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Assessing the Role of Guys Score in the Outcome of Pcnl

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Abstract

Urolithiasis is one of the oldest diseases and continues to be a major problem in India. PCNL continues to be the standard of care in selected cases according to the stone size, location, shape and composition of the stone. PCNL is recommended for cases with stones larger than 20mm, cases with struvite or cysteine stones, or in cases of anatomical variation. The outcomes of PCNL is interpreted in terms of success of the procedure and complication rates. Multiple factors have been investigated as predictors of success rates and complications. A quick, simple and reproducible method for the prediction of the outcomes of PCNL was proposed by Thomas et al called as the 'Guy's stone score'. The grading system mainly takes into consideration the number of stones, stone location and whether the renal anatomy is simple or abnormal. Currently there is no single agreement upon an ideal predictive model that characterizes the complexity of renal stones predicting surgical outcomes following PCNL. Hence the present study was conducted for evaluating the role of GUY's score in the outcome of PCNL.

Materials and methods: Patients scheduled to undergo PCNL at Ramaiah Hospitals were assessed for eligibility for the study and those satisfying the inclusion criteria were included in the study. The stone burden was determined by radiographic studies, and stones will be classified using the GSS as Guy's I, II, III and IV. Post-operative stone clearance rate was assessed by any residual shadow in x-ray KUB in the immediate post-operative period and NCCT after 3 months and patients were followed up to note any complications in the post-operative period. And stone free status was assessed

Results and discussion: 200 patients scheduled to undergo PCNL were included. Incidence of complications was more in patients with GUY'S grade IV ($P < 0.01$). Incidence of relook PCNL was more in patients with GUY'S grade IV. stone free clearance was more in patients with GUY'S grade I and II, stone size $< 200\text{mm}^2$, with essence HU < 800 HU, with lower calyx puncture. We have also observed that incidence of complications pleural effusion, urine leak and bleeding was more with Guy's IV and more with superior calyx puncture.

Conclusion: We conclude that GUY'S score is a useful tool in the initial evaluation to predict surgical outcomes in PCNL and can help in better pre-operative planning of the surgery.

Keywords: Guy's score; PCNL; Urolithiasis; Outcome; Prediction.

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Introduction

Urolithiasis is one of the oldest diseases known to humankind. It is noticed in Egyptian mummies. The incidence and characteristics of nephrolithiasis

reflect a wide geographic variation. Stones occur at all ages without any gender predominance. Nephrolithiasis continues to be a major problem in India. It is more prevalent in northern states than in southern states of India.

Modalities to tackle stone disease have improved vastly to ESWL and Flexible ureteroscopic surgeries, PCNL continues to be the standard of care in selected cases according to the stone size, location, shape and composition of the stone. The European Association of urologists have advocated the use of PCNL as first option for large, multiple or inferior calyx stones. Open stone surgery has been replaced by endoscopic procedures because of their lower post-operative complications, lower morbidity, shorter operative time and cost effectiveness. PCNL is recommended for cases with stones larger than 20mm, cases with struvite or cysteine stones, or in cases of anatomical variation.¹ There is no uniformity in methods for clinical and academic characterization of nephrolithiasis and for the evaluation of surgical outcomes.² The outcomes of PCNL is interpreted in terms of success of the procedure and complication rates. "Success" is often defined as the absence of residual stone fragments under conventional X-ray or computed tomography (CT) or when clinically insignificant residual fragments (CIRF) are observed.³

Multiple factors such as stone size and configuration, percutaneous access sheath size, location, renal access puncture performed by radiologist or urologist, presence of hydronephrosis have been investigated as predictors of success rates and complications. Attempts to identify the associated variables showed variations among the results which has made it difficult to classify the patients so that the stone free rate (SFR) or complications can be predicted. A quick, simple and reproducible method for the prediction of the outcomes of PCNL was proposed by Thomas *et al*⁴ called as the 'Guy's stone score'. The grading system mainly takes into consideration the number of stones, stone location and whether the renal anatomy is simple or abnormal. In this scoring system, calyceal diverticulum stones, staghorn stones and any stone in a patient with a spina bifida or spinal injury are the special circumstances that effect the grading of the stone. The score is based not just on the stones targeted for treatment in the particular procedure but on all of the stones and abnormal anatomy defines an abnormal renal anatomy, an abnormal collecting system or a patient with an ileal conduit (i.e. cases where the operating surgeon believes access may be difficult).⁵

Large-series PCNL results are available in the literature. Currently there is no single agreement upon an ideal predictive model that characterizes the complexity of renal stones predicting surgical outcomes following PCNL. Hence the present study was conducted for evaluating the role of

GUY's score in the outcome of PCNL.

