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Partial nephrectomy should be classified as an inpatient procedure: Results from a statewide quality improvement collaborative

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Partial nephrectomy should be classified as an inpatient procedure: Results from a statewide quality improvement collaborative

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ABSTRACT

Objectives: To examine length of stay (LOS) and readmission rates for all minimally-invasive partial nephrectomy (MIPN) and MI radical nephrectomy (MIRN) performed for localized renal masses ≤7 cm in size (cT1RM) within 12 Michigan urology practices. Both RN and PN are commonly performed in treating cT1RM. Although technically more complex and associated with higher complication rates, Centers for Medicare & Medicaid Services considers MIPN an outpatient procedure and MIRN is inpatient.

Methods: We collected data for renal surgeries for cT1RM at MUSIC-KIDNEY practices between May 2017−February 2020. Data abstractors recorded clinical, radiographic, pathologic, surgical, and short-term follow-up data into the registry for cT1RM patients.

Results: Within MUSIC-KIDNEY, 807 patients underwent MI renal surgery at 12 practices. Median LOS for cT1RM patients after MIPN ($n = 531$, 66%) was 2 days and after MIRN ($n = 276$, 34%) was also 2 days. Among patients undergoing laparoscopic or robotic PN, 171 (32%), 230 (43%), and 130 (24%) stayed ≤1, 2, ≥3 days. Among patients undergoing laparoscopic or robotic RN, 81 (29%), 112 (41%), and 83 (30%) stayed ≤1, 2, ≥3 days. No significant difference was observed between MIPN and MIRN on LOS commensurate with outpatient surgery (≤1-day, OR = 0.97, $P = 0.87$).

Conclusions: Less than one-third of patients had a LOS ≤1-day and LOS was comparable for MIPN and MIRN. Centers for Medicare & Medicaid Services should be advised that MIPN is a more complex surgery than MIRN, most patients receiving a MIPN will require a ≥2-day hospital stay and it would be more appropriate to classify MIPN an inpatient procedure with MIRN.

Keywords: Small renal mass; Renal cell carcinoma; Partial nephrectomy; Outpatient surgery

1. INTRODUCTION

Minimally-invasive partial nephrectomy (MIPN), including laparoscopic partial nephrectomy and robotic PN (RPN), are paid by Centers for Medicare and Medicaid Services (CMS) as a bundled payment under Medicare Part B [1,2]. Some surgical procedures paid by Part B may be performed at ambulatory surgical centers. Ambulatory surgical centers eligible surgical procedures are those where patients do not require hospitalization postoperatively [3]. The remainder of surgical procedures covered under Part B must be performed in a hospital. CMS staff make these determinations on a case-by-case basis, including MIPN.

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Hospital only Part B procedures are recognized to pose a significant risk to beneficiary safety and should be expected to require an overnight stay [4,5]. For surgical patients this would equate to discharge before midnight on postoperative day 1 (POD1). Postoperative care costs after a Part B procedure are included in the payment [6,7].

In contrast, minimally-invasive radical nephrectomy (MIRN) is paid by CMS' inpatient prospective payment system under Medicare Part A and is an inpatient only procedure [8]. Procedures are considered inpatient due to the "nature of the procedure, the typical underlying physical condition of patients who require the service, or the need for at least 24 hours of postoperative recovery time or monitoring before the patient can be safely discharged." Payment for Part A procedures covers all charges related to an inpatient stay from the time of admission to discharge [6]. This payment is adjusted significantly depending on the diagnosis-related group (DRG) assignment at discharge. A DRG is based on: the principal diagnosis, secondary diagnoses, surgical procedure performed, patient comorbidities, postoperative complications, and disposition status [9]. MIRN has 3 different DRGs which are assigned after reviewing the aforementioned factors [8]. The CMS classification of inpatient vs. observation level care is largely administrative, as MIRN and MIPN must be performed in hospital settings and postoperative care for both procedures are likely delivered in the same units and hospital beds [10].

Utilization of MIPN continues to increase nationally for the treatment of renal masses (RM) and is the recommended surgical treatment in the 2017 AUA guidelines when feasible [11]. MIPN surgical procedures are often more technically complex, with higher rates of postoperative complications, and increased rates of blood transfusion compared to MIRN [12,13]. We hypothesize that MIPN does not meet outpatient classification in the current CMS reimbursement system and is more appropriately classified as an inpatient procedure, similar to MIRN.

