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Utilizing a modified-Postoperative Morbidity Survey for assessing morbidity after laparoscopic or robot-assisted radical prostatectomy: a retrospective observational study

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Abstract

Background Compared with open radical prostatectomy (RP), laparoscopic or robot-assisted RP have shown a notable decrease in the incidence of organ dysfunction or potentially life-threating complications after surgery. However, despite advances, the postoperative length of hospital stay (LOS) remains longer than desired in many cases. The Postoperative Morbidity Survey (POMS) is a simple approach to detect complications capable of prolonging LOS. The primary objective of this study was to outline the incidence and type of early morbidity following laparoscopic or robot-assisted RP using modified POMS(m-POMS). The secondary objective was to investigate the correlation between m-POMS and postoperative LOS.

Methods A retrospective study of the electronic health records was performed for all eligible patients undergoing laparoscopic or robot-assisted RP over a one-year period (August 1, 2022 to July 31, 2023). Morbidity as defined by m-POMS was collected on postoperative day 1 (POD1), POD3, POD5 and POD8. Poisson regression models were employed to assess the correlation between positive m-POMS and postoperative LOS.

Results A total of 121 patients were included. Morbidity, as measured by m-POMS, occurred on POD1 (19.01%, 95% CI [13.01%, 26.91%]), POD3 (18.81%, 95% CI [12.39%, 27.52%]), POD5 (30.23%, 95% CI [18.60%, 45.10%]) and POD8 (35.29%, 95% CI [17.31%, 58.70%]). Two prevalent domains with positive m-POMS scores were infectious and pulmonary. The occurrence of morbidity as indicated by m-POMS was correlated with longer median (IQR) postoperative LOS on POD1 7 (5, 9) versus 4 (4, 6), POD3 7 (6, 11) versus 5(4, 6), and POD5 11 (6.5, 11) versus 7(6, 9) ($p < 0.05$) compared with patients who did not encounter m-POMS-assessed morbidity. Regression analysis showed that m-POMS-defined morbidity was correlated with longer postoperative LOS on POD1 and POD3.

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Conclusions The incidence of early morbidity, as defined by m-POMS following radical prostatectomy, was approximately 20%, with infectious and pulmonary complications being the most prevalent. Short-term morbidity assessed by m-POMS was significantly associated with prolonged LOS.

Keywords Radical prostatectomy, Length of hospital stay, Postoperative Morbidity Survey

Introduction

With the incidence of prostate cancer evidently rising, it has become the second most commonly diagnosed cancer in males [1]. The widespread use of prostate-specific antigen (PSA) screening, combined with growing public awareness, has led to an increase in the diagnosis of localized prostate cancer. Radical prostatectomy (RP) is recognized as an effective treatment for localized prostate cancer [2]. Compared with open RP, laparoscopic or robot-assisted prostatectomy has been associated with a significant reduction in the incidence of severe postoperative complications, which may result in organ dysfunction or potentially life-threatening consequences [3, 4]. However, the postoperative length of hospital stay (LOS) following RP remains longer than desired in some cases [5]. The viability of same-day discharge RP was proposed over a decade ago in certain medical institutions, yet its widespread acceptance and implementation have not materialized [5–7]. Increasing age, American Society of Anesthesiologists (ASA) class 3 or 4, presence of a bleeding disorder, insulin-dependent diabetes, dyspnea, smoking, congestive heart failure (CHF), and increasing operative time were identified as significant risk factors for prolonged LOS [8].

