Procedure-specific impact of body mass index on robot-derived intraoperative telemetry: a retrospective single-surgeon cohort study

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KEY WORDS

body mass index, console time, obesity, partial nephrectomy, prostatectomy

ABSTRACT

INTRODUCTION Robotic platforms automatically record intraoperative telemetry, but body mass index (BMI) effects on these micrometrics are unclear.

AIM This study aimed to evaluate BMI–telemetry associations overall and by procedure, focusing on robot-assisted radical prostatectomy (RARP) and robot-assisted partial nephrectomy (RAPN).

MATERIALS AND METHODS A retrospective consecutive single-surgeon cohort of 100 robot-assisted urologic procedures performed between April 2, 2024 and December 22, 2025 was analyzed. BMI was calculated for all participants. The primary outcome was console time, while secondary outcomes included instrument active time and camera installation rate. The associations were evaluated using the Spearman correlation and prespecified procedure-stratified models (log-linear regression for time outcomes and negative binomial regression with log [console time] offset for rate outcomes).

RESULTS The cohort included RARP (n = 43), RAPN (n = 36), and other procedures (n = 21). BMI and console time were available for 97 cases. BMI correlated with console time overall ($r = 0.272$; $P = 0.007$) and in RARP ($r = 0.487$; $P = 0.001$; n = 40), but not in RAPN ($r = 0.09$; $P = 0.6$; n = 36). In the adjusted RARP models (age and extended pelvic lymph node dissection), each 5 kg/m^2 increment in BMI was associated with a 16.8% longer console time (95% CI, 4–31.2; $P = 0.009$), a 17.7% longer instrument active time (95% CI, 4–33.2; $P = 0.01$), and a higher camera installation rate (incidence rate ratio, 1.36 per +5 kg/m^2; 95% CI, 1.07–1.72; $P = 0.01$). Quantile regression suggested a larger effect in prolonged RARP cases (75th percentile, +45 min per +5 kg/m^2; $P < 0.001$).

CONCLUSIONS Higher BMI was associated with longer surgeon-controlled times and increased camera management burden in RARP but not in RAPN. Telemetry may support BMI-adapted scheduling and workflow optimization.

INTRODUCTION Robot-assisted surgery is an established modality in urologic oncology. Robot-assisted radical prostatectomy (RARP) is used in clinically localized prostate cancer, and robot-assisted partial nephrectomy (RAPN) is a standard minimally-invasive approach for nephron-sparing surgery in selected patients with renal tumors.[1,2] In parallel with clinical outcomes, modern robotic platforms automatically capture system-generated intraoperative metrics, usually referred to as automated performance metrics, that describe procedure flow without additional manual annotations.[3] These metrics include console time (time during which the primary surgeon controls the robot), instrument active time, and event counts, such as instrument exchanges and endoscope installations. Such telemetry complements traditional "skin-to-skin" operative time by providing a system-defined representation of intraoperative workload and workflow.

Obesity remains highly prevalent, and is commonly defined as body mass index (BMI) equal to or greater than 30 kg/m^2.[4] In pelvic robotic surgery, increased adiposity may reduce working space and worsen visualization, potentially prolonging dissection and reconstruction times.

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Received: January 5, 2026.
Revision accepted: February 2, 2026.
Published online: February 9, 2026.
Wideochir Inne Tech Maloinwazyjne. 2026; 21 (1): 37-44
doi:10.20452/wiitm.2026.18014

Recent meta-analyses and cohort studies suggest that morbid obesity is associated with longer operative or console times after RARP, and may influence perioperative outcomes, while oncologic outcomes may remain comparable in appropriately selected patients.[5,6] Moreover, prolonged console time has been associated with postoperative recovery metrics and complications in single-surgeon series, highlighting the clinical relevance of efficiency measures.[7]

For RAPN, large registries indicate that the procedure is feasible in patients with morbid obesity, with perioperative outcomes broadly comparable after adjustment for case mix; however, technical demands may differ from those of pelvic surgery.[8]

Despite the availability of system-generated telemetry, most obesity studies in robotic urology rely on global outcomes, such as total operative time. Studies are limited regarding the specific robotic micrometrics (eg, camera management events) that account for increased workload in patients with obesity. Additionally, whether the relationship between BMI and telemetry is procedure-specific remains unknown. Understanding these components could improve preoperative planning, case scheduling, and workflow optimization.

