# Prediction of Surgical Outcome as Regards Stone Free Rate and Complications after Percutaneous Nephrolithotomy Using S. T. O. N. E. versus sResc Scoring Systems

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## Abstract

*Background:* Nephrolithiasis is a major worldwide source of morbidity, constituting a common urological disease affecting 10-15% of the world population.

*Aim of Study:* To compare the S.T.O.N.E versus sResc scoring system in prediction of the surgical outcome as regards stone free rate and complication after PCNL.

*Patients and Methods:* A prospective randomized clinical study conducted in Department of Urology, Faculty of Medicine, Ain Shams University Hospitals. Study period was 6 months from 3-2020 till 9-2020.

*Results:* STONE total score involved size, tract length, degree of obstruction, number of involved calyces and stone density. STONE score was $6.8 \pm 1.7$. S-ReSC total score was $3.1 \pm 1.6$. A significant statistical association between both scores was found ($\chi^2$: 119.681, $p < 0.001$). Mean STONE score was $6.19 \pm 1.20$ compared to $7.92 \pm 1.89$ in free and residual group of patients respectively ($t$: 4997; $p < 0.0001$). Mean S-ReSC score was $2.14 \pm 0.88$ compared to $4.76 \pm 1.30$ in free and residual group of patients respectively ($t$: 4997; $p < 0.0001$). Both scores were higher significantly in patients with residual stones. The ROC curve shows that the best cut off point for S-ReSC score to detect residual free rate was found $>2$ with sensitivity 100%, specificity 76.19% and Area Under Curve (AUC) 95% while the best cut off point for STONE score to detect residual free rate was found $>6$ with sensitivity 70.3%, specificity 68.3% and Area Under Curve (AUC) 76.4%.

*Conclusion:* Both S-ReSC and S.T.O.N.E Nephrolithometry Scores can be used to stratify the complexity of renal stone before PCNL to predict the stone clearance and complication.

*Key Words:* Stone free rate – PCNL – Nephrolithotomy – S. T. O. N. E – sResc.

## Introduction

**NEPHROLITHIASIS** is a major worldwide source of morbidity, constituting a common uro-

logical disease affecting 10-15% of the world population [1,2]. It is an expanding problem associated with major economic and health consequences. Consistent technical advancements provide surgeons and patients with several options for the treatment of renal calculi, including extracorporeal Shock Wave Lithotripsy (SWL), Percutaneous Nephrolithotomy (PCNL), Retrograde Intrarenal Surgery (RIRS), and conventional open surgery [3,4].

Percutaneous Nephrolithotomy (PCNL) is generally considered a gold standard in renal stones $>2$cm or lower calyceal $>1$cm offering high stone-free rates after the first treatment as compared to the other minimal invasive lithotripsy techniques. However, serious complications although rare should be expected following this percutaneous procedure [5].

Perioperative bleeding, urine leak from nephrocutaneous tract, pelvicalyceal system injury, and pain are individually confronted complications after PCNL. Thus a universally accepted scoring system for use in percutaneous management of nephrolithiasis such as; S.T.O.N.E. nephrolithometry score, and Renal Stone Complexity (S_ReSC) score have been described to enable appropriate counselling of patients, minimize adverse outcomes, and provide a means of standardized reporting of stone complexity and patient outcomes [6,7].

S.T.O.N.E. nephrolithometry score, usesnoncontrast-enhanced Computed Tomography (CT) scans parameters to describe and classify the most relevant features that affect the percutaneous management of renal calculi [8]. It represents five variables: Stone size, tract length, degree of obstruction, number of involved calyces, and stone

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essence (stone density). On the basis of these variables, a score of 5-13 can be calculated; a higher score correlates with higher stone complexity [9].

The S-ReSC scoring system is based solely on stone distribution within the collecting system and does not take into account any patient characteristic nor baseline renal anatomy [10]. They devised a 9-point system which is determined with preoperative CT, with 1 point assigned to 9 specific pelvic and calyceal locations. A score of 1 to 2 is considered low, 3 to 4 is medium, and ≥5 is high. The score is assigned by adding the cumulative sites involved [8].

### Patients and Methods

A prospective randomized clinical study conducted in Department of Urology, Faculty of Medicine, Ain Shams University Hospitals. Study period was 6 months.