Traditional postoperative assessment methods, such as discharge criteria based purely on hemodynamic stability or subjective clinical judgment, have significant limitations, particularly in systematically identifying organ-specific morbidities. These assessment methods often rely on superficial symptoms and subjective evaluations, which may overlook many potential complications that do not immediately manifest but could adversely affect recovery and extend hospital stay if left unaddressed [9]. The need for a systematic approach, like postoperative morbidity survey (POMS), is further emphasized by its capacity to capture early morbidity, which may otherwise go undetected. Early identification is essential for initiating prompt interventions, which can help to mitigate complications and optimize recovery [10]. For patients undergoing laparoscopic or robot-assisted radical prostatectomy, where early mobility and rapid recovery are critical goals, systematic morbidity assessment can directly influence the success of postoperative care pathways, such as Enhanced Recovery After Surgery (ERAS) protocols [7]. The POMS was designed to detect complications capable of prolonging hospital discharge [11]. The POMS presents a straightforward approach to identify and quantify complications after surgery, encompassing 9 domains of postoperative morbidity which including pulmonary, infection, renal, gastrointestinal, cardiovascular, neurological, wound, haematological and pain [9, 12]. Data collection in POMS is intentionally simple, relying on readily accessible clinical information without requiring additional investigations [9]. Crucially, these indicators define morbidity based on clinically important consequences, such as length of hospital stay, instead of conventional diagnostic classifications [9, 11]. POMS has undergone validation in a variety of moderate and major surgical procedures, encompassing general surgery, cardiac surgery, hip-fracture surgery and neurosurgery [9–11, 13]. It is noteworthy that, up until now, POMS has not been specifically evaluated in patients undergoing laparoscopic or robot-assisted radical prostatectomy.

The primary objective of this study was to outline the incidence and type of early morbidity following laparoscopic or robot-assisted prostatectomy using the modified POMS (m-POMS, details can be found in the Methods section), in order to gain a better understanding about which and how intervention can be focused to enhance outcomes. The secondary objective was to investigate the correlation between m-POMS and postoperative length of hospital stay (LOS).

Methods

Data source and collections

We performed a retrospective study of the electronic health records for patients whose major procedure including "prostate" at the Beijing Hospital, National Center of Gerontology between August 1, 2022 and July 31, 2023. Ethical approval was obtained from the institutional review board of Beijing Hospital (2024BJYYEC-KY0005-01). Subsequently, the trial was prospectively registered at www.chictr.org.cn (ChiCTR2400081838) on March 13, 2024, and consent was waived.

Patients who underwent laparoscopic or robot-assisted RP were identified for enrollment in the study. We excluded other procedures related to prostate, such as transurethral resection of prostate or prostate puncture biopsy performed independently. Additionally, we excluded cases involving radical prostatectomy combined with procedures other than prostate puncture biopsy, as well as instances where laparoscopic or robot-assisted operations were converted to open procedures.

Data from the electronic health records were collected in this study, including (1) demographic information; (2) pre-existing co-morbidities, the American Society of

Anesthesiologist Physical Status (ASA-PS); (3) radical prostatectomy performed either through pure laparoscopy or robot-assistance; (4) concomitant lymph node dissection or not; (5) operative time (minutes) measured from the initiation to the end of the surgery; (6) post-operative duration of drainage tube retention measured from the day of surgery (D0) to the day of removal; (7) post-operative LOS measured from the day of surgery (D0) to the day of discharge; (8) readmission within 30 days post-surgery owing to complications related to the surgical procedure.

Postoperative morbidity survey

The POMS, a 9-domain tool based on organ systems, is devised for documenting of postoperative morbidity [9, 12]. POMS data were collected for patients on postoperative day 1 (POD1), POD3, POD5 and POD8. Patients discharged home at each measurement point were presumed to be without morbidity as defined by POMS. According to the POMS methodology, each patient is assigned a maximum score of one point per organ system. For example, the presence of a temperature exceeding 38 °C and the utilization of antibiotics contribute one point to the infection category. POMS is considered positive when the criteria for any one of the 9 domains is met.

We made three modifications to the POMS scoring (Table 1). Firstly, since patients undergoing RP routinely receive intravenous antibiotics postoperatively in our hospital to prevent infection, we revised the category of "currently on antibiotics" to "changing the type of antibiotics used". This adjustment refers to the use of one type of antibiotic on the day of surgery and the subsequent addition or change to another type at the time point of assessment. This modification was necessary to provide a more accurate evaluation of morbidity related to postoperative infections within this patient cohort. Secondly, in assessing renal outcomes, the presence of a urinary catheter was not considered meeting the criterion. Specifically, renal element was defined solely based on the occurrence of oliguria or an elevation in serum creatinine levels, rather than the mere presence of a urinary catheter. This approach was particularly relevant for patients undergoing prostate cancer surgery, as these patients typically require catheterization for approximately two weeks and are often discharged with the urinary catheter in place. Thirdly, the scoring of the gastrointestinal element occurs when, at the time of assessment, a patient received either parenteral or enteral nutrition owing to the absence of explicit dietary documentation in the medical records.