AIM The main goal of this study was to evaluate whether patient BMI is associated with console time in a consecutive series of robot-assisted urologic procedures, using prespecified procedure-stratified analyses for RARP and RAPN. It also aimed to quantify the association between BMI and other telemetry-derived workload metrics (instrument active time, instrument exchanges, and endoscope installation burden), and to explore whether BMI has a stronger association with prolonged cases, using upper-quartile (75th percentile) regression for console time in RARP.

MATERIALS AND METHODS

Study design and reporting This retrospective observational cohort study was designed to analyze a consecutive series of robot-assisted urologic procedures. The report follows the STROBE recommendations for observational studies.[9] The sample size (100 consecutive cases) was based on data availability; no a priori power calculation was performed. Because the procedures were performed by a single surgeon, external validity may be limited, and the findings should be interpreted as hypothesis-generating. Future studies should validate the BMI–telemetry associations in multisurgeon and / or multicenter cohorts to assess reproducibility across different techniques, teams, and experience levels. Procedure-stratified analyses were prespecified; however, the subgroup sample sizes (RARP, n = 43; RAPN, n = 36) limit statistical power for detecting small-to-moderate associations. As an a posteriori sensitivity consideration for correlation testing (2-sided $\alpha = 0.05$), the RAPN subgroup provided approximately 80% power only for correlations of ρ equal to or greater than 0.45; therefore, a null finding in RAPN may reflect type II error rather than a true absence of association.

Setting The dataset reflects single-center, single-surgeon (RD) robot-assisted urologic surgeries performed between April 2, 2024 and December 22, 2025, using the da Vinci X robotic system (Intuitive Surgical, Sunnyvale, California, United States). The study was conducted at the Department of Urology and Urological Oncology of the Multidisciplinary Hospital in Warsaw-Międzylesie (Warszawa, Poland). Perioperative variables were collected during the index hospitalization, and 30-day readmission status was assessed from the institutional record.

Study participants All consecutive robot-assisted urologic procedures recorded in the database were included (n = 100). No additional exclusion criteria were applied. For procedure-stratified analyses, 2 major groups were prespecified—RARP and RAPN—as these procedures represented most cases and have distinct technical characteristics. Other robotic procedures were summarized descriptively. Cases were excluded from specific analyses if BMI or the corresponding telemetry variable was missing.

Data sources and variables Anthropometrics (height and weight) and demographic variables were routinely documented in the clinical record and entered into the database. BMI was expressed in kg/m^2. It was analyzed as a continuous variable, and categorized for descriptive purposes: normal weight (<25 kg/m^2), overweight (25–29.9 kg/m^2), or obese (≥30 kg/m^2). Postoperative histopathology findings for oncologic procedures (pathologic stage / grade group for RARP and renal tumor histology / stage for RAPN) were extracted from routine pathology reports and summarized descriptively to characterize the case mix. Procedure-specific case-complexity covariates that could confound BMI–telemetry associations (eg, prostate volume for RARP and renal nephrometry score / tumor location or tumor size for RAPN) were not routinely available in the database and, therefore, could not be included in the multivariable adjustment; residual confounding is possible. Additional perioperative variables (used descriptively and in exploratory analyses) included length of hospital stay (d), transfusion (number of red blood cell units), drain output on postoperative day 1 (ml), drain maintenance duration (d), and perioperative hemoglobin decrease (preoperative minus next-morning value). These variables were extracted from the values routinely documented in the electronic medical records.

Robot-derived telemetry metrics were generated automatically by the robotic platform and retrieved from case-level summaries available in an intuitive mobile application (iOS; Apple Inc., Cupertino, California, United States). The values were manually extracted into a study spreadsheet for analysis. The telemetry metrics included console time (min), instrument active time (min), instrument exchanges (count), instruments count (count), and endoscope installations (camera installs; count), including 0- and 30-degree endoscopes (exposure-normalized camera installation burden was computed as the number of installs per 100 console minutes).

