

AN EIGHT-MONTH PRELIMINARY ANALYSIS OF ROBOTIC-ASSISTED RADICAL PROSTATECTOMY (RARP) PROFICIENCY METRICS IN A ROBOTIC FELLOWSHIP-NAÏVE SURGEON DURING A PELVIC URO-ONCOLOGY FELLOWSHIP TRAINING

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Structured, competency-based fellowships are essential for training in complex robotic surgery. This study analyses the initial learning curve of a robotic-fellowship-naïve surgical fellow performing robotic-assisted radical prostatectomy (RARP) within a high-volume, metrics-driven pelvic oncology fellowship, culminating in the milestone achievement of complete skin-to-skin independent performance.

A prospective database of 68 consecutive RARP procedures (July 2025 – February 2026) was analysed. Primary endpoints were fellow participation as console surgeon, console time, and binary completion of 13 modular procedural phases. The phases were conceptually aligned with published modular training frameworks for RARP, comprising 12 phases adapted from established curricula plus a 13th phase representing complete skin-to-skin case performance. Secondary endpoints included clinical safety indicators (transfusion rate, length of stay, complications) and biochemical outcomes (postoperative prostate-specific antigen, PSA). Statistical analysis employed the Mann–Kendall test for trend analysis and Fisher's exact test for association testing.

The fellow participated in all 68 RARPs, acting as console surgeon under supervision in 48 cases (70.6%). Median fellow-specific console time was 32 minutes (IQR 20–45). A strong positive temporal trend was observed in the number of phases performed per case (Mann–Kendall $\tau = 0.61$, $p < 0.01$). All 12 procedural phases were successfully completed by the fellow, with apical dissection first completed in case 57. The 13th phase — complete skin-to-skin RARP — was achieved in cases 67 and 68, with console times of 190 and 160 minutes, respectively, representing 100% of total operative console time. No patients required perioperative blood transfusion (0/68) or surgical drainage. One patient (Case 67, 1.5%) experienced a Clavien–Dindo grade II complication requiring postoperative antibiotics. A transurethral catheter was used in 67 cases, with one suprapubic catheter as part of an enhanced recovery protocol. 95.6% (65/68) of patients were discharged on the first postoperative day. The fellow participated in 17 RARP and 7 RARC extended pelvic lymphadenectomies (ePLND). Postoperative PSA data were available for 51 cases. Of these, 41 (80.4%) achieved an undetectable PSA (< 0.1 ng/ml), while 10 cases (19.6%) had detectable PSA ranging from 0.1 to 3.5 ng/ml. Final histopathology was available for 50 cases, revealing a positive surgical margin (PSM) rate of 40.0% (20/50). Among patients with both PSA and margin data available ($n = 49$), 39 (79.6%) had undetectable PSA, with 13 (33.3%) of these having a reported PSM. The Fisher's exact test confirmed no significant association between PSA undetectability and margin status ($p = 0.20$).

Keywords: robotic surgical procedures, radical robotic prostatectomy (RARP), learning curve, clinical competence, day-case surgery, surgical margins.

INTRODUCTION

Robotic-assisted radical prostatectomy (RARP) has become the standard of care for surgical management of localised prostate cancer in many centres (Leow *et al.*, 2016). However, it is a technically complex procedure with a recognised learning curve, often cited as 20–50 cases for basic competency and 100–250 cases for optimisation of oncological and functional outcomes (Ahlering *et al.*, 2003; Volkin *et al.*, 2021). This presents a significant challenge for surgical training, necessitating structured educational programmes to ensure patient safety and trainee efficacy.

Modern surgical fellowships are increasingly adopting competency-based frameworks over traditional time-based models (Thoma and Gottlieb, 2018). The British Association of Urological Surgeons (BAUS)-approved Robotic Pelvic Uro-Oncology Fellowship at University Hospitals Coventry and Warwickshire (UHCW) employs such a framework. It utilises a modular phase-based assessment protocol inspired by published modular training curricula, which deconstructs RARP into distinct, sequential steps (Lovegrove *et al.*, 2016). This approach allows for objective, granular tracking of a trainee's progression. For the purposes of this analysis, we have defined a 13th phase representing the completion of a full skin-to-skin case, marking the ultimate fellowship milestone.

While the learning curve for RARP has been described, prospective, detailed analyses of a fellow's progression from the first console case to complete independent performance, using a validated phase-based curriculum within a defined fellowship, are uncommon. This study aims to fill that gap by prospectively analysing the first eight months of a robotic-fellowship-naïve fellow's RARP performance. The primary aim was to quantify the learning curve using objective metrics (console participation, phase completion, and achievement of complete cases). Secondary aims were to assess associated clinical and biochemical outcomes, evaluate the safety profile concerning transfusion needs and day-case feasibility, and report progress towards fellowship goals.