Statistical analysis

Categorical data were expressed as numbers (proportions), while continuous data were presented as either the mean (SD) or the median (IQR [range]).

We calculated the postoperative incidence as measured by POMS. Wilson scoring method was used to calculate the 95% confidence interval. Mann-Whitney U test was employed to compare postoperative LOS among patients with and without positive morbidity on each POMS measurement time point (POD1, POD3, POD5 and POD8) to assess the influence of morbidity on postoperative LOS. Poisson regression models were then employed to assess the correlation between positive POMS and postoperative LOS. In the adjusted regression models, the included confounding variables were as follows: age, BMI, ASA-PS, operative time, concomitant lymph node dissection, duration of drainage tube retention. The analyses were replicated for POD1, POD3, POD5, POD8, ensuring adequate observations for constructing the regression model. Patients discharged from hospital were not included in the analyses for the respective days.

A two-sided P-value < 0.05 was deemed statistically significant. The data collection and statistical analysis was employed by Microsoft Excel (version 97-2003) and SPSS (IBM, version 25.0).

A one-year sample size was employed by selecting specific dates for querying electronic health records.

Table 1 Modified postoperative morbidity recorded according to the postoperative morbidity survey

Pulmonary	Has the patient developed a new requirement for oxygen or respiratory support?
Infectious	Does the patient chang the type of antibiotics has used and/or has the patient had a temperature of ≥ 38 °C in the last 24 h?
Renal	Does the patient have any of the following: Oliguria (< 500 ml/d)? Creatinine (> 30% from preoperative level)?
Gastrointestinal	Unable to tolerate enteral diet (oral or tube feed)? Has the patient received either parenteral or enteral nutrition? Is the patient experiencing nausea, vomiting, or abdominal distention?
Cardiovascular	Has the patient undergone diagnostic tests or therapy within the last 24 h for any of the following: New myocardial infarction? Ischemia or hypotension (requiring drug therapy or fluid therapy > 200 ml/h)? Atrial or ventricular arrhythmias? Cardiogenic pulmonary edema/new anticoagulation (warfarin/heparin/Fragmin)?
Neurological	Does the patient have new confusion/delirium, focal deficit, or coma?
Wound complications	Has the patient experienced wound dehiscence requiring surgical exploration or drainage of purulence from the operative wound with/ without isolation of organisms?
Hematological	Has the patient required any of the following within the last 24 h: red blood cells, platelets, fresh frozen plasma, cryoprecipitate?
Pain	Has the patient experienced surgical wound pain significant enough to require parenteral opioids or regional analgesia?

Results

A total of 815 patients were screened for major procedure including "prostate". Of these, 692 underwent transurethral resection of prostate or prostate puncture biopsy independently, and 2 underwent RP combined with procedures other than prostate puncture biopsy. As a result, a total of 121 patients meeting the specified inclusion criteria were included in the study (Fig. 1).

The age of the included patients was 68.8 (6.2) years and the BMI was 24.9 (3.2) kg/m^2. Additionally, 21.5% of the included patients in the study were aged 75 years or older. A majority of patients (76.9%, $n=93$) exhibited ASA-PS grade I or grade II. The prevalent comorbidities included hypertension (47.1%), diabetes (27.3%) and ischemic heart disease (15.7%). The majority of patients (79.3%, $n=96$) experienced robot-assisted RP, with concomitant lymph node dissection performed in 40.5% ($n=49$) of cases. The operative time was 248.5(63.8) minutes, and the duration of drainage tube retention was 3 (2, 4) days (Table 2). Four patients experienced readmission within a 30-day period due to complications associated with their surgical procedures. These complications encompassed one case of intestinal obstruction, another of ureteral obstruction, as well as two instances of fever including one with pelvic lymphocyst infection and the other with urinary tract infection.