Outcomes The primary outcome was the console time. The secondary outcomes included instrument active time, instrument exchanges, and camera installation burden.

Ethics This retrospective observational study was conducted using anonymized, routinely collected clinical, laboratory, and robotic system telemetry data. The study involved no intervention beyond standard clinical care and no direct contact with the participants. According to the applicable national regulations and institutional policies for retrospective analyses of fully deidentified routine data[10], formal review and approval by a bioethics committee were not required. Individual informed consent was waived owing to the retrospective design and the use of anonymized data. The study was conducted according to the principles of the Declaration of Helsinki and applicable data protection regulations.

Covariates Age at surgery was derived from the year of birth and date of surgery. Sex was recorded as male or female. For RARP cases, extended pelvic lymph node dissection (ePLND) was identified from procedure descriptions, and included as an adjustment variable.

Bias and confounding To reduce selection bias, all consecutive cases in the prespecified period were included. Telemetry metrics were system-generated; however, manual transcription into the spreadsheet could introduce measurement error. The data were reviewed for plausibility and outliers before analysis. Nonetheless, unmeasured confounding may remain, as procedure-specific complexity factors were not captured (eg, prostate size, prior pelvic surgery, or tumor complexity).

Statistical analysis Continuous variables were presented as mean (SD) when approximately normally distributed, and as median (interquartile range [IQR]) when skewed. Categorical variables were reported as counts and percentages. The associations between BMI and telemetry metrics were evaluated using the Spearman correlation (overall and procedure-stratified for RARP and RAPN). All hypothesis tests were 2-sided with $\alpha = 0.05$. Where applicable, the results were interpreted primarily using effect sizes and 95% CIs rather than relying solely on *P* values; for exploratory end points, the consistency of direction and magnitude were emphasized across the analyses. To address multiplicity across the telemetry outcomes and subgroup analyses, *P* values for the Spearman correlation tests were adjusted using the Benjamini–Hochberg false discovery rate (FDR) procedure across the prespecified family of BMI–telemetry correlations (overall, RARP, and RAPN; 4 outcomes; 12 tests); FDR-adjusted *q* values are reported, with a *q* value below 0.05 considered significant. For ordinary least squares models, heteroskedasticity-consistent standard errors were used.

Models adjusted for time outcomes The console and instrument active times displayed right-skewed distributions; therefore, log-transformations were applied and ordinary least squares models were fitted on the log scale. Heteroskedasticity-robust standard errors were considered. The effects were expressed as percent change per each 5 kg/m^2 increment in BMI by back-transforming regression coefficients.

Upper-quartile (prolonged case) analysis To evaluate whether BMI has a larger effect in prolonged cases, quartile regression was fitted at the 75th percentile of the console time in RARP.

Count and rate outcomes For camera installation burden (counts observed over different console time exposures), negative binomial regression with an offset for log (console time) was used to model installation rates and account for overdispersion. The effects were expressed as incidence rate ratios (IRRs) per each 5 kg/m^2 increment in BMI.

Missing data BMI was missing for 2, whereas telemetry for 1 of the 100 cases. In addition, endoscope installation counts (0°/30°) were missing for 1 RARP case; therefore, camera installation summaries and rate models involved slightly smaller denominators (eg, n = 98 overall for install-derived metrics; n = 41 in RARP for install-derived summaries; and n = 39 in the adjusted RARP rate model). Complete case analyses were used for each model. Given the low proportion of missingness and the nature of aggregated telemetry, multiple imputations were not performed.

Sensitivity analysis A prespecified sensitivity analysis excluded an extreme BMI outlier (>2 SD above mean RARP BMI) to evaluate the robustness of associations. In addition, because endoscope installation counts showed a single high-leverage observation (extreme install count), a sensitivity analysis was conducted for the camera installation rate model, excluding that observation (and, equivalently, excluding converted cases with available install data) to assess the robustness of the IRR estimates. In this dataset, the above-2 SD criterion identified 2 RARP cases. All analyses were performed using Python software (Python Software Foundation, Beaverton, Oregon, Unites States; pandas, scipy, statsmodels).