Prior work has shown that discharge on POD1 is possible after MIPN in selected patients within different institutional series and national datasets [14-17]. Additionally, there is 1 case report where a healthy, young patient underwent outpatient MIPN [18]. Outpatient MIRN, has been demonstrated in a small cohort case series with significant postdischarge provider support [19]. We build on this prior work by comparing length of stay (LOS) of patients who underwent MIPN or MIRN in a registry of community, solo-practitioner, and academic urology practices within the state of Michigan. We specifically compared patient, surgeon, and practice demographics to determine factors associated with LOS. Our findings are intended to provide policymakers, CMS, and insurance providers with insight regarding expected LOS for MIPN and MIRN.

2. METHODS

2.1. Practices and Patients

Since 2011, the Michigan Urological Surgery Improvement Collaborative (MUSIC) has functioned as a physician-led quality improvement consortium. MUSIC began collecting data regarding patients with RMs in 2017. The MUSIC Kidney mass: Identifying and Defining Necessary Evaluation and therapY (MUSIC−KIDNEY) program seeks to standardize and improve care for patients with a localized RM ≤7 cm (cT1RM) [15]. Trained data abstractors at each site review the patient medical records who present with cT1RMs suspicious for renal cell carcinoma and enter data elements into a web-based registry. For this study, 44 physicians from 12 MUSIC practices participated. The practice settings were diverse, consisting of 2 academic practices, 9 community practices, and 1 single physician practice. Patients with non-suspicious lesions, including Bosniak I-IIF cysts and angiomyolipomas, and those with clinical T2 or higher RMs were excluded. All participating sites obtained exemption or approval from local institutional review boards before beginning data collection.

Our primary outcome was LOS for MIPN compared to MIRN in the MUSIC-KIDNEY cohort. In this cohort, we defined LOS as ≤1-day if the patient was discharged before midnight the day after surgery, LOS as 2 days if discharged before midnight 2 days postoperatively, and LOS ≥3-days if discharged on POD3 or later. Patients were classifiable as observation status if discharged ≤1-day after surgery and inpatient status if discharged ≥2-days after surgery. We then examined the patient, tumor, and surgeon characteristics associated with these LOS groups.

2.2. Payment Model Calculations

Each DRG for inpatient procedures, such as MIPN, is assigned a relative weight and; therefore, payment based on usual postoperative care required under Medicare Part A. The lowest DRG assignment is designated to a patient who does not experience postoperative complications and is relatively healthy (without complication or comorbidity [CC]). The middle DRG assignment is made if a patient has CC that complicate their postoperative hospital course. The last DRG assignment is made if a patient experiences major CC after surgery. If a beneficiary does experience major CC, the DRG relative weight and; therefore, episode payment, would more than double compared to an uncomplicated stay (w/o CC) [3].

After a DRG assignment is made, the hospital payment is calculated by specific geographic modifiers and an indirect graduate medical expense upcharge if the care was provided at a teaching hospital. Upcharges for rural hospitals, disproportionate share payments, value-based purchasing adjustments, or hospital readmissions reduction program

are technically complex calculations with data not readily available for analysis, but provide significant increases in payment if applied [20,21]. They are excluded from the sample payments.

The calculations below are based on the following formula per CMS: (fiscal year 2020 CMS base payment rate) * (DRG assignment) * (Base rate geographic adjustment factors). The FY 2020 CMS base payment rate is $5,797 [22]. Three representative MUSIC-KIDNEY practice locations are shown to demonstrate geographic differences in payment (Supplementary Table 1).

In contrast, Medicare beneficiaries are initially admitted as observation status after MIPN and paid under Medicare Part B. Their hospital payment is bundled and does not allow for modifications in payment based on CC. There is not an upcharge for indirect graduate medical expense costs if the procedure was performed at a teaching hospital. There is an adjustment for local wages based on geographic location. The calculations below are based on the following formula: [(FY 2020 CMS MIPN unadjusted payment rate) * (wage index) * 60%] + [(FY 2020 CMS MIPN unadjusted payment rate) * 40%] [23]. Hospital payment for MIPN at an unadjusted rate is $8,523.31 for the 2020 fiscal year [24]. Supplementary Table 1 shows the MIPN estimated payment calculations.