MATERIALS AND METHODS

Study design and data source. A prospective, single-robotic fellowship naïve-fellow, observational study was conducted. Data were extracted from a dedicated, ethics-approved prospective database maintained for the Robotic Fellowship at UHCW. All consecutive RARP procedures involving the fellow from 9 July 2025 to 12 February 2026 were included (n = 68). Data collection was an integral part of clinical governance and educational feedback. All patients provided written informed consent for the surgical procedure and for the use of their anonymised perioperative data for research and educational purposes, in accordance with institutional guidelines and the Declaration of Helsinki. Objective console time data were verified through the

Intuitive Surgical user profile application, which records exact console engagement times for each procedure.

Surgical technique and training model. All procedures were performed using the da Vinci X or Xi Surgical System (Intuitive Surgical Inc., Sunnyvale, CA, USA). The training model followed a stepwise, modular approach based on published frameworks for structured RARP training (Lovegrove *et al.*, 2016), with procedural phases adapted for this analysis (Table 1). Initially, the fellow acted as a bedside assistant, progressing to console surgery under direct supervision for specific phases. Responsibility was gradually increased based on satisfactory performance. The supervising consultant was physically present in the operating room for all cases in this series, with the ultimate fellowship goal being independent skin-to-skin performance of RARP and robotic cystectomy (RARC). For analytical purposes, we defined a 13th phase — complete skin-to-skin case performance — representing the fellow performing all 12 phases without consultant takeover.

Supervisor intervention was defined as physical takeover of the console. Verbal guidance and technical advice were permitted without counting as intervention. A phase was considered completed only if performed by the fellow from start to finish without physical takeover.

Table 1. Completion of procedural phases by the fellow as primary console surgeon (n = 48 console cases). Phase structure was developed with reference to published modular training frameworks for RARP (Lovegrove *et al.*, 2016)

Phase	Phase description	Number of completed console surgeon cases (n = 48)	Case number of First completion
I	Patient positioning and port placement	48	8
II	Bladder drop	27	8
III	Endopelvic fascia incision	22	8
IV	Bladder neck opening	15	38
V	Dissection of vasa and seminal vesicles	26	19
VI	Posterior space development	5	28
VII	Right lateral pedicle dissection	5	51
VIII	Left lateral pedicle dissection	3	51
IX	Santorini plexus management	4	30
X	Apical dissection	3	57
XI	Posterior urethrovesical support reconstruction	7	33
XII	Vesico- urethral anastomosis	6	28
XIII	Skin-to-skin RARP	2	67

RARP, robotic-assisted radical prostatectomy

Variables and outcomes

Primary endpoints:

1. Console role: Binary (Assistant = 0 / Console Surgeon = 1).
2. Fellow console time: Recorded in minutes, verified through Intuitive Surgical user profile data.
3. Phase proficiency: Binary completion (Yes/No) for each of the 12 RARP procedural phases, which were conceptually aligned with published modular training frameworks for RARP (Lovegrove *et al.*, 2016) (I: Patient Positioning and Port Placement to XII: Vesico-urethral Anastomosis) by the fellow as the console surgeon, plus a 13th phase for complete skin-to-skin case performance.

Secondary endpoints:

1. Clinical safety: Estimated blood loss (EBL), perioperative blood transfusion requirement, pre- and postoperative haemoglobin (Hb) levels, length of hospital stay (postoperative day of discharge), perioperative drainage use, catheter type (transurethral/suprapubic/none), and Clavien–Dindo complication grade.
2. Pathological and biochemical outcomes: Positive surgical margin (PSM) status (as reported in final histopathology) and postoperative PSA level, with undetectable defined as < 0.1 ng/ml.
3. Fellow goal progression: Number of cases with fellow participation in extended pelvic lymph node dissection (ePLND), including both RARP and RARC procedures.

Statistical analysis. Descriptive statistics were calculated for all variables: medians and interquartile ranges (IQR) for continuous non-normally distributed data, counts and percentages for categorical data. The longitudinal progression of fellow skill acquisition was analysed by plotting the cumulative number of phases performed per case against the

case sequence number. The significance of the upward trend was assessed using the non-parametric Mann–Kendall test for a monotonic trend, with the Kendall's tau correlation coefficient reported. Fellow console time progression was visualised using a scatter plot with locally weighted smoothing (LOWESS, smoothing parameter $f = 0.3$) to demonstrate the learning curve trend. The association between postoperative PSA status (undetectable vs. detectable) and PSM status (negative vs. positive) was assessed using Fisher's exact test for the subset of cases with complete data, with odds ratio and 95% confidence interval calculated where appropriate. All analyses were performed using Python (version 3.10) with the Pandas, SciPy, and Matplotlib libraries. A p -value of < 0.05 was considered statistically significant.