TABLE 1 Characteristics of the study cohort

Characteristic		Overall (n = 100)	RARP (n = 43)	RAPN (n = 36)
Age, y, mean (SD)		60.1 (12.7)	65.3 (6.8)	57.9 (11.6)
Female sex		18 (18)	0	12 (33.3)
BMI-related parameters[a]	BMI, kg/m^2, mean (SD)	27.5 (4.7)	28.8 (4.1)	26.9 (4.7)
	BMI <25 kg/m^2	27 (27.6)	8 (19.5)	11 (30.6)
	BMI 25–29.9 kg/m^2	48 (49)	18 (43.9)	19 (52.8)
	BMI ≥30 kg/m^2	23 (23.5)	15 (36.6)	6 (16.7)
	BMI missing	2 (2)	2 (2)	0
ePLND		19 (19)	16 (37.2)	0
Conversion to open surgery		3 (3)	2 (4.7)	1 (2.8)
30-day readmission		1 (1)	1 (2.3)	0
Length of stay, d, median (IQR)		5 (4–7)	4 (4–6)	5 (4–7)

Data are presented as number (percentage) unless indicated otherwise.

a Percentages for BMI categories were calculated for the patients with available BMI.

Abbreviations: BMI, body mass index; ePLND, extended pelvic lymph node dissection; IQR, interquartile range; RAPN, robot-assisted partial nephrectomy; RARP, robot-assisted radical prostatectomy

TABLE 2 Robot-derived telemetry metrics[a]

Telemetry metric	Overall (n = 100)	RARP (n = 43)	RAPN (n = 36)
Console time, min	144 (96.5–168.5)	158.5 (145.5–184.2)	103.5 (85.8–154.2)
Instrument active time, min	127 (83.5–149)	141.5 (127.2–164.5)	91.5 (73.5–129)
Instrument count, n	4 (4–4)	4 (4–4)	4 (4–4)
Instrument exchanges, n	3 (1–5.5)	5 (4–7)	1 (1–3)
Camera installs, n	3 (2–5)	5 (3–8)	2 (1–4)
Camera installs/100 console min, n	2.45 (1.71–3.74)	3.33 (2.16–4.49)	1.97 (1.28–3.09)

Data are presented as median (interquartile range).

a Telemetry availability: console time/instrument active time/instrument counts and exchanges were available for 99/100 cases. Endoscope installation counts were available for 98/100 cases.

Abbreviations: see **TABLE 1**

TABLE 3 Adjusted effect estimates in robot-assisted radical prostatectomy[a]

Outcome	Effect estimate per +5 kg/m^2 BMI (95% CI)	*P* value
Console time (log-linear OLS)	+16.8% (4–31.2)	0.009
Instrument active time (log-linear OLS)	+17.7% (4–33.2)	0.01
Camera installation rate (NB with offset)	IRR, 1.36 (1.07–1.72)	0.012
Console time (75th percentile quartile regression)	+45 min at 75th percentile	0.0002

a All models were adjusted for age and ePLND.

Abbreviations: IRR, incidence rate ratio; NB, negative binomial; OLS, ordinary least squares; others, see **TABLE 1**

RESULTS The cohort included 100 consecutive robot-assisted urologic cases. RARP accounted for 43 cases, and RAPN constituted 36; the remaining procedures (n = 21) were heterogeneous and summarized descriptively. Conversion to open surgery occurred in 3 cases (3%), and 1 case (1%) of 30-day readmission was recorded.

Baseline characteristics Mean (SD) age of the cohort was 60.1 (12.7) years. Mean (SD) BMI was 27.5 (4.7) kg/m^2; 23.5% of the patients with available BMI were individuals with obesity (BMI ≥30 kg/m^2). RARP patients were older, while the RAPN group included a higher proportion of women (**TABLE 1**). Because this was a retrospective consecutive series, there was no nonparticipation.