Modifications for outlier cases with substantially increased costs may be made under Medicare Part B but is done on a case-by-case basis. Outlier cases have to exceed the cost of typical payment by 1.75-fold, and hospitals are only paid 50% of the amount over the 1.75 factor amount [12].

2.3. Statistical Analysis

We compared clinical and demographic characteristics of patients, as well as, physician- and practice-level characteristics between MIPN and MIRN, using chi-squared test for categorical variables and Student's t test for continuous measures. We assessed the proportions of outpatient procedure (LOS ≤ 1-day) across patient-, physician- and practice-level factors. We used a mixed effects logistic regression model to evaluate the rate of outpatient procedure between MIPN and MIRN. The model included procedure type as the primary predictor variable, with MIRN as the reference group. The model included as covariates patient-, physician-, and practice-level characteristics. We included random intercepts for each urologist to account for within-physician correlation. All the analyses were performed using SAS 9.4 and statistical significance was set at 0.05.

3. Results

Of these cT1RM patients, 927 (51.2%) patients underwent immediate definitive treatment, and 881 (48.7%) are undergoing active surveillance without any initial intervention. Eight hundred and thirty-two patients underwent a minimally invasive surgery (MIPN or MIRN). Patients included in this study are patients who underwent MIRN or MIPN for cT1RM between May 2017 and February 2020; patients undergoing open surgery ($n = 31$), other interventions ($n = 64$), or no interventions ($n = 881$) were excluded, as well as, those with incomplete outcomes data ($n = 25$).

Within MUSIC-KIDNEY, 531 patients underwent MIPN (66%) and 276 patients underwent MIRN (34%) for cT1RM. Table 1 shows patient and surgeon factors by procedure type. Patients were more likely to receive a MIPN if they were younger ($P < 0.0001$), had a smaller tumor ($P < 0.0001$), or had private insurance ($P = 0.003$). MIPN were also more likely to be performed using robotic approach

Table 1
Features of patients undergoing minimally-invasive renal surgery for clinical T1 renal mass

Variable	All	MIPN	MIRN	*P* value
No. patients	807	531	276	
Age	59.5 (12.3)	57.8 (12.4)	62.8 (11.5)	<0.001
BMI	31.7 (7.0)	31.9 (7.1)	31.3 (6.6)	0.30
Tumor size	3.5 (1.5)	2.9 (1.2)	4.7 (1.4)	<0.001
Tumor stage				
T1a	515 (63.8%)	430 (81.0%)	85 (30.8%)	0.000
T1b	292 (36.2%)	101 (19.0%)	191 (69.2%)	
Race				
White	629 (77.9%)	424 (79.8%)	205 (74.3%)	0.31
African-American	102 (12.6%)	63 (11.9%)	39 (14.1%)	
Other	15 (1.9%)	9 (1.7%)	6 (2.2%)	
Unknown	61 (7.6%)	35 (6.6%)	26 (9.4%)	
Gender				
Male	484 (60.0%)	323 (60.8%)	161 (58.3%)	0.49
Female	323 (40.0%)	208 (39.2%)	115 (41.7%)	
Insurance type				
Private	495 (61.3%)	348 (65.5%)	147 (53.3%)	0.003
Public	297 (36.8%)	174 (32.8%)	123 (44.6%)	
None/Unknown	15 (1.9%)	9 (1.7%)	6 (2.2%)	
Charlson Comorbidity Index				
0	474 (58.7%)	321 (60.5%)	153 (55.4%)	0.099
1	141 (17.5%)	96 (18.1%)	45 (16.3%)	
≥2	192 (23.8%)	114 (21.5%)	78 (28.3%)	
Renal mass biopsy				
Biopsy	116 (14.4%)	81 (15.3%)	35 (12.7%)	0.32
No biopsy	691 (85.6%)	450 (84.7%)	241 (87.3%)	
Surgical approach				
Robotic	674 (83.5%)	485 (91.3%)	189 (68.5%)	<0.001
Laparoscopic	133 (16.5%)	46 (8.7%)	87 (31.5%)	
Fellowship trained surgeon				
Yes	655 (81.2%)	436 (82.1%)	219 (79.3%)	0.34
No	152 (18.8%)	95 (17.9%)	57 (20.7%)	
Surgeon completed training				
Before 2000	179 (22.2%)	91 (17.1%)	88 (31.9%)	<0.001
2000–2009	417 (51.7%)	304 (57.3%)	113 (40.9%)	
2010 or later	211 (26.1%)	136 (25.6%)	75 (27.2%)	

Values are *n* (%) or mean (SD).