Primary outcome—morbidity assessment using POMS

Morbidity, as measured by POMS, occurred on POD1 (19.01%, 95% CI: 13.01%, 26.91%), POD3 (18.81%, 95% CI: 12.39%, 27.52%), POD5 (30.23%, 95% CI: 18.60%, 45.10%) and POD8 (35.29%, 95% CI: 17.31%, 58.70%) (Table 3). Two prevalent domains with positive POMS scores were infectious and pulmonary, which were POD1 (9.1%), POD3 (10.7%), POD5 (3.3%), POD8 (1.7%) and POD1 (5.0%), POD3 (7.4%), POD5 (6.6%), POD8 (1.7%), respectively. Infectious domain decreased starting from POD5 onwards. The majority item of positive infectious domain was associated with a temperature exceeding 38 °C on both POD1 and POD3. All the pulmonary categories were associated with receiving supplemental oxygen via nasal cannula, without any additional respiratory support. The following positive domain was renal, 7 patients (5.8%) experienced a serum creatinine rise of >30% from the preoperative baseline on POD1 but recovered quickly from POD3 onwards. Other POMS-assessed morbidities exhibited minimal occurrence. 1 patient was asked for fasting and given intravenous nutrition for 7 days postoperatively, 1 patient received low-molecular-weight