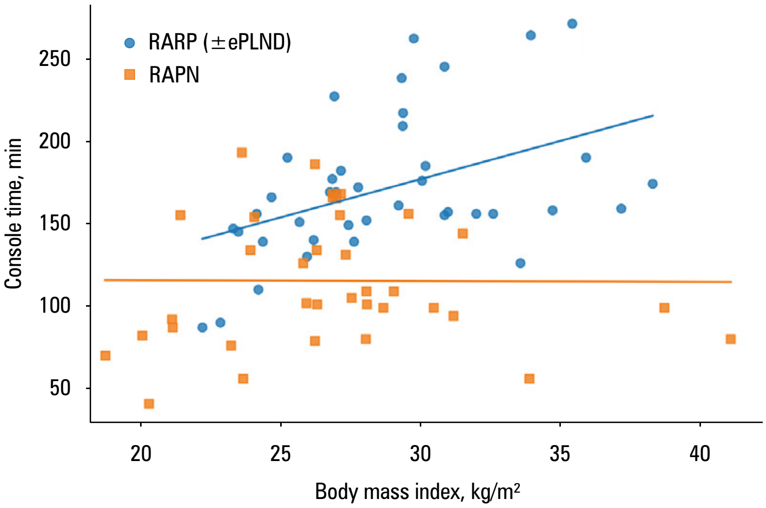

FIGURE 1 Body mass index vs console time, stratified by robot-assisted radical prostatectomy and robot-assisted partial nephrectomy, with least-squares fit lines

Abbreviations: see **TABLE 1**

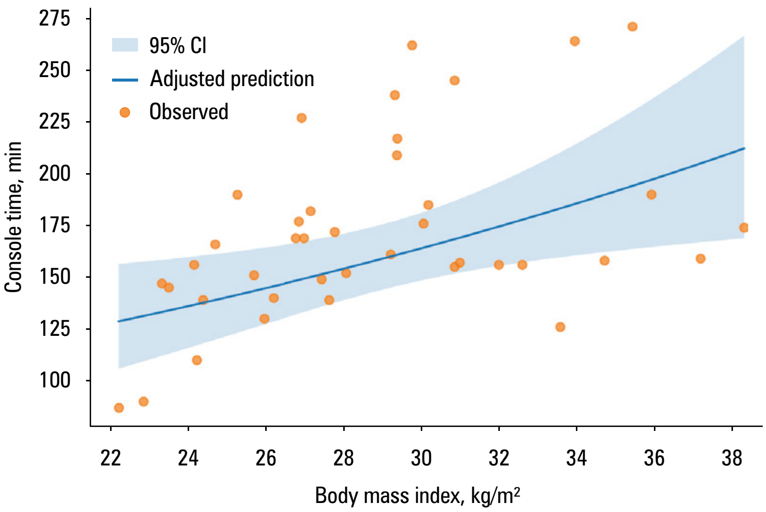

FIGURE 2 Adjusted association between body mass index and console time in robot--assisted radical prostatectomy (log-linear model; predicted minutes with 95% CI, adjusted for age and extended pelvic lymph node dissection)

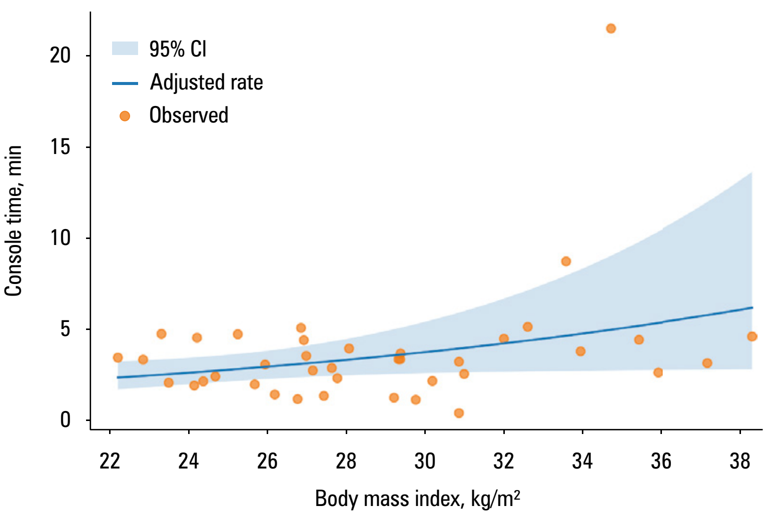

FIGURE 3 Body mass index and camera installation burden in robot-assisted radical prostatectomy (negative binomial rate model; predicted installs per 100 console minutes with 95% CI, adjusted for age and extended pelvic lymph node dissection)

BMI was not available for 2 RARP cases (missing height / weight values from the medical records), and console time was missing in 1 RARP case (telemetry summary unavailable), leaving 97 cases with complete BMI and console time for the primary BMI–console time analysis. Endoscope installation counts were available for 98 cases (additional missing install data in 1 RARP case).