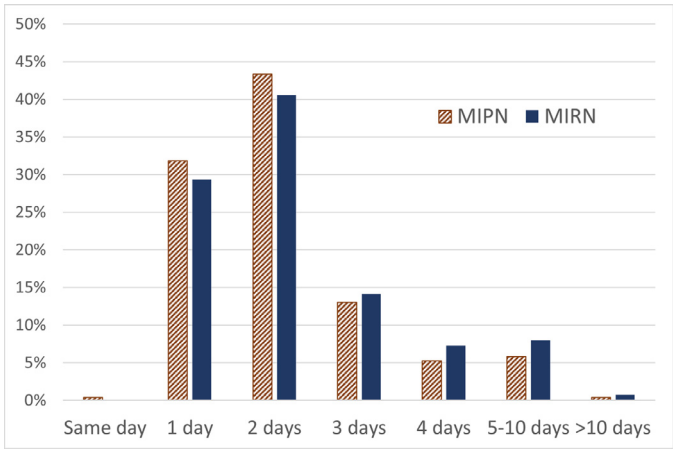

Fig. 1. Day of discharge following minimally-invasive partial nephrectomy and radical nephrectomy. Labels indicated the number of patients discharged within each cohort. The y-axis indicates percentage of the cohort.

and by urologists who completed training after 2000 ($P < 0.001$). BMI, race, gender, Charlson Comorbidity Index (CCI), and preoperative RM biopsy were not associated with type of surgery.

Hospital LOS of the MIPN and MIRN groups were nearly identical (Fig. 1). Following MIPN, 32.2% of patients had a LOS ≤ 1 day, 43.3% had LOS = 2 days, and 24.5% had LOS ≥ 3 days. Following MIRN, 29.3% of patients had LOS ≤ 1 day, 40.6% had LOS = 2 days, and 30.1% had LOS ≥ 3 days ($P = 0.229$). Median LOS for MIRN and MIPN were both identical at 2 days.

Table 2 lists patient factors associated with outpatient procedure (LOS ≤ 1 day). Younger age ($P < 0.0001$), tumor size ($P < 0.0001$), private insurance ($P = 0.012$), and patient comorbidities measured via CCI ($P = 0.009$) were associated with a LOS ≤ 1 day. There were clear associations between LOS and both tumor size and patient age (Supplementary Table 2). However, even in the most favorable subgroups, the proportion of outpatient procedures classified as observation was only 42% (67/159) of those with tumors <2 cm, 41% (83/202) of patients ≤50 years, and 35% (166/474) of those without comorbidities. Surgeon-specific factors such as fellowship training or years in practice were not associated with LOS. Surgical approach (laparoscopic vs. robotic) was not associated with LOS for patients undergoing MIPN or MIRN ($P = 0.263$). BMI, race, and gender did not have an effect on LOS.

On multivariable analysis (Table 3), there was no significance difference between MIPN and MIRN on outpatient surgery status (OR = 0.98, $P = 0.91$) controlling for patient-, physician-, and practice-level factors. Older patients (OR = 0.98, $P = 0.001$) and patients with more comorbidities (OR = 0.86, $P = 0.044$) were less likely to have an outpatient surgery. In the model, tumor size was excluded because the estimates became misleading. This is due to the high correlation of procedure and tumor size with little overlap between surgical approach. When procedure type (MIPN vs. MIRN) is omitted from the model, tumor size is a significant predictor of LOS (data not shown), as indicated in Supplementary Table 2.

Readmission within 30 days of surgery occurred in 3.5% of patients ($n = 28$), including 2.8% of MIPN ($n = 15$) and 4.7% of MIRN ($n = 13$). Following LOS ≤1-day and LOS ≥2-days, 30-day readmission rates were 2.4% and 4.0%. MIRN and LOS ≥2-days appeared to be associated with higher 30-day readmission rates, although the difference did not reach conventional statistical significance ($P = 0.165$ and $P = 0.255$, respectively).