Objective

The objective is to assess and study the predicting factors which alter the outcome of PCNL.

Materials and Methods

This is a prospective study conducted in MS Ramaiah Hospital from November 2016 to June 2018. Inclusion criteria: Patients of all age groups diagnosed to have renal stones and undergoing PCNL Exclusion criteria: 1. Stone in the diverticulum; 2. renal anomalies; 3. chronic kidney disease patients.

Patients scheduled to undergo PCNL at Ramaiah Hospitals were assessed for eligibility for the study and those satisfying the inclusion criteria were included in the study. After the approval by the Institutional Ethical Committee, written informed consent was obtained from the patients prior to intervention.

The stone burden was determined by radiographic studies, and stones will be classified using the GSS as Guy's I, II, III and IV.

The score is classified into four grades:

Grade I - Solitary stone in mid/lower pole or solitary stone in the pelvis with simple anatomy.

Grade II - Solitary stone in the upper pole or multiple stones in a patient with simple anatomy or a solitary stone in a patient with abnormal anatomy.

Grade III - Multiple stones in a patient with abnormal anatomy or stones in a calyceal diverticulum or partial staghorn calculus.

Grade IV - Staghorn calculus or any stone in a patient with spina bifida or spinal injury.

Post-operative stone clearance rate was assessed by any residual shadow in x-ray KUB in the immediate post-operative period and NCCT after 3 months and patients were followed up to note any complications in the post-operative period. And stone free status was assessed.

Statistical Analysis

Statistical software: The Statistical software namely SPSS 18.0, and R environment ver.3.2.2

were used for the analysis of the data and Microsoft word and Excel have been used to generate graphs, tables etc.

Results

In the present study 200 patients scheduled to undergo PCNL were included. Complete data was obtained from all study participants and were included for data analysis. The following observations were made.

Table 1 shows the GUY'S Score distribution, it was Grade I in 38 patients (19%), Grade II in 60

patients (30%), Grade III in 29 patients (14.5%) and Grade IV in 73 patients (36.5%).

Table 1: Guys Score distribution of patients studied.

Guys Score	No. of patients	%
Grade I	38	19.0
Grade II	60	30.0
Grade III	29	14.5
Grade IV	73	36.5
Total	200	100.0

Correlation of the various predictive factors

Table 2 shows the correlation of age, gender, prior history of renal calculus and prior treatment to

Table 2: Correlation of clinical variables in relation to Guys Score of patients studied.

Variables	Guys Score				Total (n=200)	P value
	Grade I (n=38)	Grade II (n=60)	Grade III (n=29)	Grade IV (n=73)		
Age in years						
18-20	0(0%)	2(3.3%)	0(0%)	2(2.7%)	4(2%)	0.612
21-30	2(5.3%)	7(11.7%)	2(6.9%)	11(15.1%)	22(11%)	
31-40	17(44.7%)	16(26.7%)	8(27.6%)	18(24.7%)	42(21%)	
41-50	7(18.4%)	14(23.3%)	7(24.1%)	14(19.2%)	59(29.5%)	
51-60	6(15.8%)	11(18.3%)	8(27.6%)	14(19.2%)	39(19.5%)	
61-70	6(15.8%)	6(10%)	3(10.3%)	13(17.8%)	28(14%)	
71-80	0(0%)	2(3.3%)	1(3.4%)	1(1.4%)	4(2%)	
>80	0(0%)	2(3.3%)	0(0%)	0(0%)	2(1%)	
Gender						
Female	7(18.4%)	25(41.7%)	7(24.1%)	28(38.4%)	67(33.5%)	0.055+
Male	31(81.6%)	35(58.3%)	22(75.9%)	45(61.6%)	133(66.5%)	
H/O renal calculus						
No	25(65.8%)	40(66.7%)	17(58.6%)	53(72.6%)	135(67.5%)	0.577
Yes	13(34.2%)	20(33.3%)	12(41.4%)	20(27.4%)	65(32.5%)	

GUY's score which was statistically not significant, **Chi-Square/Fisher Exact Test**

Table 3 shows the stone related details co-related with GUY'S score. Maximum number of patients

Table 3: Stone related details in relation to Guys Score of patients studied.