*Inclusion criteria included:* Renal stone >2cm, lower calyceal stone >1cm, and previously failed ESWL to remove the stone. Exclusion criteria were associated congenital anomalies pelvi-calyceal system e.g. ectopic or malrotated kidney, co-morbidity interfering with prone position (morbid obesity, COBD), bleeding disorders/uncorrected coagulopathy, untreated UTI, renal tumors, pregnancy, access prevented by surrounding organs e.g. splenomegaly or by the bowelor patients unfit for general anesthesia.

All patients candidates for PCNL were evaluated for S.T.O.N.E. score as well as S-Resc score before undergoing PCNL.

Pre-operative evaluation included comprehensive medical and surgical history from all patients included in our study, full pre-operative laboratory tests including CBC, PT, PTT, INR serum creatinine, ALT, sodium, potassium, pre-operative KUB will be done, and pre-operative NCCT will be performed. S.T.O.N.E and sResc scoring system were calculated for each case.

Operative evaluation included operative time, need for intraoperative blood transfusion, any cardiovascular complication, any related operative complication e.g. perforation of the renal collecting system, colonic injury, intraoperative bleeding.

Post-operative evaluation included post-operative change in hemoglobin and hematocrit value and need for blood transfusion, post-operative radiological evaluation will be done using KUB and/or CT to determine stone free rate, duration of hospital stay, and post-operative related complications e.g. post-operative fever, need for blood transfusion, urinary leakage and its grading according to ClavienDindo.

*Statistical analysis:*

Data were computed and analyzed using IBM SPSS software package version 20.0. (Armonk, NY: IBM Corp) Qualitative data were described using number and percent. Chi-square testwas used for categorical variables, to compare between different groups. Wilcoxon signed ranks testfor abnormally distributed quantitative variables, to compare between two periods. Student *t*-test for normally distributed quantitative variables, to compare between two studied groups. Mann Whitney testfor abnormally distributed quantitative variables, to compare between two studied groups.

### Results

In our study 100 PCNL procedures were done. All were done in prone position with a mean age of 43.8±11.7 (range from 20 to 66) and BMI of 29.3±2.4 (range from 23 to 35). The study included 42 females and 58 males Fig. (1).
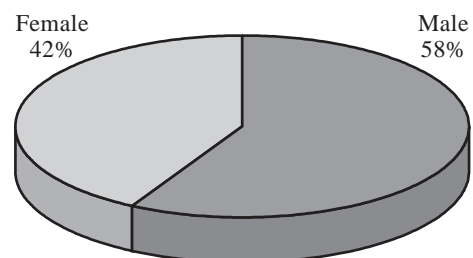


Fig. (1): Gender distribution.

As regards the past medical history 67 patients were medically free, whereas 33 patients had history of associated comorbidities (Table 1).

Table (1): Associated comorbidities.

|  | N | % |
|---|---|---|
| *DM:* | | |
| Not diabetic | 80.0 | 80.0 |
| Diabetic | 20.0 | 20.0 |
| *HTN:* | | |
| Not hypertensive | 84.0 | 84.0 |
| HTN | 16.0 | 16.0 |
| *Cardiac:* | | |
| Not cardiac | 93.0 | 93.0 |
| Cardiac | 7.0 | 7.0 |
| *Previous surgery:* | | |
| No | 73.0 | 73.0 |
| Yes | 27.0 | 27.0 |

Diabetes mellitus was found in 20 patients 16 patients were receiving anti-hypertensive medications and 7 patients were cardiac. 27 patients had previous surgical interventions.

Stonerelated factors included stone side; 51 patients had left side stones; 48 patient had right side stones. Pelvicalycial stone were the majority, reaching 80% of the patients. Pelvic stones were found in 10 patients and Calyceal stones in 10 patients Fig. (2).
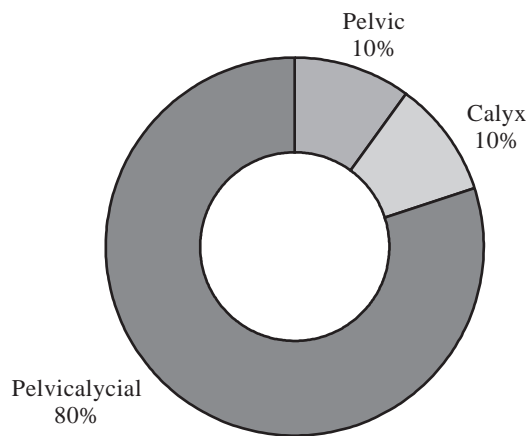


Fig. (2): Stone location.

