

Evaluation of the real applicability of diagnosis-related groups for urinary tract lithiasis surgeries

Avaliação da aplicabilidade real do diagnosis-related groups nas cirurgias de litíase do trato urinário

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ABSTRACT

Introduction: Nephrolithiasis is a highly prevalent disease, being one of the most frequent urological conditions. Transureteroscopic Ureterolithotripsy (URL) and Percutaneous Nephrolithotomy (PCNL) are the main techniques used in the treatment of this disease. These two procedures have different levels of complexity, complications and costs of care. However, both are included in the same code of the Diagnosis-Related Groups (DRG). **Objective:** This study aims to investigate how these highly distinct procedures vary in terms of length of postoperative hospital stay and whether they should be coded in separate DRGs. **Methods:** The medical records of 893 patients who underwent URL or PCNL surgeries between September 2017 and February 2021 at a University Hospital were analyzed. The variables analyzed were gender, age, type of procedure, location and size of the stone, presence of previous comorbidities or urinary tract infection, length of hospital stay, and stone recurrence. Associations and comparisons between variables were assessed using the Chi-square and Mann-Whitney tests. **Results:** Despite being grouped in the same DRG codes, URL and PCNL have different means of hospitalization periods. Most patients who underwent URL were hospitalized for only one day and most patients who underwent PCNL were hospitalized for two days. **Conclusion:** This study demonstrates that URL average length of hospital stay was shorter than the hospitalization period recommended by the DRG for this procedure. Thus, a reassessment of the DRG codes is necessary and the creation of subdivisions in order to separate URL and PCNL into distinct codes is required.

Keywords: Nephrolithiasis; Nephrolithotomy; Percutaneous; Ureteroscopy; Diagnosis-related groups.

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RESUMO

Introdução: A nefrolitíase é uma doença de alta prevalência, sendo uma das condições urológicas mais frequentes. A ureterolitotripsia transureteroscópica (UTL) e a nefrolitotomia percutânea (NLPC) são as principais técnicas utilizadas no tratamento desta doença. Esses dois procedimentos possuem diferentes níveis de complexidade, complicações e custos de atendimento. No entanto, ambos estão incluídos no mesmo código do *Diagnosis-Related Groups* (DRG). **Objetivo:** Este estudo visa investigar como esses procedimentos amplamente distintos variam em relação ao tempo de internação pós-operatório e se devem ser codificados em DRGs separados. **Métodos:** Foram analisados os prontuários de 893 pacientes submetidos às cirurgias de UTL ou NLPC entre setembro de 2017 e fevereiro de 2021 em um hospital universitário. As variáveis analisadas foram sexo, idade, tipo de procedimento, localização e tamanho do cálculo, presença de comorbidades prévias ou infecção do trato urinário, tempo de internação e recorrência do cálculo. As associações e comparações entre as variáveis foram avaliadas pelos testes qui-quadrado e Mann-Whitney. **Resultados:** Apesar de estarem agrupados nos mesmos códigos do DRG, a UTL e a NLPC possuem diferentes médias de tempo de internação. A maioria dos pacientes submetidos à UTL permaneceu internada por apenas um dia e a maioria dos pacientes submetidos à NLPC por dois dias. **Conclusão:** O estudo demonstrou que o período médio de internação pós-operatória da UTL foi menor do que o tempo preconizado pelo DRG para este procedimento. Desse modo, é necessária uma reavaliação dos códigos do DRG e a criação de subdivisões com o intuito de separar a UTL e NLPC em códigos distintos.

Palavras-chave: Nefrolitíase; Nefrolitotomia percutânea; Ureterosopia; *Diagnosis-Related Groups*.

INTRODUCTION

Nephrolithiasis is one of the most common urological conditions in clinical practice. Recent estimates indicate a prevalence of 10.6% for men and 7.1% for women in the US population¹. In addition, the lifetime risk of developing an episode has increased continuously in the last two decades, reaching a rate of 10 to 15%. There is still a 50% risk of recurrences within 10 years².