RESULTS

Case volume and fellow participation. Over the eight-month period, 68 RARP procedures were performed with fellow involvement, representing 100% of fellow involvement in the centre's fellowship RARP case volume according to the fellow's robotic theatre rotation schedule. The fellow's role evolved systematically (Fig. 1). The first case with fellow console participation occurred on the 8th operative date (Case 8, 24 July 2025). Overall, the fellow acted as the console surgeon in 48 of 68 cases (70.6%), reaching 100% console participation in the final month (February 2026) with two complete skin-to-skin cases.

Console time and modular phase acquisition. The median fellow-specific console time was 32 minutes (IQR 20–45), ranging from 5 minutes (Case 35, a Rezius-sparing case) to 190 minutes (Case 67, the first complete skin-to-skin case). The median total operative console time for all procedures was 150 minutes (IQR 120–180). The fellow's console time therefore represented a median of 21.3% of the total console time across the series, increasing to 100% in the final two complete cases.

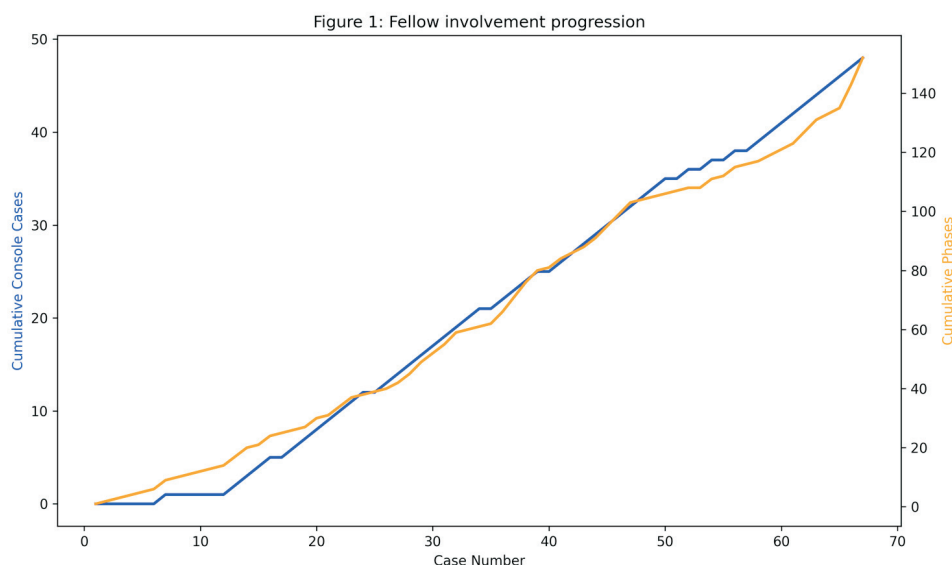


Fig. 1. Cumulative progression of fellow involvement. The blue line (left y-axis) shows the running total of cases where the fellow acted as console surgeon ($n = 48$). The orange line (right y-axis) shows the cumulative number of distinct procedural phases completed by the fellow (maximum 13, with Phase 13 representing complete skin-to-skin cases). The steepening slope of both curves after case 50 illustrates accelerated skill acquisition in the latter half of the study period. Trend significance was assessed using the Mann–Kendall test ($\tau = 0.61$, $p < 0.01$).