Majority (47%) of patients had stone size <400mm$^2$. Stonesize was 526.4±338.1 (mean ± SD) with range of 120-1674mm$^2$ (Table 2).

Table (2): Stone size.

| Size (mm$^2$) | Count | % |
|---|---|---|
| <400 | 47 | 47.0 |
| 400-799 | 33 | 33.0 |
| 800-1199 | 14 | 14.0 |
| ≥1200 | 6 | 6.0 |

Stone density was as the following, 53 patients had stone essence between 500-999HU, 33 patients had stone essence ≥1000HU. Stone density was 841.9±313.9 (mean ± SD) with range of 320-1546 HU (Table 3).

Table (3): Stone density.

| Density | Count | % |
|---|---|---|
| <500 | 14 | 14.0 |
| 500-999 | 53 | 53.0 |
| 1000-1499 | 30 | 30.0 |
| ≥1500 | 3 | 3.0 |

Tract length was 99±5.2 (mean ± SD) with range of 80-12mm. Degree of obstruction and number of involved calyces were shown in (Table 4).

Table (4): Degree of obstruction and involved calyces.

| | N | % |
|---|---|---|
| *Degree of obstruction:* | | |
| Nil | 10.0 | 10.0 |
| Minimal | 2.0 | 2.0 |
| Mild | 69.0 | 69.0 |
| Moderate | 15.0 | 15.0 |
| Marked | 3.0 | 3.0 |
| Severe | 1.0 | 1.0 |
| *Number of involved calyces:* | | |
| 1. | 16.0 | 16.0 |
| 2. | 45.0 | 45.0 |
| 3. | 25.0 | 25.0 |
| Stag horn | 14.0 | 14.0 |

During radiological evaluation all patients had element of obstruction ranging from minimal in 2 patients, moderate to severe hydronephrosis in 19 patients. Mild hydronephrosis presented in 69% of the patients.

STONE total score involved size, tract length, degree of obstruction, number of involved calyces and stone density. STONE score was 6.8±1.7 with minimum of 5.0 and maximum of 11.0. Majority of STONE grade (53%) of the included cases was low grade and 20% were high grade. S-ReSC total score was 3.1±1.6 with minimum of 1 and maximum of 7. S-ReSC Grade was as the following: Majority (48%) of the included cases was low grade and 21% were high grade. To investigate the agreement between both scores, we have done chi-square test. It shows a significant statistical association between both scores ($\chi^2$: 119.681, $p<0.001$) (Table 5).

Table (5): STONE and S-ReSC relation.

| Stone | S-ReSC total | | | | | | | Total |
|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | |
| 5 | 10 | 11 | 3 | 2 | 0 | 0 | 0 | 26 |
| 6 | 3 | 15 | 6 | 4 | 0 | 0 | 0 | 28 |
| 7 | 0 | 7 | 3 | 3 | 2 | 0 | 0 | 15 |
| 8 | 0 | 2 | 4 | 4 | 1 | 0 | 1 | 12 |
| 9 | 0 | 0 | 0 | 1 | 3 | 3 | 2 | 9 |
| 10 | 0 | 0 | 0 | 1 | 4 | 2 | 0 | 7 |
| 11 | 0 | 0 | 0 | 0 | 0 | 2 | 1 | 3 |
| Total | 13 | 35 | 16 | 15 | 10 | 7 | 4 | 100 |

Operative time was 50.2±19.7 minutes with minimum of 20 and maximum of 100 minutes. It was estimated from the moment of skin puncturing, so the time consumed in anesthesia, ureteral catheter placement and patient positioning was not considered. The mean operative time was 50.2 (±19.7) min. with a range (20-100) min. Hb was decreased significantly from 14.6 to 12.4 post-operatively.

