



PREDICTIVE ANALYSIS OF PCNL OUTCOMES USING GUYS SCORING SYSTEM

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Abstract

Background

Renal calculi larger than 2 cm can be removed with the solidified, minimally invasive treatment known as percutaneous nephrolithotomy (PCNL). PCNL is not free of complications. Guys scoring System (GSS) was devised to quantify these complications. This score uses information from computed tomography (CT), intravenous urography, plain radiography, and ultrasound to classify individuals depending on the complexity of the stone and the pelvicaliceal architecture.

Objectives

To analyze the intraoperative and postoperative complications of PCNL using Guys scoring system.

Methodology

This descriptive study of 52 patients were conducted at sheikh zayed hospital Lahore. Guys score of patients with nephrolithiasis were calculated using plain CT scan and then patients were stratified as per above GSS. PCNL was done on each patient and then various intraoperative and postoperative complications were noted in each GSS group.

Results

Mean age of included patients were 51.2 ± 10.31 years. No of patients in Guys 1, Guys 2, Gusy 3 and Guys 4 were 14, 12, 11 and 15 respectively. Male to female ratio was 2:1. Mean BMI was 25.31 ± 4.68 . Mean stone size was 35.1 ± 3.31 . There was a statistically significant differences in each Guy's scoring system group regarding mean operative time, blood transfusion, immediate stone free rate and residual stone and all of them showed highest values at GSS 4. No statistically significant difference was found in between different groups regarding hospital stay and sepsis.

Conclusion

GSS is an effective tool in predicting intraoperative and post-operative complication following PCNL.

Introduction

Renal calculi larger than 2 cm can be removed with the solidified, minimally invasive treatment known as percutaneous nephrolithotomy (PCNL). The first recorded removal of renal calculus through a nephrostomy tract was made in 1976 by Fernstorm and Johansson[1]. For substantial stones, PCNL is the recommended strategy for action. PCNL yields up to 95% stone-free rates. PCNL

is advocated as the preferred treatment for staghorn calculi in AUA recommendations. The primary line of treatment for larger stones in the lower pole is PCNL[2]. PCNL had comparable rates of complications and recurrence but higher rates of stone-free patients. For PCNL, the stone-free rates vary from 85 to 93% [3][4]. This approach has a high stone-free rate (SFR), but in comparison to other modalities like extracorporeal shockwave lithotripsy and retrograde intrarenal surgery, it has been related to higher postoperative problems such as postoperative haemorrhage, fever, and pain[5][6]. PCNL has a low but distinct complication rate and is usually a safe treatment choice. Numerous issues arise from the first penetration, including damage to the surrounding organs (colon, spleen, liver, pleura, lung). Fever and haemorrhage following surgery are two more particular concerns. The aim of treatment for patients with challenging caliceal calculi or staghorn is to maximise stone clearance while ensuring maximum preservation of renal function with the least amount of problems. According to the most recent revisions to the American Urological Association Nephrolithiasis Guideline Panel on Staghorn Calculi guidelines, percutaneous nephrolithotomy (PCNL) is a crucial part of treating the majority of large-volume and staghorn renal calculi[7]. The size, location, quantity, and grade of the hydronephrosis, in addition to the surgeon's experience, are among the several variables that affect the outcome of stone clearance. In addition to enhancing academic reporting, the widespread application of a standardised stone grading system is extremely valuable for patient counselling, therapeutic decision-making, and outcome assessment[8] Several scoring methods, such as Guy's stone score, S.T.O.N.E nephrolithometry system, CROES nephrolithometry nomogram, and S-ReSC score, have been developed to predict the results following PCNL[9]. Thomas et al created the Guy's Stone Score (GSS) in 2011. This score uses information from computed tomography (CT), intravenous urography, plain radiography, and ultrasound to classify individuals depending on the complexity of the stone and the pelvicaliceal architecture [10]. Jiang, K., et al concluded that only the Guy score (WMD = -0.29, 95% CI: -0.57 to -0.02, P = 0.03) had the ability to predict challenges following PCNL[11].

Objectives

To analyze the intraoperative and postoperative complications using Guys scoring system.

Keywords Guys scoring system, PCNL, post PCNL complications

Materials and Methods

This is a descriptive study of 52 patients conducted at Shaikh Zayed Hospital Lahore after taking permission from Institutional Review Board from 2021-2023. All the patients were signed informed consent. Patients of both genders with age in between 40-70 years presenting with complaint of renal stones on Computerized Tomography scan were included in current study. Patients with history of previous surgery, renal failure, coagulopathy, urinary tract infections or congenital renal anatomical defects were excluded from the study. Guys score is calculated for each patient by an experienced radiologist utilizing plain CT scan (Figure). Prone position percutaneous nephrolithotomy is done by an experienced urologist under general anesthesia. Plain X-Ray was done 1 month after PCNL to localize residual stone or stone free rate (SFR). SFR is defined as complete conversion of renal stone into fine particles while residual stone is defined as stone size of <4mm following PCNL.

Peroperative data is calculated including blood transfusion and mean operative time required to do PCNL. Postoperative data collected was mean hospital stay, sepsis, stone free rate and residual stone.

Data analysis was done by SPSS version 26. Chi square and Fischer exact test was applied to analyze the association of demographic profile, intraoperative factors (MEAN OPERATIVE TIME AND BLOOD TRANSFUSION), postoperative factors (sepsis, stone free rate, residual stone and mean hospital stay) with Guys scoring system (GSS).

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.

Thomas, et all 2011(7)

Results

Mean age of included patients were 51.2± 10.31 years.No of patients in Guys 1,Guys 2,Gusy 3 and Guys 4 were 14,12,11 and 15 respectively. Male to female ratio was 2:1.Mean BMI was 25.31± 4.68.Mean stone size was 35.1 ±3.31(Table 1).