Histopathology Histopathology reports were available for 41/43 RARP (95.3%) and 35/36 RAPN cases (97.2%). In RARP, most tumors were organ-confined (pT2*; 29/43; 67.4%), and a positive surgical margin (R1) was uncommon (1/43; 2.3%). In RAPN, clear cell renal cell carcinoma was the most frequent diagnosis (19/36; 52.8%), and 8/36 cases (22.2%) were benign lesions (angiomyolipoma or oncocytoma).

Telemetry overview Median (IQR) console time was 144 (96.5–168.5) minutes. RARP had longer console and instrument active times, as well as higher instrument exchange and camera install counts than RAPN (**TABLE 2**).

Unadjusted association between body mass index and console time Of the 100 cases, BMI and console time were jointly available for 97 procedures (RARP, n = 40; RAPN, n = 36), which constituted the set for the primary correlation analyses. The adjusted RARP time models involved 40 cases, whereas the adjusted RARP camera installation rate model comprised 39 procedures owing to missing install data. Across all procedures with complete data, BMI correlated with console time ($r = 0.272$; $P = 0.007$). Stratified by procedure, BMI correlated with console time in RARP ($r = 0.487$, $P = 0.001$) but not in RAPN ($r = 0.09$; $P = 0.6$). **FIGURE 1** illustrates the procedure-specific pattern.

Adjusted association in robot-assisted radical prostatectomy In the multivariable log-linear regression restricted to RARP and adjusted for age and ePLND, each 5 kg/m^2 increment in BMI was associated with a 16.8% (95% CI, 4–31.2) longer console time ($P = 0.009$) and a 17.7% (95% CI, 4–33.2) longer instrument active time ($P = 0.01$; **TABLE 3**). The adjusted association between BMI and console time is shown in **FIGURE 2**.

In the sensitivity analysis excluding the 2 RARP cases with BMI above 37 kg/m^2 (>2 SD above mean RARP BMI), the association between BMI and console time remained positive and was slightly stronger than in the primary adjusted model (+24.1% per +5 kg/m^2; 95% CI, 10.2–39.7 vs +16.8% in the main analysis.

Upper-quartile (prolonged case) analysis Quantile regression suggested that BMI had a stronger association with prolonged RARP cases, with an estimated 45-minute increase at the 75th percentile per each 5 kg/m^2 increment in BMI (P <0.001; **TABLE 3**).

TABLE 4 Histopathology result summary for robot-assisted radical prostatectomy and robot-assisted partial nephrectomy

Characteristic		RARP (n = 43)	RAPN (n = 36)
Pathology report available		41 (95.3)	35 (97.2)
RARP histopathology	pT2* stage	29 (67.4)	–
	≥pT3 stage	6 (14)	–
	pT stage not reported	8 (18.6)	–
	ISUP grade group 1–2	14 (32.6)	–
	ISUP grade group 3	9 (20.9)	–
	ISUP grade group 4–5	12 (27.9)	–
	ISUP grade group not reported	8 (18.6)	–
	Positive surgical margin (R1)	1 (2.3)	–
	Margin status not reported	6 (14)	–
RAPN histopathology	Clear cell RCC	–	19 (52.8)
	Papillary RCC	–	5 (13.9)
	Chromophobe RCC	–	2 (5.6)
	Benign lesions (angiomyolipoma/oncocytoma)	–	8 (22.2)
	Other renal tumor (EVT)	–	1 (2.8)
	Histology not reported	–	1 (2.8)
	pT1a stage	–	23 (63.9)
	pT1b stage	–	3 (8.3)
	pT stage not reported	–	10 (27.8)
	Positive surgical margin (R1)	–	2 (5.6)
	Margin status not reported	–	11 (30.6)

Data are presented as number (percentage).