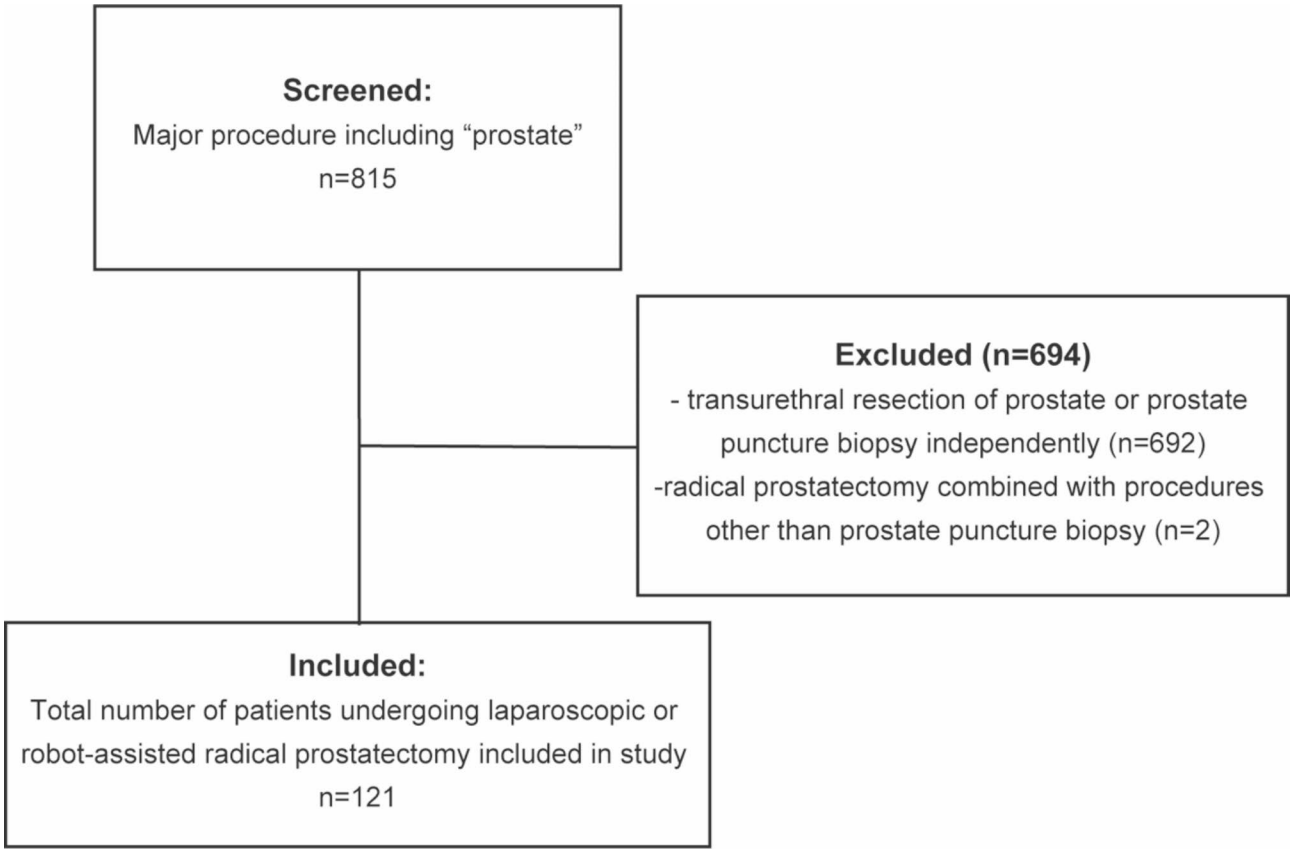

Fig. 1 Study flow chart

Table 2 Baseline characteristics of patients included in the study

	All Patients($n=121$)
Age (mean, SD) years	68.8(6.2)
≥ 75 years (n [%])	26(21.5)
BMI (mean, SD) (kg/m^2)	24.9(3.2)
ASA-PS (n [%])	
I + II	93(76.9)
III	28(23.1)
Medical co-morbidities (n [%])	
Hypertension	57(47.1)
Diabetes	33(27.3)
Hyperlipidaemia	13(10.7)
Ischemic heart disease	19(15.7)
Arrhythmia	9(7.4)
Cerebrovascular accident or TIA	14(11.6)
Cancer diagnosis except prostate	2(1.7)
Respiratory disease	7(5.8)
Liver disease	1(0.8)
Robot-assisted RP/laparoscopic RP (n [%])	96(79.3)/25 (20.7)
Lymph node dissection (n [%])	49(40.5)
Operative time (minute) (mean, SD)	248.5(63.8)
Duration of drainage tube retention (day) Median (IQR [range])	3(2,4[1–14])

SD: standard deviation; BMI: body mass index; ASA-PS: American Society of Anesthesiologists Physical Status; TIA: tansient ischemic attack; RP: radical prostatectomy; IQR: interquartile range

heparin for treating deep vein thrombosis, another 1 suffered from wound complication from POD5 onwards and 2 patients received red blood cell transfusion. None of patients suffered from neurological and pain morbidities. The incidence of postoperative morbidity, as indicated by POMS, were displayed on each day in Fig. 2.

Secondary outcome—correlation between positive POMS and postoperative LOS

The postoperative LOS of the included populations were 5(4, 6 [2–15]) days in general. The occurrence of morbidity as indicated by m-POMS was correlated with longer postoperative LOS on POD1 7 (5, 9) versus 4 (4, 6) (Z= -4.410, $p<0.001$), POD3 7 (6, 11) versus 5(4, 6) (Z= -4.295, $p<0.001$), and POD5 11 (6.5, 11) versus 7(6, 9) (Z= -1.979, $p=0.048$) compared with patients who did not encounter the m-POMS-assessed morbidity. But the correlation between occurrence of the m-POMS morbidity and postoperative LOS on POD8 was not observed. (Table 3).

The Poisson regressions, adjusted for predetermined confounding variables, validated the correlation between positive m-POMS and extended postoperative LOS. The occurrence of morbidity assessed by m-POMS was correlated with longer LOS on POD1 and POD3 compared with patients who did not encounter POMS-assessed morbidity. However, no significant correlation was observed on POD5. POD8 did not undergo analysis due to the limited patients ($n=7$) with positive POMS morbidity on that day. In addition to POMS, duration of drainage tube retention was also found to be associated with prolonged postoperative LOS on POD1, POD3 and POD5 (Table 4).

Discussion

In this study, we observed that the incidence of the m-POMS was 19.01%, 18.81%, 30.23%, 35.29% on POD1, POD3, POD5, POD8, respectively. And the two most prevalent domains with positive m-POMS scores were infectious and pulmonary. However, the m-POMS may not account for some key factors influencing prolonged hospital admission after RP, such as the presence of a drainage tube.

