

ORIGINAL ARTICLE

Utility of the Guy's stone score based on computed tomographic scan findings for predicting percutaneous nephrolithotomy outcomes

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Introduction: Although stone disease is one of the most common affliction of modern society, it has been described since antiquity. Larger renal calculi can cause pain, hematuria, infection, renal function deterioration and mortality. Hence, large renal stones should be promptly treated. Among the several present day treatment options, percutaneous nephrolithotomy (PCNL) is a one of the, minimal invasive surgery for the management of renal calculi. It is now the recommended initial treatment for large renal stones (AUA guidelines). The success in PCNL is identified by a stone free rate. These rates are, in turn, affected by factors such as stone bulk and site. The recently published Clinical Research Office of the Endourological Society (CROES) PCNL global study reported a stone-free rate (SFR) of 75.5%. Recently, GUY'S stone score have been introduced for predicting the surgical outcomes of PCNL. GUY'S stone score is the only factor which significantly and independently predict the SFR. None of the other factors like operating surgeon, patient's weight, age, and comorbidity correlate with SFR. **Aim and objective:** To evaluate the utility of the Guy's Stone Score based on Computed Tomographic Scan findings for predicting Percutaneous Nephrolithotomy Outcomes. **Results:** Mean age of our patient was 44.95+/-12.4, which was relatively younger study population as compared to others. Most of patients belonged to GS2(n= 31.48%) followed by GS3 (n=29.63%) whereas GS1 had 25.93% and GS4 had 12.96%. Out of the 54 patients, who underwent PCNL, overall immediate success rate was observed in 34 patients, i.e. 63.0% of patients After GSS stratification, this differed significantly among groups. GSS 1- 100%, GSS 2- 88.2%, GSS 3- 31.3%, GSS 4- 0%. This was statistically significant with p value of <.001. **Conclusion:** GSS based on CT scan findings is highly efficient in predicting success rates after PCNL.

KEYWORDS: Guy's Stone Score, PCNL, CT KUB

INTRODUCTION

Urinary stone disease is one of the old ailments, currently, remaining a common cause for both office and emerging room

referrals. It is a very common problem throughout the world with an incidence of 5–10% in the general population.^[1]

Although stone disease is one of the most common afflictions of modern society, it has been described since antiquity. Larger renal calculi can cause pain, hematuria, infection, renal function deterioration, and mortality. Hence, large renal stones should be promptly treated.^[2]

Among the several present day treatment options, percutaneous nephrolithotomy (PCNL) is a one of the, minimal invasive surgery for the management of renal calculi. It is now the

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recommended initial treatment for large renal stones (AUA guidelines).^[2,3] Percutaneous access to the kidney was first described in 1865 by Thomas Hillier who repeatedly drained a 4 year old boy's kidney, which he thought at that time to be congenitally obstructed. PCNL for stone disease was first described in the 1970s by Fernstrom and Johansson.^[4]

The success in PCNL is identified by a stone free rate. These rates are, in turn, affected by factors such as stone bulk and site.^[5] The recently published Clinical Research Office of the Endourological Society (CROES) PCNL global study reported a stone-free rate (SFR) of 75.5%.^[6]

Radiological imaging is routinely done to preoperatively assess patients with renal stone disease before PCNL. Imaging is also performed to plan pelvicalyceal access, and evaluate treatment success and complications after PCNL.^[7-9]

A number of approaches to classify PCNL have been attempted, but none of these are in common use. Variations also exist in their ability to predict the outcomes (the SFR and complications). Thus, there is a strict need for an effective tool to accurately predict the difficulty and outcome success of PCNL.

Recently, GUY'S stone score have been introduced for predicting the surgical outcomes of PCNL. GUY'S stone score is the only factor which significantly and independently predicts the SFR. None of the other factors such as operating surgeon, patient's weight, age, and comorbidity correlate with SFR.

Aim and Objective

The aim of the study was to evaluate the utility of the Guy's Stone Score based on computed tomographic scan findings for predicting PCNL outcomes.

MATERIALS AND METHODS

Study Site

The study was conducted at Rohilkhand Medical College and Hospital, Bareilly.

Study Population

All patients who will be undergoing PCNL for renal calculi between April 2018 and April 2020.

Study Design

It is a prospective, observational, cohort study.