Abbreviations: EVT, eosinophilic vacuolated tumor; ISUP, International Society of Urological Pathology; RCC, renal cell carcinoma; others, see **TABLE 1**

Exploratory micrometric: camera installation burden In the negative binomial rate modeling (endoscope installations per console time) adjusted for age and ePLND, high BMI was associated with a higher camera installation rate (IRR, 1.36 per each 5 kg/m^2 increment in BMI; 95% CI, 1.07–1.72; P = 0.01). **FIGURE 3** shows the observed and model-predicted rates. A sensitivity analysis excluding 1 high-leverage outlier attenuated the association but did not reverse direction. After excluding the high-leverage install observation, the adjusted association lost significance (IRR, 1.15 per each 5 kg/m^2 increment in BMI; 95% CI, 0.96–1.39; P = 0.13).

Other telemetry metrics There was no consistent association between BMI and the instrument exchange rate after accounting for console time exposure (exploratory analysis not shown).

Exploratory linkage between telemetry and perioperative outcomes To enhance clinical relevance, this study examined whether prolonged console time was associated with available perioperative proxies. Prolonged console time (upper quartile ≥169 min) was associated with higher drain output on postoperative day 1 (median [IQR], 100 [100–150] vs 50 [0–100] ml; P = 0.003; n = 84) and longer drain maintenance duration (median [IQR], 2 [2–3] vs 2 [1–2] d; P = 0.003; n = 85). In addition, console time correlated with the perioperative hemoglobin decrease (preoperative to next-morning value; r = 0.309; P = 0.002; n = 99). Conversion (n = 3), transfusion (n = 8), and 30-day readmission (n = 1) events were uncommon, limiting robust modeling of complication-related outcomes. Postoperative histopathology outcomes were available in the medical records and are summarized descriptively in **TABLE 4**; however, functional outcomes (eg, continence or erectile function) were not available in a format fit for analysis, and should be addressed in future studies.

DISCUSSION **Principal findings** This consecutive cohort study demonstrated that BMI was associated with objective, robot-derived telemetry in a procedure-specific manner. Across all procedures with complete data, high BMI correlated with prolonged console time; however, the association was observed only in RARP, and not in RAPN. In RARP models adjusted for age and ePLND, each 5 kg/m^2 increment in BMI was associated with approximately 17% longer console and instrument active times, with larger effects observed among prolonged RARP cases (75th percentile). Additionally, the exploratory rate modeling showed that high BMI was associated with a high endoscope installation burden per unit of console time, suggesting that camera management represents an additional source of workflow disruptions in patients with obesity. Endoscope (re)installations are a clinically interpretable micrometric: in robot-assisted prostatectomy, camera cleaning or camera changes are among the most frequent sources of interruptions.[11] Flow disruptions in robotic surgery have been associated with higher perceived mental workload (including situational stress and distractions) among operating room professionals,[12] and systematic evidence links operating room distractions/interruptions/disruptions with impaired team performance, prolonged operative duration, and—in some settings—higher error rates or adverse outcomes.[13] Accordingly, the higher camera-installation burden observed with increasing BMI may represent a "hidden" workload component that can contribute to surgeon and team fatigue rather than a purely technical artifact.[14,15] This interpretation has practical implications for perioperative planning: by using BMI together with planned ePLND, centers could prospectively flag RARP cases with obesity likely to exceed telemetry-defined thresholds (eg, upper-quartile console time or elevated camera installation rates) and allocate longer operating room time slots and experienced bedside assistance. Finally, telemetry-derived camera management metrics may be suitable for incorporation into training and quality improvement initiatives as objective, actionable targets—consistent with emerging frameworks that standardize robotic training using objective performance indicators.[3,16]

Comparison with contemporary literature Our RARP findings align with contemporary reports describing prolonged operative or console times in patients with obesity and morbid obesity undergoing RARP.[5,6] Notably, operative efficiency metrics, such as console time, may be clinically meaningful; prolonged console times have been associated with postoperative outcomes and recovery parameters in RARP cohorts.[7] Together, these data support the concept that obesity-related technical complexity translates into measurable increases in intraoperative workload.

