toumai) according to operating-room and platform availability rather than by randomization. All procedures were performed by experienced robotic surgeons at a high-volume referral center.

The preoperative work-up included serum PSA, DRE, multiparametric magnetic resonance imaging (mpMRI) reported with the Prostate Imaging-Reporting and Data System (PI-RADS), and prostate biopsy with Gleason/ISUP grading. Patients were stratified by D'Amico risk category. Data were obtained from medical records and from scheduled follow-up visits at one and three months.

Surgical technique

The RARP was performed using a transperitoneal approach via the Retzius space. Surgical steps were identical for both platforms (da Vinci Xi and Toumai MT-1000). In all cases, a supra-umbilical optical access was established using an open technique (8/10 mm); three additional 8 mm robotic trocars were placed along a transverse line 2 cm below the umbilicus, along with a single assistant trocar in the left flank. The same instruments were used in all cases: needle drivers with 3 – 0 V-Loc™ barbed sutures (Medtronic, Minneapolis, MN, USA), bipolar or fenestrated Maryland forceps, and monopolar scissors. Hood preservation, was performed in most cases, except for anterior tumors, where the endopelvic fascia was opened and the dorsal venous complex was ligated and transected. The attending surgeon's plan regarding neurovascular bundle (NVB) preservation was executed based on functional and oncological criteria. A continuous van Velthoven vesicourethral anastomosis and a posterior Rocco reconstruction were performed over an 18 Fr Foley catheter. Ilio-obturator or extended pelvic lymphadenectomy (PLND) was carried out based on the surgeon's assessment and validated nomograms. A pelvic drain was left in place in all cases; the incision was closed in layers and the skin with 4 – 0 Vicryl Rapide™ (Ethicon, Inc., Somerville, NJ, USA).

Outcomes and definitions

Perioperative outcomes included total operative time, console time, extent of NVB preservation, extent of PLND, blood transfusion, and conversion to open surgery. Postoperative outcomes included length of hospital stay, time to catheter removal, and complications graded with the Clavien-Dindo classification. Pathological outcomes included pathological tumor stage (pT), ISUP/Gleason grade, nodal involvement (pN+), positive surgical margins (PSM) and PSM length. Oncological and functional outcomes included the first postoperative PSA at 45 days (undetectable defined as < 0.1 ng/mL) and urinary continence, defined as the use of no pads per day, assessed at one and three months.

Statistical analysis

A convenience sample was used for this exploratory study. Continuous variables are summarized as mean (standard deviation, SD) or median (interquartile range, IQR) and were compared with the Student t-test or the Mann-Whitney U test according to distribution. Categorical variables are summarized as

frequency (%) and were compared with the chi-square or Fisher exact test as appropriate. A two-sided $p < 0.05$ was considered statistically significant. Analyses were performed using SPSS 23.0 (IBM Corp., Armonk, NY, USA).

Results

Two hundred patients were analyzed (150 da Vinci and 50 Toumai). Baseline demographic, clinical, and tumor characteristics were comparable between groups, with no statistically significant differences (Table 1). Mean age was 63.3 (SD 6.8) years and mean body mass index 27.3 (SD 3.8) kg/m²; most patients were ASA class 2 (81.5%). Multiparametric MRI was performed before biopsy in 96.5%, with PI-RADS 4–5 lesions in 85.9%. Median preoperative PSA was 7.9 ng/mL (IQR 5.6–12.0). According to the D'Amico classification, 69.0% were intermediate-risk and 30.0% high-risk.

