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RESEARCH ARTICLE
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GUY'S STONE SCORE IN THE EVALUATION AND OUTCOME OF PERCUTANEOUS NEPHROLITHOTOMY.

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Abstract:

Aim

This study aimed to ascertain the relevance of Guy's stone score with respect to Gender and Stone size in the evaluation and outcome of percutaneous nephrolithotomy.

Materials and methods : This hospital-based, prospective clinical study enrolled 100 patients who were indicated for percutaneous nephrolithotomy. All patients were allocated into groups according to Guy's stone score and were compared for factors associated with stone-free rate and complication risk. Data was entered into Microsoft Excel 2010, checked for accuracy, and then analysed using SPSS version 20.

Results : A total number of patients eligible for final analysis in our study was 100. The male: female ratio is 2.44 with 71 men and 29 women. Most of the patients belonged to the age group of 21-40 with over 52 patients and least incidence was found in age group 61-72 with just 9 patients, an indicator of a median age 35.5+- 15.5. The association between age and GSS in our study were found to be statistically significant (p=0.12). Table 3 shows the characteristics of the renal calculi. A majority of the stones were solitary out of which 49% were left and 51% were right.

Majority of the patients (45%) have been found to have a GSS grading 1, followed by the GSS Grading 2 by 32% and 16% & 7% of the patients were found to have GSS grading 3 & 4 Respectively. The findings were found to be statistically significant with age (p= 0.39) and gender (p= 0.32) indicating that the null hypothesis is rejected with 95% Confidence Interval.

Conclusions : Based on the study findings, Guy's stone score was found to be significantly associated with gender as well as age and was efficient in predicting percutaneous nephrolithotomy outcomes.

Keywords: Guy's stone score, percutaneous nephrolithotomy, PCNL, Quality of Life

Introduction:

Nephrolithiasis is a common condition, with high prevalence and recurrence, constituting one of the most common diseases of the urinary tract.[1] The disease affects 5% to 15% of the world population,

with a peak incidence in young adults between the third and fourth decade of life.[1] Ureteroscopy and percutaneous nephrolithotomy (PCNL) are the most commonly utilised modalities. Stone features such as size, extent of calyceal involvement, pelvicalyceal anatomy, and anatomic malformations dictate the feasibility of different treatment modalities and have significant impact on surgical outcomes.[2] There is immense heterogeneity in methods for clinical and academic characterization of nephrolithiasis and for the evaluation of surgical outcomes.[2] At the current time, the Guy's Stone Scoring (GSS) system, the STONE nephrolithometry scoring system, and the CROES (Clinical Research Office of Endourological Society) nomogram are used for the prediction of the success rate and possible complications following PCNL in research and clinical practice.[3]

Amongst the above-mentioned scoring systems, the GSS provides a simple, intuitive, and reproducible tool for predicting Stone free rate (SFR) following PCNL. Arguably, its external validation and use of multiple imaging modalities, including abdominal radiograph and CT, broadens its universal appeal and integration across varying guidelines for postoperative imaging.[2] A multivariate analysis showed that the GSS was the only predictive factor of SFS as compared with stone burden, operating surgeon, weight, age, comorbidity, and urine culture.[2] External validation in several series demonstrated that GSS effectively predicted SFS.[2]
The literature about the relationship between GSS and outcomes is sparse, with conflicting evidence of GSS predicting stone-free or complication rates. We apply GSS to assess the importance of the GSS in assessment and outcome prediction of PCNL. This is with the aim of pointing out the ultimate role of the GSS in the evaluation of PCNL effectiveness and its impact on outcomes in patients.

Methodology:
This clinical study was carried out at Saifullah Bakhtawar Amin Medical and Dental College, Multan, Pakistan, and it has been approved by the Institutional Review Board-I.E.S.C/71/2021. All experiments from this study were performed in accordance with the Declaration of Helsinki. Written informed consent was attained from all participants in this study regarding data usage in scientific publications.

Consecutive eligible patients for PCNL, 100 males, and females were selected. The indications for PCNL were renal pelvic stone(s) more than 2 cm in size or any symptomatic stone(s) less than 2 cm in size where the initial treatments like uretero-renoscopy or SWL have failed. Patients having positive urine culture, coagulopathy, comorbidities, or pregnancy were excluded. Prone PCNL with triangulation technique was the standard approach followed.

Demographic information, ASA classification, stone size, history of previous surgeries, and GSS were noted. The GSS status before surgery was assessed by the experienced urologists. All cases were subjected to necessary preoperative investigations in the form of blood tests. Cases were categorised based on GSS status and the results compared with respect to SFR (fragments<4 mm) and risk for complication. SFR was assessed using CT and X-ray.

Data was entered into Microsoft Excel 2010, checked for accuracy, and then analysed using SPSS version 20. Continuous data were presented as mean ± SD and compared by paired t tests. Categorical data were presented as frequencies and percentages and association by $\chi 2$ test. Binomial logistic regression analysis was performed for identifying independent predictors for complications. The null hypothesis will be rejected when $p < 0.05$.