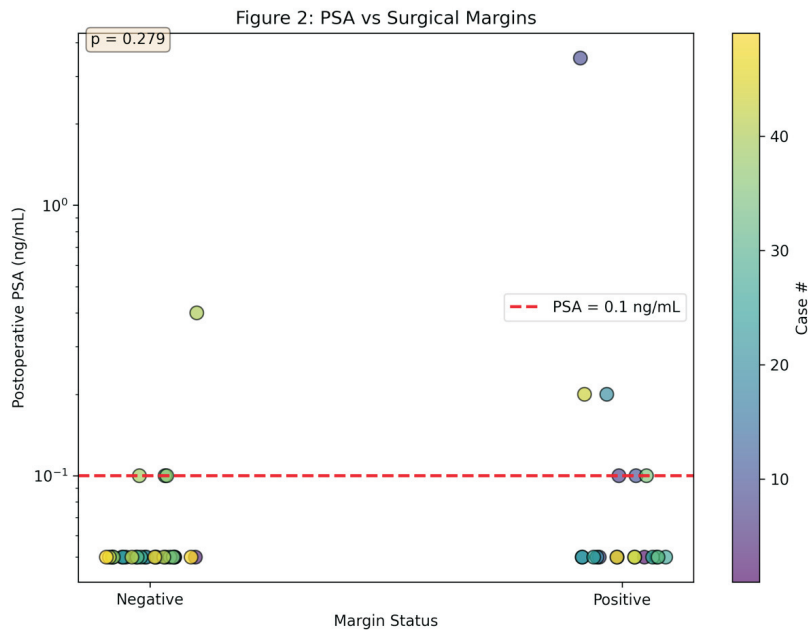


Fig. 2. Association between postoperative PSA status and surgical margin status. Scatter plot showing postoperative PSA (< 0.1 ng/ml undetectable vs. $\geq$ 0.1 ng/ml detectable) against surgical margin status (R0 negative vs. R1 positive) for the 49 cases with complete histopathological and biochemical data. Marker size is proportional to case number for visualisation. Fisher's exact test demonstrated no statistically significant association ($p = 0.20$; odds ratio = 0.34, 95% CI: 0.07–1.46), illustrating the dissociation between margin status and early biochemical outcomes in this series.

A strong and statistically significant positive trend was observed in the number of procedural phases performed by the fellow per case over time (Mann-Kendall $\tau = 0.61$, $p < 0.01$), confirming progressive skill acquisition.

Figure 2 demonstrates the progression of fellow console time across the 68-case series, analysed using LOWESS smoothing ($f = 0.3$). A clear learning curve is evident, with console time increasing from early partial console cases (as low as 5 minutes) to the complete cases at 190 and 160 minutes. The smoothing curve shows accelerated acquisition after case 50, corresponding to increasing complexity and completeness of fellow-performed phases.

A critical educational milestone was the completion of all 12 procedural phases by the fellow, followed by the achievement of complete skin-to-skin cases (Phase 13). Phase X (Apical Dissection), a key step for oncological control and functional outcomes, was first completed in the 57th case of the series. The distribution of phase completions is summarised in Table 1.

Complete skin-to-skin case performance. Cases 67 (10 February 2026) and 68 (12 February 2026) represent the first complete skin-to-skin RARP cases performed by the fellow under supervision. Key metrics for these milestone cases are presented in Table 2. Both cases demonstrated favourable clinical outcomes with minimal blood loss (50 ml each). The fellow's console time of 190 and 160 minutes represented 100% of total operative console time, confirming complete procedural performance under supervision. Case 67 experienced a Clavien–Dindo grade II complication requiring postoperative antibiotics. Case 68 was discharged uneventfully on postoperative day 1.

Clinical and biochemical outcomes. The clinical safety profile was robust across the entire series (Table 3). No patient required perioperative blood transfusion (0/68) or surgical drainage (0/68). There were no Clavien–Dindo com-

plications of grade > II. One patient (Case 67, 1.5%) experienced a grade II complication requiring postoperative antibiotics, representing the only Clavien–Dindo grade II event in the series. The median haemoglobin drop was 11 g/L (IQR 7–18), with some cases showing a paradoxical postoperative rise due to haemoconcentration. Haemoglobin drop was calculated using the most recent pre-operative Hb (up

Table 2. Characteristics of the first two complete skin-to-skin RARP cases

Parameter	Case 67	Case 68
Date	10 February 2026	12 February 2026
Fellow console time (min)	190	160
Total operative time (min)	190	160
Estimated blood loss (ml)	50	50
Prostate volume (mL)	50	25
Nerve preservation	Unilateral	None
Catheter type	Transurethral	Transurethral
Postoperative day of discharge	4	1
Clavien–Dindo Grade	II	0
Haemoglobin drop (g/l)	41	28
Positive surgical margin status	Pending	Pending
Postoperative PSA (ng/ml)	Pending	Pending

RARP, robotic-assisted radical prostatectomy

Table 3. Clinical safety and feasibility outcomes for 68 RARP procedures

Outcome metric	Result
Median estimated blood loss (IQR)	100 ml (50–200)
Perioperative transfusion rate	0% (0/68)
Perioperative drain use	0% (0/68)
Clavien–Dindo Grade II complications	0% (0/68)
Clavien–Dindo Grade II complications	1.5% (1/68)
Median haemoglobin drop (IQR)	11 g/l (7–18)
Catheter type: transurethral/ suprapubic	Transurethral 67/1
Discharge on postoperative day 1	95.6% (65/68)

RARP, robotic-assisted radical prostatectomy

to 18 days before surgery) and first post-operative day Hb. EBL reflects intraoperative estimated loss only. Discrepancies between these values may be explained by perioperative fluid administration and biological variation between non-contemporaneous measurements. A transurethral catheter was used in 67 cases (98.5%); one case (1.5%) employed a suprapubic catheter as part of a day-case surgery pilot protocol. 65 of 68 patients (95.6%) were discharged on the first postoperative day.