This pathology is also related to major financial impacts on the health system. In the year 2000, the total cumulative cost for the care of patients with urolithiasis was estimated at 2.1 billion dollars. Due to population growth and the increasing prevalence of obesity and Diabetes mellitus, it is estimated that the costs for the management of this disease are expected to increase by 1.24 billion dollars per year by 2030¹.

The treatment of ureteral stones ranges from expectant conservative management to minimally invasive procedures, which allow a faster and less painful recovery. Thus, transureteroscopic ureterolithotripsy (URL) has been shown to be the treatment of choice for the removal of stones located in the middle or lower third of the ureter due to its high effectiveness and safety³.

Percutaneous nephrolithotomy (PCNL), in turn, is indicated for patients with intrarenal stones larger than 20mm or stones larger than 10mm in the lower pole of the kidney⁴. However, despite being a minimally invasive procedure, PCNL is a major operation, with a risk of significant complications. The nephroscope can damage the kidney parenchyma and the calyceal neck, resulting in an increased risk of bleeding⁵. In addition, in some cases, it is not possible to guarantee a stone-free status for the patient⁶.

Transureteroscopic ureterolithotripsy and percutaneous nephrolithotomy are, therefore, widely different procedures in several aspects and have varying degrees of complexity, with different rates of postoperative complications and length of hospitalization. However, both are included in the same codes of the Diagnosis-Related Groups (DRG), which consists of a classification system for patients admitted to hospitals. The DRG was developed with the objective of providing a set of predictable products or services for classes of patients with similar care processes, with subcategories being created based on certain variables that demonstrated an effect on the length of hospital stay⁷⁻⁹.

Despite the great success achieved by the DRG methodology in terms of reducing hospital costs, the coding of diseases presents certain obstacles. The DRG classification system was developed despite these difficulties, disregarding the existing variability within the same group¹⁰. Therefore, in some areas, a single code has been used to describe patients receiving a broad spectrum of therapeutic regimens. This is the case for DRG codes 660 (kidney and ureter procedures for non-neoplasm with complication or comorbidity) and 661 (kidney and ureter procedures for non-neoplasm without complication or comorbidity), which encompass percutaneous nephrolithotomy and transureteroscopic ureterolithotripsy. Thus, it is necessary to carry out more studies related to the existing variability within the urinary tract lithiasis surgeries and the real applicability of the DRG for these procedures.

Our study aims to investigate how these highly distinct procedures vary in terms of length of postoperative hospital stay and whether they should be coded in separate DRGs. The alternative hypothesis is that the DRG classification is inadequate for urinary tract lithiasis procedures covered by codes 660 and 661. The null hypothesis is that these two DRG codes are correct.

METHODS

SELECTION CRITERIA

In this retrospective study, it was selected a total of 893 patients who underwent transureteroscopic ureterolithotripsy or percutaneous nephrolithotomy for the treatment of urinary tract lithiasis surgeries at a University Hospital, in Belo Horizonte, Minas Gerais, Brazil, between September 2017 and February 2021. The inclusion criteria used were that patients should have undergone transureteroscopic ureterolithotripsy or percutaneous nephrolithotomy, being coded in the DRG 660 or 661. Thirty-seven patients who did not have data related to the size and location of the stone, making the analysis unfeasible, were excluded from the study.

This study was approved by the Research Ethics Committee of a Medical College from Brazil (4.956.203). The project was authorized by the ethics committee to

waive the signing of the free and informed consent form by the participants, since it is a retrospective research using electronic medical records, in which there was no interference in patient care. In addition, the number of participants was very large, and in most cases, difficult to locate, as they no longer regularly attended the institution.

INSTRUMENTS AND PROCEDURES

Data collection was carried from the tabulation of information recorded in the DRG system of a University Hospital and in the medical records of patients submitted to transureteroscopic ureterolithotripsy and percutaneous nephrolithotomy, in the same institution. The variables analyzed were: gender, age, previous comorbidities, presence of associated urinary tract infection, size and location of the stone, type of procedure performed, surgical complications and length of postoperative hospital stay.