Variables	Guys Score				Total (n=200)	P value
	Grade I (n=38)	Grade II (n=60)	Grade III (n=29)	Grade IV (n=73)		
Stone Laterality						
Left	26(68.4%)	28(46.7%)	27(93.1%)	37(50.7%)	118(59%)	<0.001**
Right	12(31.6%)	32(53.3%)	2(6.9%)	36(49.3%)	82(41%)	
Stone Count						
Single	25(65.8%)	28(46.7%)	15(51.7%)	7(9.6%)	75(37.5%)	<0.001**
Multiple	13(34.2%)	32(53.3%)	14(48.3%)	66(90.4%)	125(62.5%)	
Stone Size						
<200 sq.mm.	20(52.6%)	15(25%)	7(24.1%)	7(9.6%)	49(24.5%)	<0.001**
200-800	18(47.4%)	45(75%)	22(75.9%)	37(50.7%)	122(61%)	
>800	0(0%)	0(0%)	0(0%)	29(39.7%)	29(14.5%)	

Chi-Square/Fisher Exact Test

Table 4: Essence HU distribution in relation to Guys Score of patients studied.

Essence HU	Guys Score				Total
	Grade I	Grade II	Grade III	Grade IV	
<800	6(15.8%)	19(31.7%)	20(69%)	15(20.5%)	60(30%)
800-1200	0(0%)	21(35%)	0(0%)	17(23.3%)	38(19%)
>1200	32(84.2%)	20(33.3%)	9(31%)	41(56.2%)	102(51%)
Total	38(100%)	60(100%)	29(100%)	73(100%)	200(100%)

P<0.001, Significant, Chi-Square Test**

Table 5 shows the tract size in patients and majority of the patients had tract size of 30 and majority of the patients in this group belongs to GUY'S grade IV.

Table 5: Tract Size distribution in relation to Guys Score of patients studied.

Tract Size	Guys Score				Total
	Grade I	Grade II	Grade III	Grade IV	
24	11(28.9%)	8(13.3%)	3(10.3%)	0(0%)	22(11%)
28	17(44.7%)	24(40%)	10(34.5%)	9(12.3%)	60(30%)
30	10(26.3%)	28(46.7%)	15(51.7%)	53(72.6%)	106(53%)
32	0(0%)	0(0%)	1(3.4%)	11(15.1%)	12(6%)
Total	38(100%)	60(100%)	29(100%)	73(100%)	200(100%)

P<0.001, Significant, Chi-Square Test Figure 20: Tract size in relation to GUY'S score.**

Table 22 shows the stone free status distribution in relation to Guy's score. And according to the present study stone free status of more than 90% was significantly high in Guy's stone grade III. 28 patients had stone free status of more than 90% and only 1 patient had stone free clearance of less than 90%.

Table 6: Stone free Status distribution in relation to Guys Score of patients studied.

Stone free Status	Guys Score				Total
	Grade I	Grade II	Grade III	Grade IV	
<90	6(15.8%)	8(13.3%)	1(3.4%)	21(28.8%)	36(18%)
90-100	32(84.2%)	52(86.7%)	28(96.6%)	52(71.2%)	164(82%)
Total	38(100%)	60(100%)	29(100%)	73(100%)	200(100%)

P=0.012*, Significant, Chi-Square Test.

Table 23 shows the co-relation of complications in relation to GUY'S score and according to the present study complications were more in GUY'S score grade IV. Out of 13 patients with decrease in haemoglobin to less than 8 g/dl requiring blood transfusion 11 patients belong to GUY'S grade IV, Out of 30 patients who had urine leak 22 patients belong to grade IV. And as well the incidence of relook PCNL was high in GUY'S grade IV. And the result was statistically significant.

Table 7: Complications and incidence of relook PCNL distribution in relation to Guys Score of patients studied.

Variables	Guys Score				Total (n=200)	P value
	Grade I (n=38)	Grade II (n=60)	Grade III (n=29)	Grade IV (n=73)		
Decrease HB						
No	38(100%)	58(96.7%)	29(100%)	62(84.9%)	187(93.5%)	0.002**
Yes	0(0%)	2(3.3%)	0(0%)	11(15.1%)	13(6.5%)	

Table Cont.....