Intra op complications included bleeding (in any quantity) occurred in all cases. Perforation occurred in 32%, colonic injury in 1%, CV events in 1% and 39% needed DJ (Table 6).

Table (6): Intra op complications.

| Intra operative complications | N | % |
|---|---|---|
| *Bleeding:* | | |
| No | 0.0 | 0.0 |
| Yes | 100.0 | 100.0 |
| *Perforation:* | | |
| No | 68.0 | 68.0 |
| Yes | 32.0 | 32.0 |
| *Colonic injury:* | | |
| No | 99.0 | 99.0 |
| Yes | 1.0 | 1.0 |
| *CV event:* | | |
| No | 99.0 | 99.0 |
| Yes | 1.0 | 1.0 |
| *Need DJ:* | | |
| No | 61.0 | 61.0 |
| Yes | 39.0 | 39.0 |

The hospital stay mean time was 2.51±1.47 and range of 1-5 days. Post-operative complications included blood transfusion which was needed in only 3%. Fever occurred in 20%. Leakage in 38%. Hematuria in 40% and distal obstruction in 15% of the study patients. Regarding stone free rate, 63% were stone free and 37% had residuals Fig. (3).
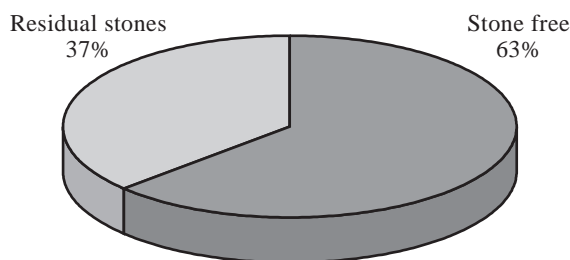
Fig. (3): Stone free rate.

Pelvicalycial stone free rate was 76.2%, pelvic 15.9% and calyceal in 7.9%. This distribution was statistically significant ($\chi^2$: 6.907, *p*:0.032). Mean STONE score was 6.19±1.20 compared to 7.92± 1.89 in free and residual group of patients respectively (*t*: 4997; *p*<0.0001). Mean S-ReSC score was 2.14±0.88 compared to 4.76±1.30 in free and residual group of patients respectively (*t*: 4997; *p*<0.0001). Both scores were higher significantly in patients with residual stones.

The ROC curve shows that the best cut off point for S-ReSC score to detect residual free rate was found >2 with sensitivity 100%, specificity 76.19% and Area Under Curve (AUC) 95% while the best cut off point for STONE score to detect residual free rate was found >6 with sensitivity 70.3%, specificity 68.3% and Area Under Curve (AUC) 76.4% Fig. (4), (Table 7).

Table (7): Relation between stone free rate and location of the stone.

| Location | Free | | Residual stones | | $\chi^2$ | *p* |
|---|---|---|---|---|---|---|
| | N | % | N | % | | |
| Pelvic | 10 | 15.9 | 0 | 0.0 | 6.907 | 0.032 |
| Calyx | 5 | 7.9 | 5 | 13.5 | | |
| Pelvicalycial | 48 | 76.2 | 32 | 86.5 | | |

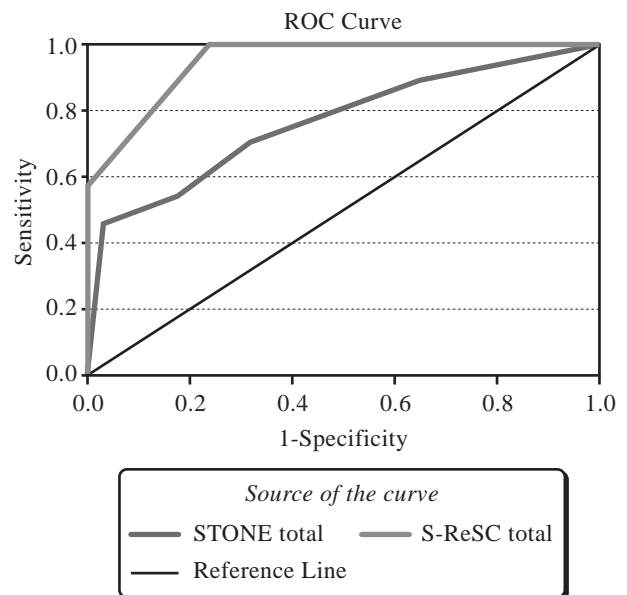| Score | Free | | Residual stones | | *t* | *p* |
|---|---|---|---|---|---|---|
| | Mean | SD | Mean | SD | | |
| STONE | 6.19 | 1.20 | 7.92 | 1.89 | 4.997 | <0.0001 |
| S-ReSC | 2.14 | 0.88 | 4.76 | 1.30 | 10.866 | <0.0001 |

Fig. (4): Receiver Operating Characteristic (ROC) curve for S-ReSC score and STONE score as a predictor for residual stone.