STATISTICAL ANALYSIS

Categorical variables were presented as absolute and relative frequencies and numerical variables as mean \pm standard deviation and median (1st quartile – 3rd quartile). The associations of variables with the type of procedure, length of hospital stay and recurrence were evaluated using the chi-square test. Comparison of age with type of procedure was performed using the Mann-Whitney test, and with length of stay, using the Kruskal-Wallis test with multiple comparisons using the Nemenyi test. The analyses were performed using the R software version 4.0.3 and a significance level of 5% was considered.

RESULTS

The study included 856 patients who underwent percutaneous nephrolithotomy and transureteroscopic ureterolithotripsy. The mean age was 48.0 ± 14.3 years, with 436 (50.9%) males and 420 (49.1%) females. Of the total number of patients, 170 (19.8%) had systemic arterial hypertension as a comorbidity, 14 (1.6%) had diabetes mellitus, and 66 (7.7%) had both hypertension and diabetes. A total of 48 (5.6%) of the study participants had urinary tract infection associated with urolithiasis in the pre- or postoperative period. Of a total of 856 patients evaluated, 694 (81%) underwent transureteroscopic ureterolithotripsy, while 163 (19%) underwent percutaneous nephrolithotomy. The DRG 660 included 111 patients, of which 97 were submitted to the URL and 14 to PCNL. In the DRG 661, 745 participants were included, of which 597 were submitted to URL and 148 to PCNL (Table 1).

There was a predominance of kidney stones with a size between 10 and 20 mm, which corresponded to 74 (37.9%) participants, followed by patients with multiple intrarenal stones, corresponding to 71 (36.4%) cases. Kidney stones smaller than 10mm and larger than 20mm occurred in 15

(7.7%) and 35 (17.9%) individuals, respectively. Among the ureteral stones, there was a predominance of stones with a size between 5 and 10 mm, which corresponded to 374 (59.7%) cases. Ureteral stones with a size between 11 and 15 mm had the second highest incidence with 176 (28.1%) patients. Ureteral stones measuring 16 to 20mm and stones larger than 20mm had an incidence of 4.3% and 7.8%, respectively (Table 1).

Regarding length of hospital stay, a total of 500 (58.3%) patients were hospitalized for only 1 day, while 203 (23.7%) were hospitalized for 2 days, 25 (2.9%) for 3 days, and 129 (15.1%) for more than 3 days. Of the total number of patients involved in this study, 124 (14.5%) had stone recurrence (Table 1).

Table 1. Descriptive analysis.

	Statistics
Female	421 (49,1)
Male	436 (50,9)
Age	48,0 ± 14,3 48,0 (37,0–59,0)
Comorbidities	
No comorbidities	607 (70,8)
Hypertension	170 (19,8)
Diabetes Mellitus	14 (1,6)
Hypertension and Diabetes Mellitus	66 (7,7)
Urinary tract infection	
Yes	48 (5,6)
No	809 (94,4)
Procedure	
Transureteroscopic Ureterolithotripsy	694 (81,0)
Percutaneous Nephrolithotomy	163 (19,0)
Size of kidney stone (n=195)	
<10mm	15 (7,7)
10-20mm	74 (37,9)
>20mm	35 (17,9)
Multiple stones	71 (36,4)
Size of ureteral stone (n=626)	
5-10mm	374 (59,7)
11-15mm	176 (28,1)
16-20mm	27 (4,3)
>20mm	49 (7,8)
Length of hospital stay	
1 day	500 (58,3)
2 days	203 (23,7)
3 days	25 (2,9)
More than 3 days	129 (15,1)
Recurrence	
Yes	124 (14,5)
No	733 (85,5)

Among patients undergoing transureteroscopic ureterolithotripsy there was a 5.3% incidence of urinary tract infection (UTI), while in percutaneous nephrolithotomy this incidence was 6.7%. Therefore, there was no significant association between the type of procedure and the occurrence of urinary tract infections ($p=0.604$). There was also no significant association between the type of procedure and the rate of stone recurrence ($p=0.471$), since the number of recurrences after transureteroscopic ureterolithotripsy was 97 (14%) and after percutaneous nephrolithotomy was 27 (16.6 %) (Table 2).