4. Discussion

This registry of patients across diverse practices shows no appreciable difference in LOS between MIPN and MIRN for cT1RM. LOS commensurate with observation status (LOS ≤ 1-day) only occurred in a minority of patients (<33%) following either procedure. Surgical approach, laparoscopic or robotic, did not have an appreciable effect on LOS or 30-day readmissions after surgery. Multivariable analysis revealed that older age and more comorbidities-were associated with inpatient vs. outpatient surgery, but even in the most favorable categories (age <50-years, no comorbidities [CCI = 0], and tumor size ≤2 cm), rates of outpatient surgery were no higher than 42%. Collectively, these findings demonstrate a similar pattern of LOS for patients undergoing MIPN vs. MIRN, with 69% of patients in our cohort staying 2 or more midnights.

Nationally, the 2020 CMS arithmetic LOS for MIRN is 2.5–7.5 days depending on DRG assignment [3,18]. However, hospitals have continued to increase observation stays, decrease inpatient stays, and are reluctant to transition a patient from observation to inpatient status due to fear of audit and possible denial of payment [25,26].

Payment differences still persist between an uncomplicated MIPN and MIRN. If a healthy index patient undergoes MIPN in Detroit, MI the payment is $8,024.63 (Fig. 2). If that same patient underwent MIRN and spent

Table 2
Features of patients undergoing MIRN and MIPN according to LOS

Variable	All	Outpatient Surgery (LOS ≤1 day)	Inpatient Surgery (LOS 2 day or more)	*P* value
No. patients	807	252 (31.2%)	555 (68.8%)	
Median age, years (SD)	59.5 (12.3)	56.7 (12.2)	60.8 (12.2)	<.0001
BMI, units (SD)	31.7 (7.0)	31.7 (6.9)	31.7 (7.0)	0.93
Tumor size, cm (SD)	3.5 (1.5)	3.2 (1.4)	3.7 (1.5)	<.0001
Tumor stage				
T1a	515 (63.8%)	178 (34.6%)	337 (65.4%)	0.007
T1b	292 (36.2%)	74 (25.3%)	218 (74.7%)	
Race				
White	629 (77.9%)	188 (29.9%)	441 (70.1%)	0.051
African-American	102 (12.6%)	30 (29.4%)	72 (70.6%)	
Other	15 (1.9%)	8 (53.3%)	7 (46.7%)	
Unknown	61 (7.6%)	26 (42.6%)	35 (57.4%)	
Gender				
Male	484 (60.0%)	161 (33.3%)	323 (66.7%)	0.13
Female	323 (40.0%)	91 (28.2%)	232 (71.8%)	
Insurance type				
Private	495 (61.3%)	170 (34.3%)	325 (65.7%)	0.012
Public	297 (36.8%)	75 (25.3%)	222 (74.7%)	
None/unknown	15 (1.9%)	7 (46.7%)	8 (53.3%)	
Charlson Comorbidity Index				
0	474 (58.7%)	166 (35.0%)	308 (65.0%)	0.009
1	141 (17.5%)	42 (29.8%)	99 (70.2%)	
≥2	192 (23.8%)	44 (22.9%)	148 (77.1%)	
Renal mass biopsy				
Biopsy	116 (14.4%)	35 (30.2%)	81 (69.8%)	0.79
No Biopsy	691 (85.6%)	217 (31.4%)	474 (68.6%)	
Surgical approach				
Robotic	674 (83.5%)	205 (30.4%)	469 (69.6%)	0.26
Laparoscopic	133 (16.5%)	47 (35.3%)	86 (64.7%)	
Fellowship trained surgeon				
Yes	655 (81.2%)	200 (30.5%)	455 (69.5%)	0.38
No	152 (18.8%)	52 (34.2%)	100 (65.8%)	
Surgeon completed training				
Before 2000	179 (22.2%)	65 (36.3%)	114 (63.7%)	0.062
2000−2009	417 (51.7%)	115 (27.6%)	302 (72.4%)	
2010 or later	211 (26.1%)	72 (34.1%)	139 (65.9%)	

Values are *n* (%) or mean (SD).