Table 1
Baseline demographic, clinical and tumor characteristics

Variable	Total (n = 200)	Toumai (n = 50)	da Vinci (n = 150)	p value
Age, years, mean (SD)	63.3 (6.8)	63.5 (7.6)	63.2 (6.5)	0.820
BMI, kg/m², mean (SD)	27.3 (3.8)	27.9 (3.7)	27.1 (3.9)	0.153
HTN (%)	97 (48.5%)	25 (50.0%)	72 (48.0%)	0.935
DBT (%)	24 (12.0%)	10 (20.0%)	14 (9.3%)	0.079
ASA (%)				0.073
ASA 1	5 (2.5%)	0 (0.0%)	5 (3.3%)	
ASA 2	163 (81.5%)	46 (92.0%)	117 (78.0%)	
ASA 3	32 (16.0%)	4 (8.0%)	28 (18.7%)	
Prostate size, cc, mean (SD)	44.3 (19.5)	48.2 (17.0)	43.0 (20.1)	0.078
MRI prior to biopsy (%)	190 (95.0%)	47 (94.0%)	143 (95.3%)	1.000
PIRADS MRI (%)				0.396
PIRADS 1	1 (0.5%)	0 (0.0%)	1 (0.7%)	
PIRADS 2	13 (6.8%)	6 (12.8%)	7 (4.8%)	
PIRADS 3	11 (5.7%)	2 (4.3%)	9 (6.2%)	
PIRADS 4	110 (57.3%)	24 (51.1%)	86 (59.3%)	
PIRADS 5	55 (28.6%)	15 (31.9%)	40 (27.6%)	
Preoperative PSA, ng/mL, median (IQR)*	7.9 (5.6–12.0)	8.0 (5.8–11.1)	7.7 (5.6–13.1)	0.907
DRE (%)				0.489
T1c	87 (43.5%)	22 (44.0%)	65 (43.3%)	
T2a	57 (28.5%)	11 (22.0%)	46 (30.7%)	
T2b	41 (20.5%)	12 (24.0%)	29 (19.3%)	
T2c	9 (4.5%)	4 (8.0%)	5 (3.3%)	
T3	6 (3.0%)	1 (2.0%)	5 (3.3%)	
Biopsy Gleason score (%)				0.283
Gleason 6 (3 + 3)	5 (2.5%)	2 (4.0%)	3 (2.0%)	
Gleason 7 (3 + 4)	64 (32.0%)	14 (28.0%)	50 (33.3%)	

Variable	Total (n = 200)	Toumai (n = 50)	da Vinci (n = 150)	p value
Gleason 7 (4 + 3)	84 (42.0%)	24 (48.0%)	60 (40.0%)	
Gleason 8 (4 + 4)	29 (14.5%)	4 (8.0%)	25 (16.7%)	
Gleason 9 (4 + 5)	15 (7.5%)	6 (12.0%)	9 (6.0%)	
Gleason 10 (5 + 5)	3 (1.5%)	0 (0.0%)	3 (2.0%)	
D'Amico Risk (%)				0.574
Low	2 (1.0%)	1 (2.0%)	1 (0.7%)	
Intermediate	138 (69.0%)	36 (72.0%)	102 (68.0%)	
High	60 (30.0%)	13 (26.0%)	47 (31.3%)	

Data are n (%) unless otherwise stated. Bold p < 0.05. SD standard deviation, IQR interquartile range..

Operative variables are shown in Table 2. Both total operative time (220.2 vs 196.5 min) and console time (198.2 vs 170.5 min) were longer in the Toumai group (p = 0.001). This group underwent extended PLND more frequently (24.0% vs 4.7%; p = 0.001), whereas the distribution of NVB preservation did not differ significantly (p = 0.471). The difference in operative time persisted after excluding patients who underwent extended PLND. Blood transfusion was rare (2.0% vs 0.7%; p = 0.438) and there were no conversions to open surgery in either group.