Sample Size

All patients who will be undergoing PCNL for renal calculi between April 2018 and April 2020 in Rohilkhand Hospital, Urology department will be enrolled in study after taking informed consent. We have taken 54 cases as the case volume/year at our institute based on the previous 2 years PCNL record data.

Time Frame

2 years (April 2018 To April 2020).

Inclusion Criteria

All consecutive adult patients of renal calculi who will be scheduled for PCNL in Rohilkhand Hospital and Medical College, Urology department shall be included in the study.

Exclusion Criteria

The following patients will be excluded from the study:

1. Patients undergoing bilateral concomitant PCNL
2. Patients with bleeding diathesis/uncorrected coagulopathy.

Study Population

All consecutive patients who underwent PCNL for renal calculi in Rohilkhand Hospital and Medical College, Urology department in 2 years (April 2018–April 2020) were prospectively evaluated. All patients signed an informed consent form and were counseled about the procedure and the potential benefits and complications of the PCNL procedure. All patients underwent routine serum and urine examinations and a NCCT scan preoperatively and the stones were classified as per the model.

The stone burden was determined by radiographic studies, and stones were classified using the GSS as Guy's I, II, III, and IV. The score comprised four grades:

Guy's scoring system

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 stag horn calculus.

Grade IV: stag horn calculus or any stone in a patient with spina bifida or spinal.

Hydronephrosis secondary to stone obstruction was not considered abnormal anatomy.

Operative Technique

Patients underwent PCNL as per the standard protocol after ensuring sterile urine. Antibiotic prophylaxis was given to all the patients. Urethral catheter insertion and cystoscopy in lithotomy position were initial steps. Patients were then made in prone position and percutaneous access was obtained using C-arm fluoroscopy and with or without contrast dye. Tract was dilated with Alken's serial dilator and a 28/30 Fr Amplatz sheath was placed. Nephroscopy was performed with a rigid, 26 iFr nephroscope (wolf). Calculi were fragmented after identification with pneumatic lithoclast (Swiss Lithoclast Master). Confirmation of stone clearance was done by fluoroscopy. If multiple punctures were required, they were done before dilating the first track and guidewires were secured. Antegrade approach was used to place Double J stent if needed. At the end of the procedure or in most of the cases a 20 Fr nephrostomy tube was placed into the renal pelvis or the punctured calyx. All complications were noted and graded as per Clavien system (Appendix).

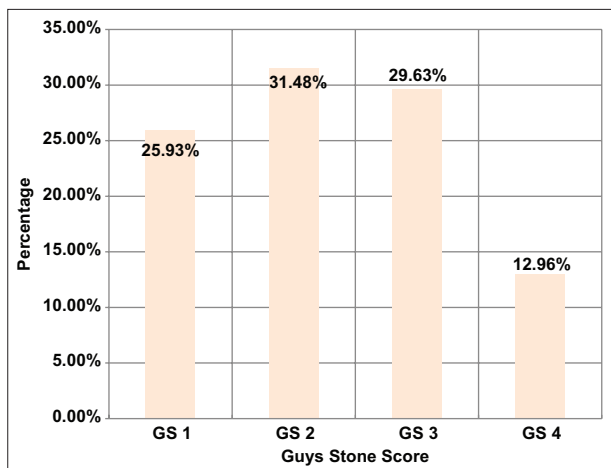


Figure 1: Distribution of study group as per Guy's Stone Score

Table 1: Association among study group between, Stone Type * Guys Stone Score

Stone type		Guys Stone Score				Total
		GS 1	GS 2	GS 3	GS 4	
Solitary Stone	Count	14	7	0	0	21
	Percent	100.0%	41.2%	0.0%	0.0%	38.9%
Multiple	Count	0	10	11	0	21
	Percent	0.0%	58.8%	68.8%	0.0%	38.9%
Partial Staghorn	Count	0	0	5	0	5
	Percent	0.0%	0.0%	31.3%	0.0%	9.3%
Complete Staghorn	Count	0	0	0	7	7
	Percent	0.0%	0.0%	0.0%	100.0%	13.0%
Total	Count	14	17	16	7	54
	Percent	100.0%	100.0%	100.0%	100.0%	100.0%

Table 2: Association among study group between, Final stone free * Guys Stone Score