Table 1: Demographic profile and mean stone size in each Guy's scoring system group

	Guys score 1 (14)	Guys score 2 (12)	Guys score 3 (11)	Guys score 4 (15)	P value
Mean age	52± 10.21	48± 11.1	59.2± 7.48	61.5± 5.21	0.27
Gender	9M:5 F	10M:2 F	7M:4F	11M:4F	0.42
BMI(Kg/m ²)	22.4± 4.17	25.9± 4.11	27± 5.1	21± 4.2	0.86
Stone size(mm)	30.7± 3.8	34.2± 4.7	40.2± 5.21	43.12± 4.31	0.001

There was a statistically significant differences in each Guy's scoring system group regarding mean operative time,blood transfusion,immediate stone free rate and residual stone and all of them showed highest values at GSS 4 except immediate stone free .No statistically significant difference was found inbetween different groups regarding hospital stay and sepsis. (Table 2)

Table 2: Clinical profile in each Guy's scoring system group

	Guys score 1 (14)	Guys score 2 (12)	Guys score 3 (11)	Guys score 4 (15)	P value
Mean operative time(in min)	70.6± 10.25	83.9± 11.2	98.2± 28.4	123.5±10.4	0.001
Blood transfusion	0	1	3	6	0.001
Immediate stone free rate	11(78.6%)	8(66.6%)	5(45.4%)	6(40%)	0.001
Hospital stay(in days)	5(4-7)	5(4-7)	6(5-8)	7(5-9)	0.376
Sepsis	0	2	1	0	0.261
Residual stone	4(28.5%)	7(58.3%)	8(72.7%)	12(80%)	0.001

Discussion

Based on preoperative computed tomographic scan data, Vicentini et al. employed Guy's Stone Score (GSS) to forecast percutaneous nephrolithotomy outcomes in the supine position in 155 renal patients.Based on CT results, they validated the GSS tool's value in accurately assessing renal stones in terms of surgical outcome and complications[12]. In the current study, the stone free rate (SFR)

was 40% for Guy score 4 and 78.6% for Guy score 1. Reduced stone-free rates following MPCNL have been correlated to increased stone size and number, calix placement, staghorn calculus, and moderate to severe hydronephrosis, according to Zhu, Z. et al [13][14]. The comparison of the stone burden between the non-stone-free and stone-free groups was illustrated by Rais-Bahrami, S. et al. There was a statistically significant nearly twofold increase in the stone burden in the non-stone-free group. The difference in stone burden between the two groups may be the result of the complex difficulties that these increased stone burdens provide for PCNL techniques. These substantial loads frequently point to intricate or numerous stone formations that obstruct the collecting system's full access, preventing total fragmentation and resulting in a lower percentage of stone-free status [15]. In grades 1, 2, 3, and 4, our study found that the SFR following PCNL was 78.6%, 66.6%, 45.4%, and 40%, respectively. The results of this study are consistent with those of Thomas et al., who determined that the GSS SFR for grades 1, 2, 3, and 4 was 81%, 72.4%, 35%, and 29%, respectively [10].

Bleeding during or after PCNL can be an acute or fatal complication that might occur during needle passage, tract dilatation, or nephrostomy. While acute bleeding from injuries to the primary renal vessels is rare, it is generally caused by damage to the segmental arteries rather than smaller intrarenal capillaries [16][17]. According to Turna et al., partial (GSS grade 3) and complete (GSS grade 4) staghorn stones are prone to cause bleeding because they require more manoeuvres to entirely remove stone fragments out of the calyces. This raises the risk of more parenchymal and pelvicalyceal injury, which can cause bleeding [18][19]. Multiple tracts needed to break the stone correspond to partial or entire staghorn stones in advanced guys scores [20]. According to our investigation, there is a correlation between longer intraoperative durations and a higher risk of bleeding during PCNL. According to Lee, J. K. et al.'s results, the risk of severe bleeding during PCNL was substantially correlated with staghorn stones, large stones, and extended operation times [21]. The idea makes obvious considering the extent of vascular damage each tract causes. Larger, more intricate, and many stones require more percutaneous tracts [22][23].

According to the current study, the mean operative time for Guys 1, Guys 2, Guys 3, and Guys 4 was 70.6 ± 10.2 , 83.9 ± 11.2 , 98.2 ± 28.4 , and 123.5 ± 10.4 . This indicates that the mean operative time increases with stone complexity, which is correlated with an increase in Guys score. According to Kumar, U. et al., for each unit increase in GSS, the operative time increased by 9.9 min ($P < 0.001$) [24]. Surgery for staghorn stones took considerably more time than for solitary stones ($p > 0.001$) or many stones ($p = 0.043$), according to research by Doykov, M. et al [25]. Because of their difficult-to-reach locations and heavier stone loads, stones with Guys 3 and 4 in PCNL took longer to shatter into smaller pieces, producing more debris and making it take longer to collect the stones.

In the current study, there is a positive correlation between mean stone size and higher Guys score. It was demonstrated by Doykov, M. et al. that the patients who still had stones either had multiple stones or staghorn stones. The higher prevalence of residual stone is correlated with the positioning of stone in multiple locations. Greater density, volume, and size of the stone were linked to the patients who still had stone [26][27].

The current investigation shows no correlation between Guys score and hospital stay or sepsis.

Conclusion

Guy's scoring system is a straightforward, dependable method for grading stone complexity prior to PCNL. Additionally, there is a strong positive link between it and residual stone, mean operative time, intraoperative blood loss, and stone free rate.

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