Requiring blood transfusion						
No	38(100%)	58(96.7%)	29(100%)	62(84.9%)	187(93.5%)	0.002**
Yes	0(0%)	2(3.3%)	0(0%)	11(15.1%)	13(6.5%)	
Urine Leak						
No	36(94.74%)	58(97%)	29(100%)	57(69.9%)	180(78.09%)	<0.001**
Yes	2(5.26%)	2(3%)	0(0%)	16(30.1%)	20(21.91%)	
Relook PCNL						
No	38(100%)	60(100%)	29(100%)	65(89%)	192(96%)	0.003**
Yes	0(0%)	0(0%)	0(0%)	8(11%)	8(4%)	

Chi-Square/Fisher Exact Test

Discussion

For large and complex kidney stones PCNL is an important surgical intervention, and its success depends on several variables. Some of these can be predicted before surgery, i.e., stone burden and upper tract anatomy, but success also depends on surgical experience.³ Several scoring systems have been developed for predicting the SFS after shock-wave lithotripsy, retrograde intrarenal surgery and PCNL. The Guy's stone score (GSS) includes stone number, location, presence of staghorn stones and abnormal anatomy to determine different grades, and it was reported that the SFS declined with increasing grades of complexity.³

The present study included 67 females and 133 males.

Stone distribution

PCNL is considered the first line recommended procedure for renal calculus. But patients with complex multiple renal calculi pose a special challenge for PCNL as these patients have high chances of incomplete stone clearance.

When stone related characteristics were compared with the GUY'S score, more stones with

left side laterality in GUY'S grade III ($p < 0.01$), Multiple stones were more compared to single stones and maximum belongs to GUY'S grade IV ($p < 0.01$), Stone size of 200-800 mm² in maximum number of patients more in GUY'S grade II and III. Essence HU of >1200 in maximum number of patients more in GUY'S grade IV ($p < 0.01$), with tract size of 30 in maximum number of patients more in GUY'S grade IV ($p < 0.01$).

On correlating the stone free status with the stone characteristics stone free status was >90% in 100% of patients with solitary stone in upper calyx, lower calyx, mid-calyx and it was 93.5% in patients with stone in renal pelvis. Whereas the stone free status of >90% was achieved in 61.5% patients with staghorn calculus and 77.5% patients in patients with stone at multiple calyces. And the result was statistically significant ($p < 0.01$).

GUY'S Score and stone free status

External validation in several series demonstrated that GSS effectively predicted SFS. There are limitations to this system. First, it fails to account for important variables such as calyceal involvement, stone size, density, and composition. These variables determine technical difficulty of PCNL and thus have important implications for procedural success.

Table 8: Stone free status in various studies in relation to Guy's score.

Study	Pre-operative imaging	Post-operative imaging	Definition of stone free	Clearance by stone complexity
				Overall, 62%
				Grade 1, 81%
Thomas K et al., ⁴	CT, radiograph, IVU	KUB radiograph	4-mm fragments	Grade 2, 72.4%
				Grade 3, 35%
				Grade 4, 29%
				Overall, 76.1%
				Grade 1, 100%
Mandal S et al., ⁶	Radiograph, IVU, USS, noncontrast	KUB radiograph CT	Complete absence of stones	Grade 2, 74%
				Grade 3, 56%
				Grade 4, 0%

Table Cont....

				Overall, 71.6%
				Grade 1, 95.2%
Vicentini FC et al., ⁷	Noncontrast CT		Asymptomatic fragments n 4 mm	Grade 2, 79.5%
				Grade 2, 79.5%
				Grade 3, 59.5%
				Grade 4, 40.7%
				Overall, 90%
				Grade 1, 95%
Ingimarsson JP et al., ⁸	Noncontrast CT		No fragments/no fragments. 2 mm/ no fragments. 4 mm	Grade 2, 97%
				Grade 3, 95%
				Grade 4, 75%
				Overall, 56%
				Grade 1, 70.2%
Labadie K et al., ⁹	CT scan	Unclear	Not defined	Grade 2, 65.4%
				Grade 3, 48.1%
				Grade 4, 35.9%
				Overall, 71.9%
				Grade 1, 91.5%
Noureldin YA et al., ¹⁰	Unclear	Plain radiographs or noncontrast CT	Asymptomatic residual fragments n 4 mm residual	Grade 2, 80%
				Grade 3, 47.6%
				Grade 4, 43.2%
				Overall, 75%
				Grade 1, 92.8%
Bozkurt IH et al., ¹¹	CT scan KUB radiograph (unless CT; which is reserved for only symptomatic patients)		Asymptomatic residual fragments n 4 mm	Grade 2, 72.4%
				Grade 3, 68.5%
				Grade 4, 47.4%

In the present study GUY'S score of I, II, III and IV in 38,60,29 and 73 patients respectively. The stone free success rate of >90% was achieved in 84.2% in GUY'S grade I, 86.7% in GUY'S grade II, 96.6% in GUY'S grade III, 71.2% in GUY'S grade IV. Although the stone free status was more in GUY'S grade III and it was comparatively equal in GUY'S grade I and II and more compared to GUY'S grade IV. But the result statistically not significant.