## Discussion

Percutaneous Nephrolithotomy (PCNL) is generally considered a gold standard in renal stones >2cm or lower calyceal >1cm offering high stone-

free rates after the first treatment as compared to the other minimal invasive lithotripsy techniques. However, serious complications although rare should be expected following this percutaneous procedure [5].

In our study 100 PCNL procedures with a mean age of 43.8±11.7 (range from 20 to 66). The study included 42 females and 58 males. As regards the past medical history 67 patients were medically free, whereas 33 patients had history of associated comorbidities.

Diabetes mellitus was found in 20 patients 16 patients were receiving anti-hypertensive medications and 7 patients were cardiac. 27 patients had previous surgical interventions. Pelvicalycial stone were the majority, reaching 80% of the patients. Pelvic stones were found in 10 patients and Calyceal stones in 10 patients.

Majority (47%) of patients had stone size <400mm$^2$. Stonesize was 526.4±338.1 (mean ± SD) with range of 120-1674mm$^2$. 53 patients had stone essence between 500-999HU, 33 patients had stone essence ≥1000HU. Stone density was 841.9±313.9 (mean ± SD) with range of 320-1546 HU. Tract length was 99±5.2 (mean ± SD) with range of 80-12mm.

During radiological evaluation, all patients had element of obstruction ranging from minimal in 2 patients, moderate to severe hydronephrosis in 19 patients. Mild hydronephrosis presented in 69% of the patients.

STONE total score involved size, tract length, degree of obstruction, number of involved calyces and stone density. STONE score was 6.8±1.7 with minimum of 5.0 and maximum of 11.0. S-ReSC total score was 3.1±1.6 with minimum of 1 and maximum of 7.

In our study, operative time was 50.2±19.7 minutes with minimum of 20 and maximum of 100 minutes. It was estimated from the moment of skin puncturing, so the time consumed in anesthesia, ureteral catheter placement and patient positioning was not considered. This was relatively less than other series with a mean operative times 60.3min., 74min by Rathee and his colleague, and Sujeet Poudyal and his colleagues respectively [11].

In a study done by Kumar and his colleagues they observed that for every unit of increase in STONE score, the operative time increased by 8.1min (*p*<0.001). In our study, the hospital stay mean was 2.51±1.47 and range of 1-5 days. The

length of stay in Kumar et al., study increased by 0.58 days (*p*=0.001) for every unit of rise in STONE score [2]. Bleeding (in any quantity) occurred in all cases. Perforation occurred in 32%, colonic injury in 1%, CV events in 1% and 39% needed DJ. Blood transfusion was needed in only 3%. Fever occurred in 20%. Leakage in 38%. Hematuria in 40% and distal obstruction in 15% of the study patients.

In our study the complication rate was 25% the most common post-operative complication was fever. Our results were compatible with El-Nahas and his colleagues, whom they recorded complication rate of 22% and were not comparable with Resorlu and his colleagues, whom they recorded complication rate of 55% [12]. El-Nahas et al., 2012 study on 251 patients recorded rate of 27%. Variability in the perioperative complication rates with other series referred to stone complexity, number of procedures done, surgeon experience and the patients' co-morbidities [12].

In our study we found correlation between our results and study done by Poudyal and his colleagues where the complication rate was 27.9% with the most common complication fever and a study done by Kumar and his colleagues where the complication rate was 22.92% and the most common complication was fever [2]. We found a correlation between the calculated scores with the perioperative complications. The rate of complications increases with the increase in the calculated scores as indicated by the previous studies.

