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Prediction of the Stone-Free Rates After Percutaneous Nephrolithotomy (PCNL) Using Guy's Stone Score

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ABSTRACT

INTRODUCTION: Percutaneous nephrolithotomy (PCNL) is a minimally invasive major operation to treat large renal calculi, but does not always render the patient stone-free. Currently, no standardized method is available to predict the stone-free rate after PCNL. This study will validate the use of Guy's stone score in predicting the stone-free rates after PCNL.

METHODS: Total 107 cases were studied from 1 May 2014 to 30 April 2016 who were diagnosed as a case of renal calculi and underwent PCNL. The Guy's stone score was independently applied to consecutive PCNL cases according to the preoperative imaging findings.

RESULTS: Mean age of cases considered for study purposes was 43.64 years. Multiple calculi were seen in 43.9%, while a staghorn calculus was seen in 16.8%. 70% of the cases were left stone free in with overall success rate (SR) of 85.98%. The SR for cases having Guy's score grade I is 100%, while it is 95.45% for grade II, 38.46 % for grade III and 28.5 % for grade IV.

CONCLUSION: Findings of the study reveals that as the Guys score grading increases the success rate decreases and the possibility of complications to be encountered increases. Guys score may improve the accuracy of preoperative counselling of the patient.

KEYWORDS: Renal calculi, PCNL, Guys stone score, stone free rate

INTRODUCTION

Percutaneous extraction of renal stone – properly termed percutaneous nephrolithotomy (PCNL) which was invented over three decades ago has become a standard, well established procedure for the treatment of renal stones.[1, 2, 3, 4] Indications and limitations of PCNL have been well established. The most important indication for treating renal stone disease is the large stone burden.[5, 6] PCNL is effective with overall stone free rates between 76–84% and even higher.[7] However, it continues to be one of the more challenging urological procedures, which if not performed well, can be associated with significant complications.[8, 9, 10] This study will evaluate the role PCNL in the management of renal calculi in our setup with respect to efficacy and attending complications.

Although PCNL is a minimally invasive major operation to treat large renal calculi, but does not always render the patient stone-free. Currently, no standardized method is available to predict the stone-free rate after PCNL. Aiming for a quick, simple and reproducible method for the prediction of the outcomes of PCNL, the 'Guy's stone score' has been proposed.[11] The score correlates with stone free rates but not with complications. The grading system mainly takes into consideration the number of stones, stone location and whether the renal anatomy is simple or abnormal. This study will validate the use of Guy's stone score in predicting the stone-free rates after PCNL.

METHODS: In this prospective study, total of 107 cases were studied from 1 May 2014 to 30 April 2016 who were diagnosed as a case of renal calculi and underwent PCNL. Each patient's medical chart reviewed to ascertain the history and examination findings, X-Ray and ultrasonography of KUB, intravenous urography (IVU), CT KUB (plain or contrast). All the patients were subjected to PCNL under strict aseptic measures. The Guy's stone score[11] (table I) was independently applied to consecutive PCNL cases according to the preoperative imaging findings. The procedure was performed in prone position under general anesthesia in a purpose built operating room with state of the art facilities of uroradiological imaging.

Intraoperative findings and immediate postoperative complications were noted. Success rate was defined as patients who were stone free or who were having clinically insignificant residual fragments (CIRF). The cut off point of 4 mm was used to define the size of CIRF. Patients were followed 1 month following the surgical procedure with X-ray and ultrasonography of KUB and requirement of any additional procedure was noted. DJ stent was removed after 30 days if no stone is visible.

The data was analyzed statistically using SPSS Statistical software (ver.22.0.0) and primer. All the Outcome variables i.e quantitative data were summarized in the form of Mean ± SD. Study results were statistically analysed by using appropriate statistical methods such as Cochrane test, pearson test. The differences between proportions were analyzed using Chi square test. The levels of significance and α - error were kept 95% and 5% respectively, for all statistical analyses. P values <0.05 were considered as statistically Significant (S).

Table I: Guy's stone score

Grade I	A solitary stone in the mid/lower pole with simple anatomy or A solitary stone in the pelvis with simple anatomy
Grade II	A solitary stone in the upper pole with simple anatomy or Multiple stones in a patient with simple anatomy or Any 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

RESULTS: Mean age of cases considered for the study purposes was 43.64 years with males comprising 60.7% while females were 39.3%. Multiple calculi were seen in 43.9% % while another 11.2%% had pelvic calculi. A staghorn calculus was seen in 16.8%. 40.2% of the cases had Guy's score grade I, while 41.1% had grade II, 12.1% had grade III and remaining 6.5% had grade IV (table II). Stone clearance was done in maximum number of cases through a single tract that is 78.5%. Additional tracts were made in 21.5%. 71% had postoperative fever while 12.1% had UTI. Haemorrhage was seen in 4%. One patient had sepsis while 4.67% had pulmonary complications in the form of hydrothorax. Urinary leak was noted in 4.6%. 70% of the cases were left stone free with overall success rate of 85.98%. Residual stone was seen in 14.01%. The SR for cases having Guy's score grade I is 100%, while it is 95.45% for grade II, 38.46 % for grade III and 28.5 % for grade IV (table III). It seems that as the guys score grading increases, the success rate decreases with a significant P value <0.05.