To date, POMS has not been specifically assessed in patients undergoing the laparoscopic or robot-assisted radical prostatectomy. The incidence of postoperative morbidity, as assessed by the m-POMS in this study, is lower compared to similar studies involving a diverse cohort of surgical patients. In an earlier study of urological surgical procedures, including radical prostatectomy, radical cystectomy, and radical nephrectomy, Grocott et al. [9] reported that POMS-assessed morbidity was 93.8% of in-hospital patients on POD3, 77.5% on POD5,

Table 3 Incidence of postoperative morbidity measured by m-POMS

	POD1($n=121$) N(%)	POD3($n=101$) N(%)	POD5($n=43$)N(%)	POD8($n=17$)N(%)
Discharged home	0	20(16.5)	78(64.5)	104(86.0)
m-POMS positive				
Any m-POMS positive	23(19.01)	19(18.81)	13(30.23)	6(35.29)
Median(IQR) positive domains	1(1, 1)	1(1, 2)	1(1, 1)	1(1, 1)
Postoperative LOS, median (IQR[range]) (days)	7(5, 9[4–15])	7(6, 11[4–13])	11(6.5, 11[6–13])	11(10.5, 12.25[9–13])
m-POMS negative				
Incidence	98(80.99)	82(81.19)	30(69.77)	11(64.71)
Postoperative LOS, median (IQR[range]) (days)	4(4, 6[2–15])	5(4, 6[4–15])	7(6, 9[6–15])	10(9, 11[9–15])
	Z=-4.410	Z=-4.295	Z=-1.979	Z=-0.934
	$P<0.001$	$P<0.001$	$P=0.048$	$P=0.351$

POMS: Postoperative Morbidity Survey; POD: postoperative day; IQR: Interquartile range; LOS: length of hospital stay