Table 2
Intraoperative variables

Variable	Total (n = 200)	Toumai (n = 50)	da Vinci (n = 150)	p value
Operative Time, min, mean (SD)	202.5 (32.5)	220.2 (37.1)	196.5 (28.5)	0.001
Console time, min, mean (SD)	177.4 (32.3)	198.2 (34.3)	170.5 (28.6)	0.001
Conservation neurovascular bundle (%)				0.471
No conservation	10 (5.0%)	4 (8.0%)	6 (4.0%)	
Right	31 (15.5%)	5 (10.0%)	26 (17.3%)	
Left	42 (21.0%)	14 (28.0%)	28 (18.7%)	
Bilateral	54 (27.0%)	15 (30.0%)	39 (26.0%)	
Total one side / partial other side	35 (17.5%)	7 (14.0%)	28 (18.7%)	
Partial one side	15 (7.5%)	3 (6.0%)	12 (8.0%)	
Partial both sides	13 (6.5%)	2 (4.0%)	11 (7.3%)	
Lymphadenectomy (%)				0.001
No	30 (15.0%)	3 (6.0%)	27 (18.0%)	
Local	151 (75.5%)	35 (70.0%)	116 (77.3%)	
Extended	19 (9.5%)	12 (24.0%)	7 (4.7%)	
Blood transfusion (%)	2 (1.0%)	1 (2.0%)	1 (0.7%)	0.438
Conversion to open surgery (%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	N/A

Data are n (%) unless otherwise stated. Bold p < 0.05. SD standard deviation, IQR interquartile range..

Postoperative outcomes are summarized in Table 3. Length of hospital stay (1.6 vs 1.6 days; p = 0.902) and time to catheter removal (10.7 vs 10.7 days; p = 0.689) were identical. Overall complications did not differ significantly (Toumai 22.0% vs da Vinci 12.0%; p = 0.132); however, the distribution of Clavien-Dindo grades differed (p = 0.03), driven by more grade I events in the Toumai group (16.0% vs 2.7%). Major complications (Clavien IIIa–IIIb) were infrequent (2.0% vs 2.7%). On final pathology, 51.0% of tumors were pT2c, 31.0% pT3a and 18.0% pT3b, without between-group differences (p = 0.983), and nodal involvement (pN+) was found in 3.5%.

Oncological and functional outcomes are shown in Table 4. PSM were similar between groups (26.0% vs 24.7%; p = 1.0), as was PSM length (p = 0.974). An undetectable first PSA (< 0.1 ng/mL) at 45 days was achieved in 96.0% (Toumai) versus 94.0% (da Vinci) (p = 0.716). Continence (no pads) at one month was 84.0% in the Toumai group versus 69.3% in the da Vinci group, a non-significant trend favoring Toumai (p

= 0.066). At three months, continence rates converged (88.0% vs 86.7%; p = 0.300), with only 1.5% of patients reporting moderate and 0.5% severe incontinence.

Table 3
Postoperative and pathological variables

Variable	Total (n = 200)	Toumai (n = 50)	da Vinci (n = 150)	p value
Length of hospital stay, mean (SD)	1.6 (0.7)	1.6 (0.6)	1.6 (0.7)	0.902
Time to catheter removal, days, mean (SD)	10.7 (2.6)	10.7 (2.0)	10.7 (2.8)	0.689
Complications (%)	29 (14.5%)	11 (22.0%)	18 (12.0%)	0.132
Clavien-Dindo mod.□ (%)				0.03
No complication	171 (85.5%)	39 (78.0%)	132 (88.0%)	
Clavien I	12 (6.0%)	8 (16.0%)	4 (2.7%)	
Clavien II	12 (6.0%)	2 (4.0%)	10 (6.7%)	
Clavien IIIa	1 (0.5%)	1 (2.0%)	0 (0.0%)	
Clavien IIIb	4 (2.0%)	0 (0.0%)	4 (2.7%)	
Postoperative Gleason score (%)				0.138
Gleason 6 (3 + 3)	1 (0.5%)	0 (0.0%)	1 (0.7%)	
Gleason 7 (3 + 4)	42 (21.0%)	10 (20.0%)	32 (21.3%)	
Gleason 7 (4 + 3)	115 (57.5%)	27 (54.0%)	89 (59.3%)	
Gleason 8 (4 + 4)	17 (8.5%)	8 (16.0%)	9 (6.0%)	
Gleason 9 (4 + 5)	24 (12.0%)	5 (10.0%)	19 (12.7%)	
pT Stage %)				0.983
T2c	102 (51.0%)	26 (52.0%)	76 (50.7%)	
T3a	62 (31.0%)	15 (30.0%)	47 (31.3%)	
T3b	36 (18.0%)	9 (18.0%)	27 (18.0%)	
Node Involvement (pN+) (%)	7 (3.5%)	2 (4.0%)	5 (3.3%)	1.000