Table II – Distribution of cases according to the Guys score

Guys score	Frequency	Percent	Cumulative Percent
I	43	40.2	40.2
II	44	41.1	81.3
III	13	12.1	93.5
IV	7	6.5	100.0
Total	107	100.0	

Table III - Correlation of cases with Guys score and success rate

Guys score and Success rate (SR) Cross tabulation					
Yes		SR		Total	SR Percent
		No			
Guys score	I	43	0	43	100
	II	42	2	44	95.45
	III	5	8	13	38.46
	IV	2	5	7	28.5
Total		92	15	107	

DISCUSSION

Kidney stones are a common problem affecting all population groups across the globe. Percutaneous extraction of renal stone – properly termed percutaneous nephrolithotomy (PCNL) which was invented over three decades ago has become a standard, well established procedure for the management of renal stones.

Mean age of cases was 43.64 years. Muhammad et al did a study in September 2015 and found that most of the cases were around 40 yrs age group.[12] More number of cases was males that are 60.7% while females were 39.3%. Abdul et al did a similar study in 2014 and found that males predominated with male- female ratio 2.6: 1 (86: 33).[13] Multiple calculi was seen in 43.9% while another 11.2%% had pelvic calculi. A staghorn calculus was seen in 16.8% cases. Sarhad et al did a study in Islamabad and found that 30% of cases had a staghorn calculus, 45% were having pelvic calculi.[14] Stone clearance was done in maximum number of cases through a single tract that is 78.5%. Additional tracts were made in an attempt to clear the stones in 21.5%. Hegarty NJ et al did a study and concluded that monotherapy with PCNL utilizing multiple percutaneous tracts is highly effective in the treatment of staghorn calculus and other large-volume renal calculi.[15]

The main complications of PCNL are residual calculi, bleeding and renal perforation. Infectious complications related to PCNL are reported in up to 32.7%. In most of the cases it is limited to postoperative fever, despite antimicrobial prophylaxis, and it usually resolves with continuing antibiotics for 48 hours. Although rare, postoperative septicemia or severe sepsis can induce life-threatening situations.[7] 71% of the cases had postoperative fever while 12.1% had UTI. One patient had sepsis that was managed in the intensive care with higher antibiotics and supportive care. Haemorrhage was seen in 4% of our cases which was managed conservatively with blood transfusion. Entry through the pleural cavity may lead to an accumulation of fluid, causing hydrothorax, which occurred in 4.6% of patients as compared to the study conducted by R. Gupta et al where pleural injury was seen in 5% of the Patients.[16]

Both success rate and complication rate is important for determination of the surgical outcome of PCNL. Success rates can be easily assessed with a generally used < 4 mm cut off point to define CIRF and the sum of CIRF and stone free rates to define success rate.[17] 70% of the cases were left stone free while only 16 % were left with clinically insignificant residual fragments (CIRF). Overall success rate was 85.98%. Residual stone of varying size was seen in 14.01%. It was also noted that maximum residual stones were seen in cases having staghorn calculus and multiple calculi with a significant P value (<0.005). Aron et al in 2004 found that Stone clearance was seen in 72% patients.[18] It was observed that as the size of the stone increases, and as the complexity of the situation increases, the stone free rate decreases.[19, 20]

Several groups have attempted to identify significant predictors of the stone-free after PCNL and they have suggested stone size, number, location, and pelvicalyceal system anatomy as predictors.[21, 22] The scoring systems in contemporary use for predicting the outcome of PCNL are Guy's stone score, the STONE nephrolithometry score, the Clinical Research Office Of Endo-Urological Society (CROES) nephrolithometric nomogram, and staghorn morphometry. These have attempted to incorporate important variables in an efficient and simple manner to quantify renal stone complexity.[23]

A quick, simple and reproducible method which has a good correlation with the stone free rate (SFR) and the complication rates of PCNL will improve accuracy of the preoperative counselling of the patient. In the present study 40.2% of the cases had Guy's score grade I, while 41.1% had grade II, 12.1% had grade III and remaining 6.5% had grade IV. The SR for cases having Guy's score grade I is 100%, while it is 95.45% for grade II, 38.46 % for grade III and 28.5 % for grade IV. It seems that as the guys score grading increases, the success rate decreases with a significant P value <0.05.

Thomas et al have found that the Guy's stone score can accurately predict the SFR after PCNL.[11] In their study which they have described the development and validation of the scoring system, they have found that as the grade increases, the success decreases. Grade 1 stones had an 81%, grade 2: 72.4% grade 3: 35% and grade 4: 29% stone free rates. The overall success rate was 62% and complications were seen in 52% of the patients. Eğilmez T et al also found out that the overall success rate was 85% and Guy's stone score 1 and 2 showed a statistically significant correlation with success. Complication rate was 24% and Guy's stone scores 3 and 4 had statistically significant correlations with the complications.[24]

The standard method should be the one that has been most researched and tested, that can be safely applied under all circumstances, that consistently produces optimal and reproducible results, and of paramount importance, that can be taught and learnt easily. Refinements in techniques, improvement in equipment and increasing clinical experience have led to improved stone free rates being achieved with acceptably low patient morbidity.

CONCLUSION

Findings of the study reveals that as the Guys score grading increases, the success rate decreases and the possibility of complications to be encountered increases. Guys score may improve the accuracy of preoperative counselling of the patient. As experience is gained in percutaneous stone surgery there is continuous improvement in the success rate and a decrease in operating time, complication rate and hospital stay after treatment of renal calculi.

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