Postoperative PSA data were available for 51 of the 68 cases (75.0%), with the remaining 17 cases being recent operations pending scheduled follow-up. Of these 51, 41 (80.4%) achieved an undetectable PSA (0.1 ng/ml), while 10 cases (19.6%) had detectable PSA ranging from 0.1 to 3.5 ng/ml. The detectable PSA cases are detailed in Table 4, which lists all cases with detectable postoperative PSA, including those where the fellow was not the console surgeon. These cases are included for completeness of the secondary biochemical endpoint but do not directly inform the fellow's learning curve.

The 17 cases without postoperative PSA data are the most recent operations (January–February 2026). In the UK NHS setting, routine postoperative PSA follow-up at around six weeks postoperative is sometimes delayed due to clinic capacity and administrative processes. Missing data are therefore logistical, not selective.

Pathological margin status and correlation. The final histopathology with margin status was available for 50 cases. The overall positive surgical margin (PSM) rate was 40.0% (20/50). When stratified by pathological tumour stage, the PSM rate was 20.7% (6/29) for organ-confined pT2 disease and 60.9% (14/23) for non-organ-confined pT3 disease.

Table 4. Characteristics of cases with detectable postoperative PSA (n = 10)

Case	PSA after operation (ng/ml)	Pathological stage	Positive surgical margin	Console surgeon
8	0.1	pT3a	Yes	Yes
10	3.5	pT2c	Yes	No
11	0.1	pT3a	Yes	No
21	0.2	pT2a	Yes	Yes
33	0.1	pT2c	No	Yes
36	0.1	pT2c	Yes	No
38	0.1	pT2c	No	Yes
40	0.1	pT3a	No	Yes
41	0.4	pT3a	No	No
44	0.2	pT2c	Yes	Yes

PSA, prostate-specific antigen

For the 49 patients with both margin status and postoperative PSA data available, the distribution was as follows:

Undetectable PSA (0.1 ng/ml): 39 patients (79.6%)

Detectable PSA (≥ 0.1 ng/ml): 10 patients (20.4%)

Among the 39 patients with undetectable PSA, 13 (33.3%) had a reported PSM on final histopathology. Among the 10 patients with detectable PSA, 6 (60.0%) had a reported PSM.

The Fisher's exact test showed no statistically significant association in this sample ($p = 0.20$; odds ratio = 0.34, 95% CI: 0.07–1.46), as visualised in Figure 3. This dissociation underscores the complexity of interpreting margin status as a surrogate for biochemical recurrence. Given the sample

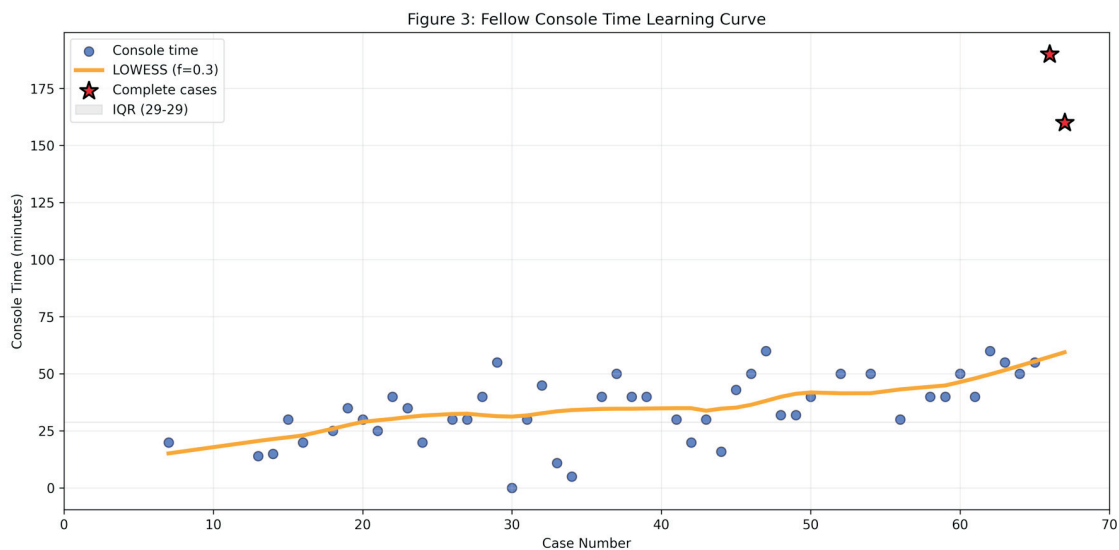


Fig. 3. Fellow console time progression across 68 consecutive RARP cases. Blue dots represent individual fellow console times (minutes) as recorded in the Intuitive Surgical user profile for each procedure. The orange line represents LOWESS (locally weighted scatterplot smoothing) with smoothing parameter $f = 0.3$, demonstrating the learning curve trend. Cases 67 and 68 (190 and 160 minutes) represent complete skin-to-skin performance, with console time equalling total operative time, demonstrating achievement of the fellowship milestone. The shaded region indicates the interquartile range (IQR = 25 minutes), spanning from the 25th percentile (20 minutes) to the 75th percentile (45 minutes) of fellow console times across the series.

size, this finding is hypothesis-generating and requires validation in larger cohorts.