Data are n (%) unless otherwise stated. Bold p < 0.05. SD standard deviation, IQR interquartile range. □ Clavien-Dindo classification.

Table 4
Oncological and functional outcomes

Variable	Total (n = 200)	Toumai (n = 50)	da Vinci (n = 150)	p value
Positive surgical margin (PSM) (%)	50 (25.0%)	13 (26.0%)	37 (24.7%)	1
PSM length (%)				0.974
Negative	150 (75.0%)	37 (74.0%)	113 (75.3%)	
Focal (< 3 mm)	30 (15.0%)	8 (16.0%)	22 (14.7%)	
Large (≥ 3 mm)	20 (10.0%)	5 (10.0%)	15 (10.0%)	
First PSA at 45 days, ng/mL, median (IQR)	0.0 (0.0–0.0)	0.0 (0.0–0.0)	0.0 (0.0–0.0)	0.662
First PSA undetectable (< 0.1ng/mL) (%)	189 (94.5%)	48 (96%)	141 (94%)	0.716
Continence at one mo. (%)	146 (73.0%)	42 (84.0%)	104 (69.3%)	0.066
Continence at 3 mo. (%)				0.300
Continence (0 pads)	174 (87.0%)	44 (88.0%)	130 (86.7%)	
Mild UI (1–2 pads)	22 (11.0%)	4 (8.0%)	18 (12.0%)	
Moderate UI (3–4 pads)	3 (1.5%)	2 (4.0%)	1 (0.7%)	
Severe UI (≥ 5 pads)	1 (0.5%)	0 (0.0%)	1 (0.7%)	

Data are n (%) unless otherwise stated. Bold p < 0.05. SD standard deviation, IQR interquartile range. UI (urinary incontinence).

Discussion

Establishing equivalence between robotic platforms is increasingly relevant, both for the surgeon-robot relationship and for patient access to minimally invasive surgery. Perioperative, oncological, and functional data generated by experienced surgeons in high-volume centers are essential to define such equivalence, yet comparative series with sufficient robustness remain scarce. To our knowledge, this is one of the first prospective comparisons of the Toumai and da Vinci platforms in RARP from Latin America, and it shows meaningful parity between the two systems across baseline-matched groups.

Both operative and console times were longer with Toumai (220.2 vs 196.5 min and 198.2 vs 170.5 min, respectively; p = 0.001). This difference may be partly explained by the substantially higher proportion of extended PLND performed in the Toumai group (24.0% vs 4.7%; p = 0.001), a decision left to the operating surgeon; nevertheless, the difference persisted in the subgroup without extended PLND, suggesting a contribution of platform-specific docking and instrument-exchange times. Our figures are

consistent with Rocco et al. [11], who reported 192.5 min for Toumai versus 183.5 min for da Vinci, and with Chen et al. [7], whose operative times were also longer with Toumai (138 vs 108 min), albeit shorter than ours and without lymphadenectomy.

Safety outcomes were reassuring and comparable between platforms. There were no conversions to open surgery, and perioperative transfusion was rare in both groups, in line with previous reports. Major postoperative complications (Clavien IIIa–IIIb) were infrequent (2.0% vs 2.7%), closely matching the 2.5% versus 2.5% reported by Rocco et al. [11]. The higher rate of Clavien grade I events in the Toumai group probably reflects minor, self-limited events recorded during the early adoption of a new platform rather than a clinically meaningful difference, as overall complications did not differ. Mean hospital stay (1.6 days) showed no between-group difference and was similar to Rocco et al. [11] (2 days) and shorter than Chen et al. [7] (5 days), likely reflecting institutional discharge pathways. Catheterization averaged 10.7 days, consistent with the 9 days reported by Rocco et al. [11].