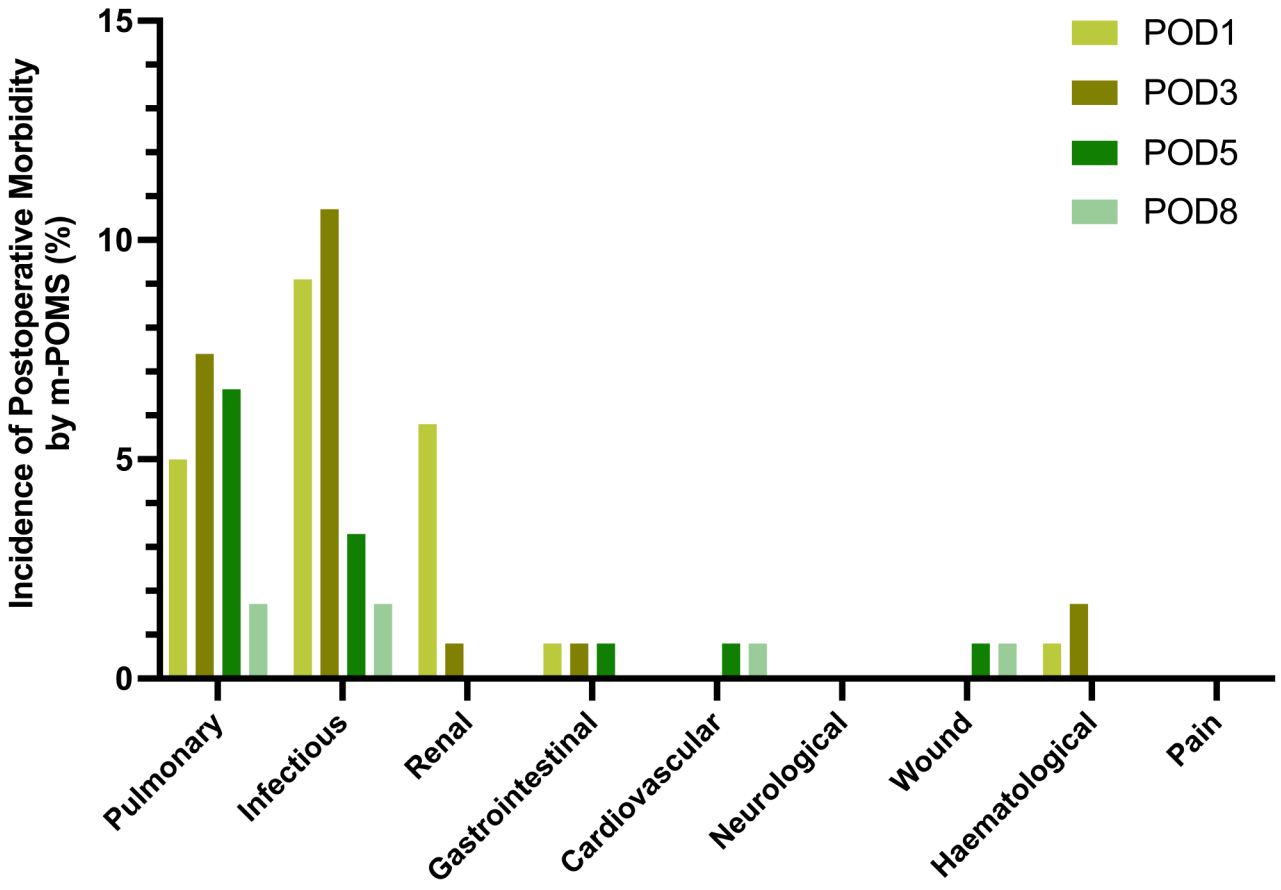

Fig. 2 Incidence of Postoperative Morbidity by m-POMS on POD1, POD3, POD5, POD8. Values are proportions of the total number of the included patients

Table 4 Correlation between positive m-POMS and postoperative LOS

	POD1, *n* = 121		**POD3, *n* = 101**		**POD5, *n* = 43**	
Parameters	Exp(B)	95% CI	Exp(B)	95% CI	Exp(B)	95% CI
Age (year)	0.999	0.986, 1.012	0.994	0.985, 1.003	0.992	0.980, 1.004
BMI	0.990	0.953, 1.028	0.998	0.962, 1.035	1.002	0.977, 1.028
ASA-PS	1.026	0.934, 1.127	1.030	0.931, 1.138	1.073	0.936, 1.231
Operative time(min)	1.001	0.999, 1.002	1.001	0.999, 1.002	1.001	0.999, 1.002
Lymph node dissection	1.037	0.870, 1.237	0.961	0.841, 1.098	0.909	0.783, 1.054
Duration of drainage tube retention(day)	1.097	1.065, 1.131	1.089	1.058, 1.121	1.050	1.019, 1.083
m-POMS positive	1.382	1.192, 1.602	1.479	1.256, 1.741	1.210	0.981, 1.492

POMS: Postoperative Morbidity Survey; LOS: length of hospital stay; POD: postoperative day; CI: confidence interval; BMI: body mass index; ASA-PS: American Society of Anesthesiologists Physical Status

65.4% on POD8, 80% on POD15, which was much higher than what was observed in our study. This difference was attributed to the inclusion of radical cystectomy and radical nephrectomy in that patient cohort, as well as the use of open surgical approaches for radical prostatectomy procedure. It is also noteworthy that, during that period, the Enhanced Recovery After Surgery (ERAS) had not yet been firmly established within the field of perioperative care. Gareth et al. [14] reported that POMS morbidity occurred in 33.7–49.8% of patients who underwent elective major noncardiac surgery on POD3. Our study demonstrated that the incidence of POMS morbidity was 18.81% (95% CI [12.39%, 27.52%]) on POD3, supporting earlier researches which indicated that laparoscopic, particularly robot-assisted RP, was well-suited to potential day-case approach with reduced morbidity and a relatively lower incidence of early postoperative complications [4, 5].

The most frequently observed morbidity, as defined by POMS, was infectious, affecting approximately 10% of

patients on POD1 and POD3, with a decline noted from POD5 onwards. Most positive infectious domains were related to transient temperature elevations above 38 °C without clear evidence of infection. Although infection can cause fever, surgical trauma may also induce fever via the release of pyrogenic cytokines, even in the absence of infection [15]. Postoperative fever is common [16–18], yet it adds stress to families and healthcare providers, potentially prolonging the length of postoperative hospitalization. The subsequent prevalent morbidity defined by POMS was pulmonary domain, requiring the administration of supplemental oxygen through a nasal cannula, suggesting it was minor. The next most prevalent morbidity manifested in renal domain, with 7 patients experiencing temporary elevations in postoperative serum creatinine levels. No patient satisfied the POMS criteria for defining morbidity related to pain. This is consistent with previous studies, which showed that the pain visual analogue scale was less than 3 in 90.8% of patients following robot-assisted RP [19].