Progress towards fellowship objectives. The fellow participated in the extended pelvic lymph node dissection (ePLND) component in 17 RARP cases and all 7 RARC cases performed concurrently during the study period, totaling 24 exposures to advanced pelvic lymphadenectomy. The achievement of two complete skin-to-skin RARP cases represents fulfilment of the primary fellowship objective for robotic prostatectomy, representing early progress toward the BAUS fellowship requirement of 10–20 independent RARP procedures under supervision within the training year. The fellow also achieved console proficiency in key phases of RARC (ureteric identification, posterior dissection, lateral pedicle control, and ePLND), positioning for complete RARC independence within the remaining fellowship timeframe.

DISCUSSION

This prospective analysis demonstrates that a phased, metrics-driven fellowship enables rapid and safe skill acquisition in RARP, culminating in the milestone achievement of complete skin-to-skin case performance within eight months. The fellow achieved primary console involvement in over 70% of cases, mastered all 12 procedural modules, and successfully performed two complete RARP cases — representing early progress toward the primary BAUS fellowship objective well within the 12-month training period. This accelerated timeline compared to traditional learning curve estimates (often cited as 20–50 cases for basic competency (Ahlering *et al.*, 2003; Volkin *et al.*, 2021)) validates the efficacy of structured, competency-based training frameworks incorporating objective phase-based assessment.

The encouraging safety profile — 0% transfusion, 0% drainage, 0% major (> II) complications, and 95.6% day-1 discharge — strongly supports the feasibility of RARP as a day-case procedure even during the supervised learning curve, aligning with and extending findings from established Enhanced Recovery After Surgery (ERAS) pathways (Pridgeon *et al.*, 2013; Asimakopoulos *et al.*, 2022). The minimal haemoglobin drop (median 11 g/l) and absence of transfusion requirements further argue against the routine necessity for group-and-save blood ordering in standard RARP, promoting sustainable and cost-effective practice (Kim *et al.*, 2011). The single grade II complication (postoperative infection requiring antibiotics) in a complete skin-to-skin case represents an expected morbidity within published benchmarks (3%, range 2–9%) (Lovegrove *et al.*, 2016; Yilmaz *et al.*, 2025) and does not detract from the overall safety profile.

A pivotal finding is the dissociation between pathological margin status and biochemical recurrence. In our series, 80.4% of patients with available postoperative PSA achieved an undetectable level, with 33.3% of these having

a reported PSM. This underscores a critical issue in RARP outcome reporting: the lack of standardisation in defining and reporting positive surgical margins. Factors including specimen handling, inking technique, sectioning thickness, and the clinical significance of a focal, Gleason grade 6 margin at the apex in an otherwise organ-confined tumour vary widely between institutions and even between pathologists (Yossepowitch *et al.*, 2014; Epstein *et al.*, 2017). Our data suggest that postoperative PSA may be a more robust early predictor of oncological success than margin status alone in this context — an observation supported by other large series (Ploussard *et al.*, 2011).

The PSM rate, particularly in pT3 disease (60.9%), remains a focus for continued technical refinement and is consistent with early learning curve reports from other fellowship programmes (Ahlering *et al.*, 2003; Volkin *et al.*, 2021). Importantly, the PSM rate in organ-confined pT2 disease (20.7%) compares favourably with published benchmarks for trainees (Ficarra *et al.*, 2012). The detectable PSA rate of 19.6% in this series reflects a mix of advanced pathological stage cases and early learning curve cases (Viney *et al.*, 2009; Mitsunari *et al.*, 2024), correlating with literature data and providing valuable feedback for ongoing quality improvement.

We acknowledge that the positive surgical margin rate of 40.0% overall and 60.9% in pT3 disease is higher than published benchmarks for experienced surgeons. This is consistent with early learning curve series from other fellowship programmes (Ahlering *et al.*, 2003; Volkin *et al.*, 2021). While inter-pathologist variability in margin assessment is a documented phenomenon (Yossepowitch *et al.*, 2014), we do not suggest that it fully explains the observed rates. Continued technical refinement remains a priority.

The fellow's concurrent training in RARC (seven cases) provided synergistic benefits, enhancing proficiency in pelvic anatomy, vascular control, and ePLND — skills directly transferable to RARP. Achieving complete skin-to-skin RARP cases and console competence in key RARC steps sets the stage for the remaining fellowship objective: independent performance of robotic cystectomy with urinary reconstruction.