Final stone free		Guys Stone Score				Total
		GS 1	GS 2	GS 3	GS 4	
Yes	Count	14	17	14	5	50
	Percent	100.0%	100.0%	87.5%	71.4%	92.6%
No	Count	0	0	2	2	4
	Percent	0.0%	0.0%	12.5%	28.6%	7.4%
Total	Count	14	17	16	7	54
	Percent	100.0%	100.0%	100.0%	100.0%	100.0%
Chi-Square test	Value	df	P Value	Association is		
Pearson Chi-Square	7.565	3	0.053	Not Sig		

RESULTS

Mean age of our patient was 44.95 ± 12.4 , which was relatively younger study population as compared to others. Majority of the patient were male (70.37%). Mean BMI in our study was 26.28 ± 5.19 which was in the normal range. Most of patients belonged to GS2 ($n = 31.48\%$), followed by GS3 ($n = 29.63\%$), whereas GS1 had 25.93% and GS4 had 12.96% as shown in Figure 1. Most of Solitary stone belonged to GS1 score, multiple to GS3 and partial and complete to GS3 and GS4 respectively as shown in Table 1. Out of the 54 patients, who underwent PCNL, overall immediate success rate was observed in 34 patients, that is, 63.0% of patients. After GSS stratification, this differed significantly among groups. GSS 1–100%, GSS 2–88.2%, GSS 3–31.3%, and GSS 4–0%. This was statistically significant with $P < 0.001$ as shown in Table 2.

DISCUSSION

Mean age of our patient was 44.95 ± 12.4 , which was relatively younger study population as compared to others.^[10,11] Majority of the patient were male (70.37%) similar to other studies.^[10]

Mean BMI in our study was 26.28 ± 5.19 which was in the normal range and was comparatively lower than other studies, which might be explained due to less number of overweight and obese patients in our study.

In the study by Thomas *et al.*^[12] in their original study, the stone score was the only factor that significantly and independently predicted the SFR ($P = 0.01$). None of the other factors (i.e., stone burden, operating surgeon, patient's weight, age, comorbidity, and urine culture) correlated statistically significantly with the SFR. None of the factors correlated with the overall complication rate or severity.

STONE FREE RATE

Out of the 54 patients, who underwent PCNL, overall immediate success rate was observed in 34 patients, that is, 63.0% of patients as shown in Table 2.

After GSS stratification, this differed significantly among groups.

GSS 1–100%, GSS 2–88.2%, GSS 3–31.3%, and GSS 4–0%. This was statistically significant with $P < 0.001$.

Similar results have been obtained by other studies as well.

Study	Country	Clearance by stone complexity
Thomas <i>et al.</i> ^[12] 2011	UK	Overall 62% Grade1 81% Grade2 72.4% Grade3 35% Grade 4 29%
Mandal <i>et al.</i> ^[10] 2012	India	Overall 76.1% Grade 1 100% Grade 2 74% Grade 3 56% Grade 4 0%
Vicentini <i>et al.</i> ^[11] 2014	Brazil	Overall 71.6% Grade 1 95.2% Grade 2 79.5% Grade 3 59.5% Grade 4 40.7%
Ingimarsson <i>et al.</i> ^[13] 2014	Lebanon	Overall 90% Grade 1 95% Grade 2 97% Grade 3 95% Grade 4 75%

Numerous authors have either assessed this SFR on plain X-ray KUB which have high chances of missing residual fragments or an variable imaging such as plain X-ray, USG, or CT scan which have variable sensitivity in identifying residual stones. For example - CROES PCNL global study revealed an overall SFR of 76% post PCNL.^[6] An important finding of the study was that SFR were most commonly determined by conventional radiography (73.4%) and ultrasonography (12.4%) and only 14% of stone-free patients were confirmed by CT.^[6] It is, therefore, likely that the true overall SFR was lower than that reported, given the lower sensitivity of plain film radiography, and ultrasonography compared with CT90.

In our study, we have used <4 mm fragment criteria on CT scan done postoperatively as SFR.

Study	Post-op imaging	Definition of stone free
Thomas <i>et al.</i> ^[12] 2011	Xray kub	<4 mm fragment
Mandal <i>et al.</i> ^[10] 2012	Xray kub	Complete absence of stones
Vicentini <i>et al.</i> ^[11] 2014	Non-contrast CT	Asymptomatic fragments<4 mm
Ingimarsson <i>et al.</i> ^[13] 2014	Non-contrast CT	No fragments/no fragments>4 mm

CONCLUSION

GSS-based on CT scan findings is highly efficient in predicting success rates after PCNL.

GSS-based on CT scan findings is highly efficient in predicting complications after PCNL.

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