Complications

According to the present study there was high incidence of complications and Relook PCNL in GUY'S grade IV. Categorizing of patients according to Guys stone score (I-IV) helps urologist appropriately counsel patients regarding their likely postoperative clinical outcome and, in complex scenarios, refer patients to tertiary centers.

Conclusion

Incidence of complications was more in patients with GUY'S grade IV (P<0.01).

Incidence of relook PCNL was more in patients with GUY'S grade IV.

We have also observed in our study that stone free clearance was more in patients with GUY'S grade I and II, stone size <200mm², with essence HU <800 HU, with lower calyx puncture,

We have also observed that incidence of complications pleural effusion, urine leak and bleeding was more with Guy's IV and more with superior calyx puncture.

We conclude that GUY'S score is a useful tool in the initial evaluation to predict surgical outcomes in PCNL and can help in better pre-operative planning of the surgery.

Conflict of interest: None

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References

1. Krishna reddy.S.V, Shaik Ahammad basha. Outcome and complications of percutaneous nephrolithotomy as primary versus secondary

- procedure for renal calculi. *Int Braz J Urol.* 2016;42:262-269.
2. Simone L Vernez, I Zhamshid Okhunov, Piruz Motamedinia, Vincent Bird, Zeph Okeke, Arthur Smith. Nephrolithometric scoring systems to predict outcomes of percutaneous nephrolithotomy. *J Urol.* 2011;186:556-562.
 3. Lokesh Sharma, Shubham Lavania, Ayush Khetarpal, Nisar Ahmed, Rajeev Mathur, R.G.Yadav. Outcome of PCNL-Success and complications. *IOSR-JDMS.* 2016;15:121-125.
 4. Thomas K, Smith NC, Hegarty N, Glass JM. The Guy's stone score--grading the complexity of percutaneous nephrolithotomy procedures. *Urology.* 2011;78:277-281.
 5. Tulga Egilmez, Mehmet Resit Goren. Predicting surgical outcome of percutaneous Nephrolithotomy: Validation of the Guy's stone score and Nephrolithometric Nomogram in terms of success and complications. *J Clin Anal Med* 2015;6(3):281-6.
 6. Mandal S, Goel A, Kathpalia R, et al. Prospective evaluation of complications using the modified Clavien grading system, and of success rates of percutaneous nephrolithotomy using Guy's Stone Score: a single center experience. *Indian J Urol.* 2012;28:392-398.
 7. Vicentini FC, Giovanni SM, Mazzucchi E, et al. Utility of the Guy's stone score based on computed tomographic scan findings for predicting percutaneous nephrolithotomy outcomes. *Urology.* 2014;83: 1248-1253.
 8. Ingimarsson JP, Dagrosa LM, Hyams ES, Pais VM Jr. External validation of a preoperative renal stone grading system: reproducibility and inter-rater concordance of the Guy's stone score using preoperative computed tomography and rigorous postoperative stone-free criteria. *Urology.* 2014;83:45-49.
 9. Labadie K, Okhunov Z, Akhanavein A, et al. Evaluation and comparison of urolithiasis scoring systems used in percutaneous kidney stone surgery. *J Urol.* 2015;193:154-159.
 10. Noureldin YA, Elkoushy MA, Andonian S. Which is better? Guy's versus S.T.O.N.E. nephrolithometry scoring systems in predicting stone-free status post-percutaneous nephrolithotomy. *World J Urol.* 2015;33:1821-1825.
 11. Bozkurt IH, Aydogdu O, Yonguc T, et al. Comparison of Guy and clinical research office of the Endourological Society nephrolithometry scoring systems for predicting stone-free status and complication rates after percutaneous nephrolithotomy: a single center study with 437 cases. *J Endourol.* 2015;29:1006-1010.
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