Figure 2 illustrates the progressive increase in fellow console time over the case series, with LOWESS smoothing ($f = 0.3$) demonstrating accelerated acquisition after case 50. This pattern closely resembles learning curve analyses reported in recent surgical education literature (Soomro *et al.*, 2020), where a threshold effect is often observed after 40–50 cases. The complete cases at 190 and 160 minutes represent the natural plateau of this curve, where the fellow assumes full procedural responsibility with consultant supervision only as a safety measure.

LIMITATIONS

This study has several limitations.

First, it is a single-centre, single-fellow design, which restricts generalisability to other training environments with different case mix, supervision intensity, or institutional protocols. We acknowledge that the binary definition of intervention (physical console takeover versus no takeover) does not capture the frequency or nature of verbal guidance. However, this binary approach was chosen for objectivity and reproducibility, consistent with published modular training frameworks (Lovegrove *et al.*, 2016). Our assessment of phase completion was binary (completed without physical console takeover versus not completed). While this approach is objective and aligns with published modular training frameworks (Lovegrove *et al.*, 2016), it does not capture gradations in technical quality or efficiency. Validated continuous scoring tools such as GEARS or the RARP Assessment Score were not used in this preliminary analysis but will be incorporated into ongoing and future work.

Second, the follow-up period is limited to early postoperative outcomes; long-term functional (continence, potency) and oncological (biochemical recurrence-free survival) outcomes are not yet mature for analysis and will require continued prospective data collection. Functional outcomes (continence, erectile function) were not assessed in this study, as the primary objective was proficiency metrics. These outcomes require longer follow-up and a separate dedicated analysis, which is currently in progress.

Third, the presence of a supervising consultant in all cases, while ethically imperative, represents a confounder for true independence.

Fourth, the PSM analysis is limited by heterogeneity in pathological reporting, correlating with literature data (Yosepowitch *et al.*, 2014; Epstein *et al.*, 2017). We did not perform detailed pathological characterisation of positive margins (e.g., margin length, location, Gleason grade at margin), as this was beyond the scope of a proficiency-metrics study. Future work will incorporate these variables.

Fifth, while two complete cases represent a milestone, confirmation of sustained independent performance will require additional cases to demonstrate consistent proficiency.

Sixth, the statistical analysis is primarily descriptive. CUSUM analysis or segmented regression — while methodologically stronger — was not performed, as this preliminary study was conducted without external funding and with the analytical tools available to a surgical fellow in training. The Fisher's exact test ($n = 49$, $p = 0.20$) is underpowered; therefore, the observed lack of association between PSA undetectability and margin status should be interpreted as hypothesis-generating rather than conclusive.

CONCLUSIONS

This metrics-based study confirms that a structured, phased robotic fellowship facilitates rapid and safe proficiency acquisition in RARP, enabling achievement of complete

skin-to-skin case performance within eight months. The fellow achieved high-level console involvement (70.6%), mastered all 12 curriculum phases, and successfully performed two complete RARP cases, meeting the primary fellowship objective. The procedure demonstrated a favourable safety profile with 0% transfusion rate, 0% major complications, and 95.6% day-1 discharge, supporting its viability as day-case surgery without routine blood cross-match. Postoperative biochemical outcomes revealed 80.4% undetectable PSA (41/51 cases), with 10 cases (19.6%) showing detectable PSA ranging from 0.1 to 3.5 ng/ml, primarily associated with advanced pathological stage. The discordance between margin status (40.0% PSM) and biochemical outcomes highlights the critical need for standardised pathological reporting protocols in prostate cancer. The achievement of complete RARP cases marks fulfilment of a key fellowship milestone, with the forthcoming focus on consolidating this skillset for independent RARC performance and accumulating the requisite 10–20 independent cases to confirm sustained proficiency as specified by BAUS fellowship guidelines.

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ASTOŅU MĒNEŠU PROVIZORISKA ANALĪZE ROBOTASISTĒTAS RADIKĀLAS PROSTATEKTOMIJAS (RARP) VEIKŠANĀ ĶIRURGAM BEZ IEPRIEKŠĒJAS ROBOTIKAS STAŽĒŠANĀS PIEREDZES, PIEDALOTIES IEGURŅA ROBOTISKĀ URO-ONKOLOĢIJAS STAŽĒŠANĀS PROGRAMMĀ