In contrast, the absence of a BMI–console time association in RAPN aligns with the registry level observations that nephron-sparing surgery remains feasible in patients with morbid obesity, with outcomes comparable to those of patients without obesity, after accounting for case mix and perioperative risk.[8] The heterogeneous relationship between BMI and RAPN efficiency possibly reflects the dominant influence of tumor complexity, renal anatomy, and perinephric fat characteristics, which are not fully captured by BMI alone.

Added value of telemetry: moving beyond "minutes" A key contribution of this study is the use of system-generated telemetry (automated performance metrics) to quantify discrete components of intraoperative workload beyond total operative time.[3] Console and instrument active times isolate surgeon-controlled phases of an operation, and may be more sensitive to technical factors than room time. Additionally, event counts, such as endoscope installations, provide a microlevel proxy for visualization of interruptions and workflow disruptions. By decomposing efficiency into such components, telemetry may uncover the most responsive elements to targeted interventions (eg, camera management, port placement strategies, or team choreography) in patients with obesity.

Clinical implications The effect estimates can be translated into practical scheduling guidance. For example, the adjusted model showed that for RARP with an expected console time of approximately 160 minutes, a 5 kg/m^2 increase in BMI corresponded to an additional 25–30 minutes of console engagement. Because the effect appeared larger in prolonged cases, the scheduling impact may be greatest for high-complexity procedures in patients with obesity. Therefore, telemetry-informed planning could reduce overruns, improve operating room utilization, and help align staffing and anesthesia time with anticipated workload.

Strengths The strengths of this study include consecutive case design, objective telemetry extraction (reducing measurement bias), and the use of modeling approaches appropriate for skewed time data and overdispersed count / rate data. Procedure-stratified analyses reduce clinical heterogeneity and support clinically meaningful interpretation.

Limitations The study has some limitations. First, it is a single-center, single-surgeon dataset; thus, the results may not be generalized to other institutions, teams, or robotic platforms. Second, there could have been unmeasured confounding, since procedure-specific complexity variables were lacking (eg, prostate volume, prior pelvic surgery, and tumor complexity scores for RAPN). To further characterize oncologic case mix, a descriptive summary of available postoperative histopathology for RARP and RAPN was added (**TABLE 4**); however, key preoperative complexity descriptors and robotic software version metadata remained unavailable, and residual confounding is possible. Third, telemetry definitions and event logging may vary by software version and platform, which could affect comparability across settings. Finally, the exploratory camera installation finding was influenced by a high-leverage observation, emphasizing the need for confirmation in larger datasets.

Future research Future studies should validate BMI–telemetry associations in multicenter cohorts, and incorporate anatomic fat distribution metrics (visceral fat area and periprostatic fat) that may outperform BMI in explaining technical challenges. Combining telemetry with clinical variables could improve prediction models for operative time and enable personalized surgery planning.

CONCLUSIONS

In this consecutive cohort, high BMI was associated with prolonged console and instrument active times in RARP but not in RAPN, indicating a procedure-specific effect of obesity on robotic operative efficiency. Robot-derived telemetry offers a granular framework to quantify intraoperative workload, and may support BMI-adapted scheduling and workflow optimization. These findings require validation in larger, multicenter datasets.

ARTICLE INFORMATION

ACKNOWLEDGMENTS None.

FUNDING None.

CONTRIBUTION STATEMENT RBD was responsible for the study conception and design, data collection and curation, statistical analysis, manuscript drafting and revision, and approval of the final manuscript.

CONFLICT OF INTEREST None declared.

AI STATEMENT Artificial intelligence was not used in the preparation of this manuscript.

HOW TO CITE Drobot RB. Procedure-specific impact of body mass index on robot-derived intraoperative telemetry: a retrospective single-surgeon cohort study. Wideochir Inne Tech Maloinwazyjne. 2026; 21: 37-44. doi:10.20452/wiitm.2026.18014

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