Regarding stone free rate, 63% were stone free and 37% had residuals. Pelvicalycial stone free rate was 76.2%, pelvic 15.9% and calyceal in 7.9%. This distribution was statistically significant ($\chi^2$: 6.907, *p*:0.032). Our stone free rate is comparable to ratios published in Shin et al., 2011 which was 69.9% and Huang et al., 2005 which was 74.4% [13,14]. Other series showed stone free rate of 87%, 84%, 89.2% and 83% [15-17] while lower values were shown 56% and 49% by (El-Nahas et al., 2012 and Al-kohlany et al., 2005) respectively [12,18]. The difference in our stone rate with the other studies may be attributed to the higher stone burden in their studies than in ours.

STONE total score involved size, tract length, degree of obstruction, number of involved calyces, and stone density. STONE score in our study was 6.8±1.7 with minimum of 5.0 and maximum of 11.0. Majority 53% of the included cases was low grade and 20% were high grade. S-ReSC total score was 3.1±1.6 with minimum of 1 and maxi-

mum of 7. Majority (48%) of the included cases was low grade and 21% were high grade. Mean STONE score was 6.19±1.20 compared to 7.92± 1.89 in free and residual group of patients respectively (*t*: 4997; *p*<0.0001). Mean S-ReSC score was 2.14±0.88 compared to 4.76±1.30 in free and residual group of patients respectively (*t*: 4997; *p*<0.0001). Both scores were higher significantly in patients with residual stones.

In our study, the best cut off point for S-ReSC score to detect residual free rate was found >2 with sensitivity 100%, specificity 76.19% and Area Under Curve (AUC) 95% while the best cut off point for STONE score to detect residual free rate was found >6 with sensitivity 70.3%, specificity 68.3% and Area Under Curve (AUC) 76.4%. There are few studies comparing S-ReSC and S.T.O.N.E score in predicting the outcome of PCNL. Yarimoglu andcolleagues study reported mean S.T.O.N.E and S-ReSC scores of 9.7±1.6 and 6.2±2.0 respectively. The overall stone-free rate was 59%. Both scoring systems were significantly correlated with stone-free status in univariate analysis. S-ReSC score was the only significant independent predictor in multivariate analysis. Their study demonstrated that S-ReSC scoring system could effectively predict post-operative stone-free status for staghorn stones. However, both scoring systems failed to predict complication rates [19].

A recent retrospective study by Al Adl et al., on 162 PCNLs reported SFR was 75.9% and complication rate was 30.9%. The mean acquisition time of scores was 05.1±0.3 seconds for S.T.O.N.E. score and 102.6±3.5 seconds for S-ReSC score. Moreover, Operative Time (OT), Estimated Blood Loss (EBL) had best association with S-ReSC score [20]. All Al Adl et al., reported that all scores had comparable predictive accuracy on ROC curves regarding SFR. Stone essence and tract length are not different in cases with residual stones. Number of involved calyces, single vs multiple stones and renal pelvic obstruction were significant predictors of SFR in regression analysis [20].

A total of 157 PCNLs were reviewed by Bibi et al. The overall stone-free rate was 59% (92/157) with a complication rate of 22% (35/157). Stone Burden <542mm³ is significantly associated with Stone-Free Rate (SFR) (*p*=0.001). On univariate analysis, all the scoring systems were identified as significant factors in terms of SFR. S-ReSC score was associated with complications (*p*<0.02) [21]. The initial stone-free and complication rates after TPCNL were 78.7 (111/141) and 17.0%

(24/141) in Choi et al., study. On univariate analysis, all scoring systems were identified as significant factors in terms of Stone-Free Rate (SFR) [22]. The area under the Receiver Operating Characteristic (ROC) curves for the S.T.O.N.E score and stone burden showed good results which was 0.816 [22].

ClevienDindo classification involving need for transfusion, fever and leakage. 65% of the included patients had no complications. The other 35 patients had different degrees of complications as shown in table. By running statistical analysis to find relation between mean of S-ReSC and STONE between different grades of ClevienDindo classification, no significant difference was found (*p*>0.05). In Al Adl et al., study, Clavien grade was associated with S.T.O.N.E. score. They also concluded that S.T.O.N.E. and S-ReSC scores were easily applicable and provided better association with blood loss and operative time [20]. The relatively small number of patients involved was a main limitation factor that would have influenced the confidence of statistical analysis of our data.