Strukturētas, uz operācijas posmu moduļu sekvencēm balstītas stažēšanās programmas ir būtiskas komponentes komplicētu robotasistēto operāciju veikšanas apmācībā. Šis pētījums analizē sākotnējo mācīšanās likni, ķirurgam bez iepriekšējas robotikas stažēšanās programmas pieredzes veicot robotasistētu radikālu prostatektomiju (RARP) intensīvas, uz operācijas posmu moduļu sekvencēm balstītas iegurņa uro-onkoloģijas stažēšanās programmas ietvaros, sasniedzot galveno šīs programmas mērķi — pilnīgi patstāvīgu operācijas veikšanu no ādas grieziņa līdz pēdējās šuves uzlikšanai. Tika analizēta prospektīva datu bāze ar 68 secīgām RARP procedūrām (laika intervālā 2025. gada jūlijs – 2026. gada februāris). Primārie mērķi stažēšanās programmas dalībniekam bija piedalīšanās kā konsoles ķirurgam, konsoles darba laiks un 13 procedūras moduļu fāžu bināra izpilde. Fāzes konceptuāli tika saskaņotas ar literatūrā publicētiem RARP modulārās apmācības sekvencēm, ietverot 12 fāzes, kas pielāgotas no izstrādātām mācību programmām, pievienojot 13. fāzi, kas atspoguļo pilnīgu, independentu operācijas veikšanu. Sekundārie mērķa kritēriji ietvēra klīniskās drošības rādītājus (transfūziju biežums, uzturēšanās ilgums slimnīcā, komplikācijas) un bioķīmiskos rezultātus (pēcoperācijas PSA). Statistiskajā analizē tika izmantots Manna–Kendala tests tendenču noteikšanai un Fišera eksaktais tests asociāciju pārbaudei. Stažēšanās programmas dalībnieks piedalījās visās 68 RARP operācijās, darbojoties kā konsoles ķirurgs zem uzraudzības 48 gadījumos (70,6%). Stažēšanās programmas dalībnieka vidējais konsoles darba laiks bija 32 minūtes (IQR 20–45). Laika gaitā tika novērota spēcīga pozitīva tendence veikto fāžu skaitā vienā operācijā (Manna–Kendala $\tau = 0,61$, $p < 0,01$). Stažēšanās programmas dalībnieks sekmīgi pabeidza visas 12 procedūras fāzes, un pirmo reizi 10. fāze (apikālā disekcija) tika pabeigta 57. gadījumā. 13. fāze – pilnīga RARP operācija – tika sasniegta 67. un 68. gadījumā, ar konsoles darba laiku attiecīgi 190 un 160 minūtes, kas veidoja 100% no kopējā operācijas konsoles laika. Nevienam pacientam nebija nepieciešama perioperatīva asins pārliešana (0/68) vai perioperatīvas drenāžas ievadīšana. Vienam pacientam (67. gadījums, 1,5%) bija Clavien–Dindo II pakāpes komplikācija, kurai nepieciešama pēcoperācijas antibiotiku terapija. 67 gadījumos tika izmantots perioperatīvi transuretrālais katetrs, vienā — suprapubiskais katetrs kā daļa no paātrinātas atveseļošanās protokola. 95,6% (65/68) pacientu tika izrakstīti pirmajā dienā pēc operācijas. Stažēšanās programmas dalībnieks piedalījās 17 RARP un 7 RARC (robotiska radikāla cistektomija) ekstendētās iegurņa limfadenektomijās (ePLND). Pēcoperācijas PSA dati bija pieejami 51 gadījumam. No tiem 41 (80,4%) sasniedza nenosakāmu PSA līmeni (0,1 ng/ml), bet 10 gadījumos (19,6%) PSA bija nosakāms robežās no 0,1 līdz 3,5 ng/ml. Galīgā histopatoloģija bija pieejama 50 gadījumiem, uzrādot pozitīvu rezekcijas līniju (PSM) biežumu 40,0% (20/50). Starp pacientiem, kuriem bija pieejami gan PSA, gan rezekcijas līniju statusa dati ($n = 49$), 39 (79,6%) bija nenosakāms PSA, un 13 (33,3%) no šiem gadījumiem bija PSM. Fišera eksaktais tests neapstiprināja statistiski nozīmīgu saistību starp nenosakāmu PSA un rezekcijas malu statusu ($p = 0,20$). Strukturēta, uz operācijas posmu moduļu sekvencēm balstīta stažēšanās robotiskās ķirurģijas programma nodrošina ātru un drošu RARP prasmju apguvi, atspēkojot RARP perioperatīvu plānojumu kā ambulantu operāciju pat mācīšanās liknes laikā. Pilnīgi patstāvīgu operāciju veikšanas sasniegšana astoņos mēnešos pierāda, ka robotiskās ķirurģijas stažēšanās programmas mērķus var sasniegt viena stažēšanās programmas gada ietvaros. Neatbilstība starp bioķīmisko recidīvu pēcoperācijas periodā un rezekcijas līniju statusu uzsver kritisko nepieciešamību pēc standartizētiem patoloģijas ziņojumu protokoliem.