Result:
A total number of patients eligible for final analysis in our study was 100. The male: female ratio is 2.44 with 71 men and 29 women (Table 1).

Table 1. Baseline characteristics (Sex)

Sex	Cases
Male	71
Female	29

Most of the patients belonged to the age group of 21-40 with over 52 patients and least incidence was found in age group 61-72 with just 9 patients, an indicator of a median age 35.5+- 15.5. (Table 2).

Table 2: Baseline Characteristics (Age group)

Age group	Cases
2-20	10
21-30	26
31-40	26
41-50	19
51-60	10
61-72	9
Age, Mean +- SD, yr	35.5+-15.5

The association between age and GSS in our study were found to be statistically significant (p=0.12). Table 3 shows the characteristics of the renal calculi. Most of the stones were solitary out of which 49% were left and 51% were right (Table 3)

Table 3: Renal Calculi Characteristics

Stone side	Cases
Left	49
Right	51

Majority of the patients (45%) have been found to have a GSS grading 1, followed by the GSS Grading 2 by 32% and 16% & 7% of the patients were found to have GSS grading 3 & 4 Respectively. The findings were found to be statistically significant with age (p= 0.39) and gender (p= 0.32) indicating that null hypothesis is rejected with 95% Confidence Interval, as shown in Table 4.

Table 4: Guy's Stone score findings

Guy's score	Cases
1	45
2	32
3	16
4	7

Number of cases and their site has been shown in Table No 5.

Table 5: Site of Calculi

Location	Cases
Lower & Mid pole	2
Lower & Upper pole	1
Lower & Upper pole & Mid ureteric	1
Lower pole	8
Lower pole and upper ureteric	5
Lower ureteric	1
Mid and Lower pole	1
Mid pole	2
Mid Pole & Mid Ureteric	1
Mid Ureteric	1
Pelvi-Ureteric Junction	8
Renal Pelvis	25
Renal Pelvis, Mid & Lower Pole	9
Renal Pelvis & Lower Pole	15
Renal Pelvis & Lower Ureteric	1
Renal Pelvis & Mid Pole	1
Renal Pelvis & Upper Pole	1
Renal Pelvis & Upper Ureteric	1
Renal Pelvis, Upper & Lower Pole	2
Renal Pelvis, Upper, Mid & Lower Pole	7
Upper & Lower Pole	1
Upper Pole	1
Upper Ureteric	4
Upper, Mid & Lower Ureteric	1

Discussion:

This study aimed to evaluate the relevance of the Guy's Stone Score (GSS) in assessing the outcomes of percutaneous nephrolithotomy (PCNL). [4] Previously, no definitive tool was available to predict

PCNL outcomes and complication rates, crucial for both physicians and patients. Effective tools should assess surgical difficulty and risk, aiding in patient counselling and surgeon communication.[5] Although several studies have attempted to classify PCNL outcomes and complications, inconsistencies and lack of clinical adoption persist. A quick, simple, and reproducible tool is essential for accurate predictions, patient counselling, surgeon training, and service planning.[5]

The Guy's Stone Score (GSS) is a straightforward and reliable method for predicting PCNL success rates, typically using kidney, ureter, bladder (KUB) films and intravenous urography (IVU).[5] Recent studies have incorporated computed tomography (CT) scans to enhance GSS accuracy by providing better details on stone characteristics and renal anatomy.[5] Vicentini et al.[6] validated the GSS's effectiveness using CT data, demonstrating improved prediction of surgical outcomes and complications.

In 2008, Tefekli et al.[7] investigated the severity of complications related to stone complexity but found no significant associations. Conversely, de la Rosette et al.[8] categorised renal stones by size (<1 cm, 1–2 cm, and >2 cm) and observed a significant link between stone size and surgery duration. Michel et al.[9] also reported a correlation between stone size and complications. In line with our findings, Mandal et al.[10] established an association between the GSS and stone-free rates (SFR). Our study's SFRs were consistent with the literature. For instance, Thomas et al.[11] reported GSS SFRs of 81%, 72.4%, 35%, and 29% for grades 1 through 4, respectively. Mandal et al. found SFRs of 100%, 96.9%, 100%, and 60% for these grades, while other studies reported 97.2%, 86.5%, 90.5%, and 74.5%, respectively.

Kirli et al.[12] assessed the GSS's effectiveness in predicting SFR and complication rates in children undergoing PCNL. They found a positive association between the GSS and SFR ($p = 0.02$) and concluded that the GSS was the only independent predictor of stone-free status.

Limitation: A notable limitation of this study is its single-center design and small sample size, particularly the limited number of patients with GSS grades 3 and 4. Only Guy's Stone Score (GSS) was utilized in this study based on an intravenous pyelogram (IVP) to predict the outcome, so it cannot be compared with other Stone Scores, which required a CAT scan.

Conclusion:
Results of the study have established the efficiency of the GSS in predicting the outcome of PCNL. Further studies will be encouraged based on the characteristics of renal anatomy and stones in all conditions. This kind of scoring can prove to be an effective tool in training residents who are learning the basics of PCNL.

Declarations
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