There was a significant association between the type of procedure and length of hospital stay ($p<0.001$). Among the individuals submitted to transureteroscopic ureterolithotripsy, there was a predominance of patients hospitalized for only 1 day, corresponding to 464 (66.9%) patients. In the postoperative period of percutaneous nephrolithotomy, there was a predominance of individuals hospitalized for 2 days, corresponding to 103 (63.2%) patients (Table 2).

There was a significant association between the proportion of patients with associated urinary tract infection and the length of hospital stay, so that the number of patients with UTI was proportionally higher according to the length of hospital stay ($p<0.001$). A total of 2 (0.4%) patients with UTI were hospitalized for only one day, 14 (6.9%) patients for 2 days, and 32 (20.8%) for 3 or more days (Table 3).

DISCUSSION

Our findings indicated that the average length of hospital stay was significantly different between transureteroscopic ureterolithotripsy and percutaneous nephrolithotomy, being 1 day and 2 days, respectively. Seitz et al. (2012)¹¹ attributes the longer expected hospitalization time of PCNL to the higher risk of bleeding in the postoperative period. However, these two procedures are both grouped in the same DRG code, 660 and 661. According to the DRG database and website, the DRG 660 preconizes 2.8 days of hospitalization while the DRG 661 suggests only 1.4 days¹². This confirms our main hypothesis that URL is wrongly classified in the DRG and that a new subdivision should be created to stipulate a smaller hospitalization time for surgical procedures on the ureter.

Krambeck et al. (2008)¹³ evaluated the 19 year follow-up data of 754 patients who underwent percutaneous nephrolithotomy, and the stone recurrence rate identified in this study was approximately 37%. Carr et al. (1996)¹⁴, assessed the stone-free state of 62 patients, and the post-PCNL recurrence rate at 1 and 2 years was 4.2% and 22.6%,

Table 2. Comparison of variables with the type of procedure.

	Procedure		<i>p</i> -value ^Q
	Transureteroscopic ureterolithotripsy (n=694)	Percutaneous nephrolithotomy (n=163)	
Sex			<0,001
Female	318 (45,8)	103 (63,2)	
Male	376 (54,2)	60 (36,8)	
Age	47,8 ± 14,5 47,0 (37,0-59,0)	49,2 ± 13,1 48,0 (39,0-59,0)	0,280 ^M
Comorbidities			0,117
No comorbidities	503 (72,5)	104 (63,8)	
Hypertension	128 (18,4)	42 (25,8)	
Diabetes Mellitus	10 (1,4)	4 (2,5)	
Hypertension and Diabetes	53 (7,6)	13 (8,0)	
Urinary tract infection			0,604
Yes	37 (5,3)	11 (6,7)	
No	657 (94,7)	152 (93,3)	
Size of kidney stone (n=195)			<0,001
<10mm	8 (16,3)	7 (4,8)	
10-20mm	11 (22,4)	63 (43,2)	
>20mm	0 (0,0)	35 (24,0)	
Multiple stones	30 (61,2)	41 (28,1)	
Size of ureteral stone (n=626)			0,003
5-10mm	372 (61,1)	2 (11,8)	
11-15mm	166 (27,3)	10 (58,8)	
16-20mm	26 (4,3)	1 (5,9)	
>20mm	45 (7,4)	4 (23,5)	
Length of hospital stay			<0,001
1 day	464 (66,9)	36 (22,1)	
2 days	100 (14,4)	103 (63,2)	
3 days	17 (2,4)	8 (4,9)	
More than 3 days	113 (16,3)	16 (9,8)	
Recurrence			0,471
Yes	97 (14,0)	27 (16,6)	
No	597 (86,0)	136 (83,4)	

Legend: Chi-square test; Mann-Whitney test.

respectively. Also, in a study by Raman et al. (2009)¹⁵, 537 patients who underwent percutaneous nephrolithotomy were evaluated and residual fragments were identified in 42 (8%) of the patients. The most common site for residual fragments was the lower calyx (47%). They also reported that 11 (61%) of the 18 patients who experienced a stone-related event required a secondary surgical intervention.