Table 3
Multivariable analysis of factors associated with having an outpatient procedure (LOS ≤1 day)

	OR	95% CI	*P* value
MIPN (vs. MIRN)	0.98	(0.67, 1.43)	0.91
African-American (vs. White)	0.93	(0.56, 1.55)	0.78
Other race (vs. White)	2.35	(0.78, 7.14)	0.13
Unknown race (vs. White)	1.35	(0.73, 2.49)	0.33
Female gender (vs. Male)	0.77	(0.55, 1.08)	0.13
Public insurance (vs. Private)	0.83	(0.57, 1.21)	0.33
No or unknown insurance (vs. Private)	1.40	(0.45, 4.41)	0.56
Renal mass biopsy (vs. no biopsy)	0.99	(0.61, 1.59)	0.96
Robotic surgery (vs. laparoscopic)	0.85	(0.53, 1.37)	0.50
Fellowship-trained surgeon (vs. not)	1.09	(0.52, 2.27)	0.82
Completed training in 2000−2009 (vs before 2000)	0.48	(0.21, 1.08)	0.08
Completed training in 2010 or later (vs. before 2000)	0.89	(0.43, 1.84)	0.76
Age	0.98	(0.96, 0.99)	0.001
BMI	1.00	(0.97, 1.02)	0.68
Charlson Comorbidity Index	0.86	(0.73, 1.00)	0.044

The model is controlled for surgeon thru random effects. Tumor size has been excluded because the estimates became unstable and misleading as procedure type (PN vs. RN) and tumor size are highly correlated and there is little overlap between PN and RN according to tumor size.

1.5 days in the hospital, the payment would be $10,104.87. Payment differences become more apparent with complicated cases. For example, if a complicated MIPN requiring a several days LOS was performed and cost $17,500, the hospital would be paid $8,024.63 plus an outlier payment of $1,752.42 if the patient remained observation status after surgery. This example hospital would have a negative profit of $7,464.63. In comparison, if this same case was instead a MIRN and met the highest DRG assignment, the hospital would have a net profit of $120.16. It is important to note that a Medicare beneficiary can transition to inpatient status after MIPN and would transition to the DRG assignments previously listed.

A possible illustration of these payment differences nationwide can be seen in recent work by Ellimoottil and co-authors who utilized the SEER database from 2008 to 2011. They demonstrated a significant difference in mean hospital episode payment for RN ($18,052) and PN ($15,910) [27]. However, they did not differentiate between open PN and MIPN which may skew results, as open PN is an inpatient only procedure utilizing the same DRG assignments.

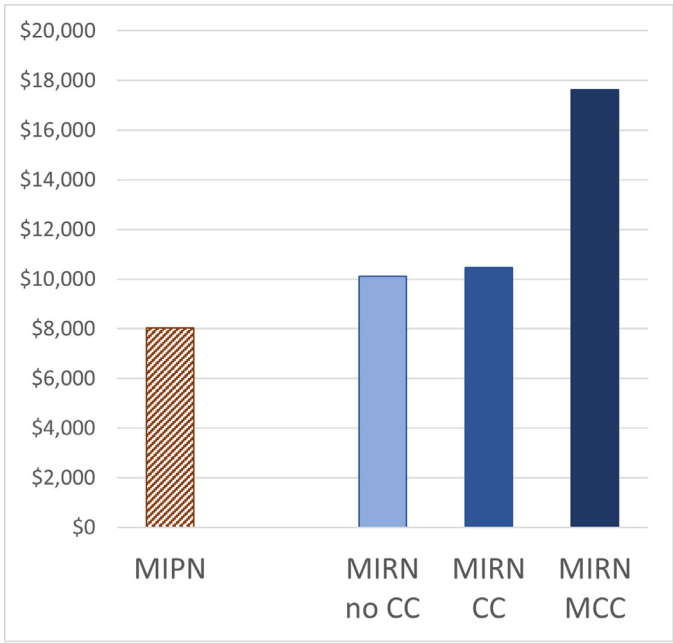

Fig. 2. Estimated CMS payment to a hospital after a Medicare beneficiary undergoes a MIPN or MIRN for a patient without complication or complexity (no CC), with CC, or with major CC.