Oncologically, PSM rates were similar (26.0% vs 24.7%; p = 1.0). Chen et al. [7] reported 25% versus 16.7% (also non-significant), albeit with a lower bilateral NVB-preservation rate than in our series. An undetectable early PSA was achieved in 96.0% versus 94.0% of patients, close to the values reported by Rocco et al. [11] (87.5% vs 92.5%). These findings suggest that the oncological quality of surgery, as reflected by margins and early biochemical response, is preserved with the Toumai platform in experienced hands.

Functionally, continence (no pads) at one month favored Toumai (84.0% vs 69.3%), although the difference did not reach statistical significance (p = 0.066) and should be interpreted cautiously given the sample size and the non-randomized design; this trend is partially concordant with Rocco et al. [11] (72.5% vs 80%). By three months, continence rates converged (88.0% vs 86.7%; p = 0.300), similar to Chen et al. [7] (83.3% vs 87.5%). Chen et al. [7] additionally demonstrated comparable equivalence for robot-assisted partial nephrectomy, which further supports the interchangeability of the two systems across procedures.

This study has several limitations. Its non-randomized design may introduce selection bias, and the 3:1 allocation—dictated by platform availability—produced unbalanced group sizes, although baseline characteristics were comparable. The single-center setting and the involvement of experienced surgeons in a high-volume center limit extrapolation to low-volume or less experienced environments. The sample size was based on convenience and the follow-up was short, precluding conclusions on biochemical recurrence and on long-term oncological and functional outcomes; continence was assessed by pad use rather than by a validated patient-reported outcome measure. Finally, surgeon-dependent intraoperative decisions (extent of PLND and NVB preservation) and the learning curve inherent to a newly introduced platform may have influenced operative times.

Despite these limitations, to our knowledge this represents the first Latin American comparative experience with the Toumai platform in RARP and adds a substantial, prospectively collected sample to the emerging evidence base, reinforcing the importance of the surgeon-robot relationship [7, 8, 11].

Conclusion

In a high-volume center and in the hands of experienced surgeons, the da Vinci and Toumai platforms achieved equivalent short-term oncological, functional, and complication outcomes in RARP. Larger, multicenter, and randomized studies with longer follow-up are needed to confirm these findings and to define the role of new robotic platforms in expanding access to robotic surgery.

Abbreviations

ASA American Society of Anesthesiologists; BMI body mass index; DRE digital rectal examination; IQR interquartile range; mpMRI multiparametric magnetic resonance imaging; NVB neurovascular bundle; PCa prostate cancer; PI-RADS Prostate Imaging-Reporting and Data System; PLND pelvic lymph-node dissection; PSA prostate-specific antigen; PSM positive surgical margin; RARP robot-assisted radical prostatectomy; SD standard deviation.

Declarations

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Competing interests The authors have no relevant financial or non-financial interests to disclose.

Ethics approval This study was performed in line with the principles of the Declaration of Helsinki. Approval was granted by the Institutional Review Board / Ethics Committee for Protocol Evaluation (CEPI) of Hospital Italiano de Buenos Aires (Protocol No. 10193).

Consent to participate Written informed consent was obtained from all individual participants included in the study.

Consent to publish The manuscript does not contain any individual person's identifying data; consent to publish is therefore not applicable.

Data availability The datasets generated and/or analyzed during the current study are available from the corresponding author on reasonable request.

Author contributions All authors contributed to the study conception and design. Material preparation, data collection and analysis were performed by Buffa, A, Tobia, I, Martnez PF, Villamil W and Romeo, A. The first draft was written by Buffa, A. All authors read and approved the final manuscript.

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