Our results indicated that POMS performed well in correlating with the postoperative LOS on early test days (POD1, POD3 and POD5, $P<0.05$), as determined by the positive POMS domains. However, it should be noted that the observed correlations require further validation through prospective studies to determine any direct causal impact. In the multivariate analysis, in addition to POMS, duration of drainage tube retention also affected LOS independently. Symptomatic lymphocele or lymphorrhea represented a common complication following robot-assisted RP [19], leading to the excessive fluid drainage and prolonged drainage tube retention. However, patients experienced symptomatic lymphocele or lymphorrhea did not meet the criteria within any of the POMS domains. Therefore, although short-term morbidity defined by POMS although POMS serves as a dependable approach to document short-term morbidity following major surgery and correlates with LOS, it may be necessary to adapt this approach for specific patient groups to enhance its sensitivity to detect clinically relevant morbidity [11, 20].

There were several limitations to our study. Firstly, it was a retrospective cohort investigation, relying on the accessibility of precise data from electronic health records. While optimizing data capture, we examined records of nurses, medical and surgical details, as well as medication and anesthetic charts. Information bias is a concern, given the possibility of missing or incomplete data, which may have impacted the identification of significant morbidity. Although previous retrospective applications of POMS [9, 10] have supported our approach, the reliance on retrospective records could have limited the full accuracy of morbidity assessments. Secondly, it was challenging to ascertain patients' dietary intake from medical records, leading us to adapt the gastrointestinal domain to account for the administration of parenteral or enteral nutrition. While practical given the data limitations, this adjustment may have resulted in underestimating morbidity in the gastrointestinal domain. Additionally, in accordance with our institutional medical routine following radical prostatectomy, we modified the original POMS criterion from "currently on antibiotics" to "change in antibiotic type" to better capture relevant morbidity associated with postoperative infections. This modification, while providing a more tailored perspective on morbidity, may limit comparability with other studies using standard POMS criteria. Thirdly, the study was conducted at a single tertiary teaching hospital, reflecting regional healthcare practices, which limits the generalizability of our findings to other patient populations or clinical settings. The single-center design restricts external validity, and thus, future multi-center studies are recommended to validate these findings across broader settings. Furthermore, the number of patients decreased after postoperative day 5 (POD5), reducing our statistical power to establish correlations between morbidity and length of stay (LOS) beyond this time point. This reduction suggests that our findings related to late postoperative outcomes should be interpreted with caution.

Conclusions

In this study, the incidence of early morbidity, as defined by m-POMS following radical prostatectomy, was approximately 20%. The predominant morbidities observed were infectious and pulmonary. While m-POMS was found to be correlated with an increased length of hospital stay in the early postoperative period, the retrospective observational nature of our study limits the ability to infer causality. Notably, m-POMS does not account for drainage-related factors, which are critical contributors to prolonged hospitalization following radical prostatectomy. A potential modification to m-POMS, termed RP-POMS, could be beneficial for achieving a more accurate assessment of morbidity following radical prostatectomy. Moreover, this study offers an opportunity to better address early-stage postoperative morbidity within our institution. Strategies such as preoperative pulmonary function training and the selective omission of routine drainage tube placement when feasible could potentially reduce LOS and improve patient satisfaction.

Author contributions

WP Peng: Conceptualization; Data curation; Formal analysis; Funding acquisition; Investigation; Methodology; Writing – original draft; Writing – review & editing. XL Sun: Methodology; Visualization; Formal analysis; Writing – review & editing.S Zhao: Data curation; Formal analysis; Investigation.HM Hou: Data curation; Formal analysis.J Bao: Data curation; Formal analysis; Funding acquisition; Investigation; Methodology; Writing – review & editing.

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

Declarations

Ethics approval and consent to participate
Ethical approval was obtained from the institutional review board of Beijing Hospital (2024BJYYEC-KY0005-01) and consent was waived.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

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