Patient costs are significantly affected by a status of inpatient or observation at discharge. After MIRN, under Medicare Part A, patients are charged a deductible for their hospital episode, this amount is $1408 for 2020. Their deductible covers readmissions 60 days after hospitalization and postacute nursing care after discharge [24]. After MIPN, under Medicare Part B, patients are charged via a cost sharing model payment. Their deductible is lower than Part A, $198 in 2020, but patients pay 20% of services such as doctor services, medical equipment, and medication related to their hospital stay. The patient's self-administered home medications are not covered under Medicare Part B and are directly charged to the patient adding to their out-of-pocket costs [12]. If a patient is readmitted to the hospital after their initial observation stay for MIPN, they pay another deductible which may be another observation deductible under Part B, or the higher inpatient deductible under Part A leading to total out of pocket costs that may surpass the cost of the inpatient deductible [28].

We evaluated MIRN and MIPN patients by LOS to identify factors that may identify patients who could be predicted to undergo a LOS ≤1-day. Patients that were younger, had smaller tumors, private insurance, and no comorbidities were more likely to have an outpatient procedure. Nevertheless, the LOS ≤1-day rates in the most favorable groups still did not exceed 42%. Prior analysis of retrospective data by other groups found that similar factors affect LOS after RPN, but they were unable to develop an accurate LOS prediction tool that could be used to identify candidates for outpatient surgery [29]. On multivariate analysis, we found that 2 factors affected LOS ≤1-day: patient age and CCI ≥2, with no significant difference between MIPN and MIRN. A prior retrospective study showed that POD1 discharge after a RPN for cT1RMs appeared safe without an increase in postoperative complications [17]. However, this was in a highly selected group of patients who underwent preoperative education and are not applicable broadly due to increased resource requirements and patient differences.

The current study found a higher (albeit statistically insignificant) 30-day readmission rate for patients with a LOS ≥2 days compared to those with ≤1-day (3.96% vs. 2.38%, $P = 0.255$). Prior work evaluated the American College of Surgeons National Surgical Quality Improvement Program (ACS-NSQIP) database to determine 30-day postoperative complications between RN and PN. Authors from that work argued that PN should be considered inpatient based solely on the similar complication rates [13]. Their work is misleading as they did not differentiate between open PN or MIPN, the former has always been an inpatient only procedure. Our analysis adds the findings that duration of hospitalization and 30-day readmission rates are no different.

Our study does have several limitations. First, we do not have final hospital billing information regarding payment for each patient undergoing MIPN or MIRN. However, we did demonstrate that there were no observable differences on LOS. While both the observed and adjusted analysis in this study demonstrated no significant difference between MIPN and MIRN on LOS, we did notice that the confidence interval for the estimated effect was quite wide (0.67−1.43). Although the point estimate was suggestive of no difference between the 2 groups, the study sample size limits our ability to obtain a more precise estimate. Second, while we have solid data regarding the actual LOS for each

patient, we cannot evaluate which patients were transitioned to inpatient status after initial observation status, which affects hospital payment. Finally, prior work has demonstrated shorter LOS in highly selected MIPN and MIRN groups with extensive patient education [14,17,18,30]. Nonetheless, our real-world cohort is likely more applicable on a national level, as it is composed of diverse patient populations and urology practices.

These limitations notwithstanding, our findings have important implications for patients, physicians, payers, and policymakers. MIPN when feasible is the standard of care, compared to MIRN even though they are often more complex with higher known complication rates. Under current Medicare payment model, the hospital payment for MIPN is less than MIRN for those patients with an uncomplicated postoperative stay. As complexity, complications, and LOS increase, the difference in hospital payment for MIPN vs. MIRN widens. Policymakers should consider MIPN as an inpatient procedure in conjunction with MIRN, based on our findings to more accurately reflect the time and effort of usual postoperative care.

5. Conclusions

In our study of patients undergoing surgery for cT1RM within a diverse patient registry, we demonstrated that MIPN and MIRN were associated with similar LOS and similar 30-day readmission rates. A majority of patients undergoing MIPN required hospitalization of ≥ 2-days. This does not meet classification as on observation status stay after surgery and has significant effects on hospital payment and patient out of pocket costs. The current administrative CMS classification of MIPN should be reviewed by patients, providers, and policymakers, as it can have significant impact on patient care, patient out of pocket costs, and hospital payment.

Conflict of Interest

The authors have no conflicts of interest.

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Supplementary materials

Supplementary material associated with this article can be found in the online version at https://doi.org/10.1016/j.urolonc.2021.01.001.

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