A study performed by Wang et al. (2019)¹⁶, appraised 178 patients who underwent URL and 201 patients who underwent PCNL during a period of 2 years, and found recurrence rates of 5.06%, and 3.48%, respectively. Therefore, they found no significant difference between the two groups ($p>0,05$). Similarly, in our study, for a total

Table 3. Comparison of variables with the length of hospital stay.

	Length of hospital stay			p-value ^Q
	1 day (n=500)	2 days (n=203)	3 or more days (n=154)	
Sex				0,474
Female	242 (48,4)	107 (52,7)	72 (46,8)	
Male	258 (51,6)	96 (47,3)	82 (53,2)	
Age	46,6 ± 14,2	50,0 ± 13,4	50,1 ± 15,1	0,003 ^K
Comorbidities				0,232
No comorbidities	370 (74,0)	139 (68,5)	98 (63,6)	
Hypertension	88 (17,6)	46 (22,7)	36 (23,4)	
Diabetes Mellitus	8 (1,6)	3 (1,5)	3 (1,9)	
Hypertension and Diabetes	34 (6,8)	15 (7,4)	17 (11,0)	
Urinary tract infection				<0,001
Yes	2 (0,4)	14 (6,9)	32 (20,8)	
No	498 (99,6)	189 (93,1)	122 (79,2)	
Size of kidney stone (n=195)				<0,001
≤20mm	22 (39,3)	53 (54,1)	14 (34,1)	
>20mm	6 (10,7)	24 (24,5)	5 (12,2)	
Multiple stones	28 (50,0)	21 (21,4)	22 (53,7)	
Size of ureteral stone (n=626)				<0,001
5-10mm	277 (64,9)	49 (49,0)	48 (48,5)	
≥11mm	150 (35,1)	51 (51,0)	51 (51,5)	
Recurrence				0,118
Yes	64 (12,8)	30 (14,8)	30 (19,5)	
No	436 (87,2)	173 (85,2)	124 (80,5)	

Legend: Chi-square test; Kruskal-Wallis test.

of 626 patients submitted to URL and 195 submitted to PCNL evaluated over 3 years, we found recurrence rates of 14.0% and 15.8%, respectively, demonstrating no significant difference between the two groups.

Studies also reported on the incidence of postoperative complications following these procedures. They found that 1.68% of patients presented urinary tract infections (UTI) after a URL whilst 1.99% of the patients evolved with an UTI in the postoperative period following a PCNL ($p>0,05$)¹⁴. Comparably, our study showed no significant difference related to the incidence of UTI between the two groups. However, we observed a significant increase in hospitalization time in those patients who had an associated urinary tract infection, independently of the procedure performed ($p<0,001$) (Table 3).

Our study is inherently limited due to its retrospective character. The study group comprised 81% of subjects undergoing URL, and only 19% of patients undergoing PCNL, however both groups are similar in their clinical characteristics and comorbidities. Infection, in both groups, was also a determining factor for longer hospital stay, with no statistical difference between the groups.

CONCLUSION

Our study proved that PCNL is properly coded by DRG, as it had an average hospitalization period in

agreement with the average recommended by codes 660 and 661. However, URL had a significantly shorter mean of hospital stay than that stipulated by DRG 660 and 661. Therefore, it is necessary to make a reassessment of the DRG codes and a modification on URL classification, reducing the period of hospitalization stay recommended for this procedure. This can impact decreasing the financial costs related to hospitalization.

AUTHORS' CONTRIBUTION

We describe contributions to the papers using the taxonomy (CRediT) provide above: Conceptualization, Visualization & Methodology: APL. Cunha, MM. Constante, ACD. Almeida. Investigation: MM. Constante, ACD. Almeida. Writing – original draft: MM. Constante, ACD. Almeida, BRA. Cougo. Review & editing: APL. Cunha, IRD. Bizzone. Project administration, Supervision: APL. Cunha, IRD. Bizzone. Validation & Software: BRA. Cougo. Formal Analysis: MM. Constante, ACD. Almeida, APL. Cunha.

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