*Conclusion:*

Both S-ReSC and S.T.O.N.E Nephrolithometry Scores can be used to stratify the complexity of renal stone before PCNL to predict the stone clearance and complication. Both can be valuable tools for providing uniformity for comparison of outcome, proper planning of the surgery and preoperative counseling of the patient.

*Conflicts of interest:* No conflicts of interest were found.

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# التنبؤ بالنتائج الجراحية فيما يتعلق بمعدل الخلو من الحصوات والمضاعفات
# بعد إستخراج حصوات الكلى عن طريق منظار الكلى
# بإستخدام مقياس S.T.O.N.E
# مقابل مقياس حصوات الكلى المتكامل SReSC

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تعد حصوات الكلى مصدر رئيسى للآمراض على مستوى العالم، كما يعتبر من آشهر آمراض المسالك البولية التى تؤثر على ١٠–١٥٪ من سكان العالم. كما يعتبر مشكلة متنامية مرتبطة بعواقب إقتصادية وصحية كبير.

وتوفر التطورات التقنية للجراحين والمرضى العديد من الخيارات لعلاج الحصوات الكلوية، بما فى ذلك التفتيت بالموجات التصادمية (ESWL)، وإستخراج الحصوات بمنظار الكلى (PCNL)، وإستخراج حصوات الكلى عن طريق منظار الحالب المرن، والجراحة التقليدية.

ويعتبر إستخراج الحصوات عن طريق المنظار (PCNL) آفضل طريقة لعلاج حصوات الكلى آكبر من ٢سم آو آكبر من ١سم فى كآس الكلى السفلى فهى تقدم معدلات عالية خالية من الحصوات بعد العلاج الآول بالمقارنة مع التقنيات الآخرى... وعلى الرغم من هذا فقد تؤدى إلى مضاعفات خطيرة يجب توقعها بعد إستخراج الحصوات بهذه الطريقة... مثل النزيف بعد آو آثناء الجراحة وتسرب البول وإصابة القولون.

لذا فقد تم وصف معايير مقبوله عالمياً مثل مقياس ستون S.T.O.N.E ومقياس حصوات الكلى المتكامل S-ReSC وذلك لإستخدامها فى تقيم إستخراج الحصوات عن طريق منظار الكلى لتمكين المشورة المناسبة للمرضى، وتقليل النتائج السلبية، وتوفير وسيلة موحدة لتسجيل نتائج المريض.

إن مقياس ستون S.T.O.N.E. يحسب المعلومات الموجودة فى فحوصات التصوير المقطعى لوصف وتصنيف آكثر المعلومات ذات الصلة التى تؤثر على إستخراج الحصوات عن طريق منظار الكلى PCNL حيث آنه يمثل خمس متغيرات والتى تشمل حجم الحصى، طول مسار منظار الكلى، درجة تضخم الكلى، عدد كؤوس الكلى المعنية، وكثافة الحصوة. وعلى آساس هذه المتغيرات، يمكن حساب درجة ٥–١٣ وكلما إرتفعت درجة المقياس كلما قلت نسبة خلو الكلى من الحصوات بعد العملية وزادت نسبة المضاعفات.

كما يعتمد مقياس حصوات الكلى المتكامل S-ReSC فقط على توزيع الحصى داخل الكلى ولا يآخذ بعين الإعتبار آى خصائص للمريض آو آى صفات تشريحية للكلى. لقد وضعوا نظاماً من ٩ نقاط يتم تحديده عن طريق الآشعة المقطعية قبل الجراحة، مع تعيين نقطة واحدة إلى ٩ مواقع محددة لحوض وكؤوس الكلى. تعتبر النتيجة من ١ إلى ٢ منخفضة، ومن ٣ إلى ٤ متوسطة، وآكثر من ٥ عالية. ويتم تعيين النتيجة عن طريق إضافة المواقع التراكمية المعنية.

وبناء عليه تهدف هذه الدراسة إلى مقارنة القيمة التنبؤية لمقياس S.T.O.N.E مقابل مقياس الكلى المتكامل S-ReSC فيما يتعلق منسبة الخلو من الحصوات بعد عملية إستخراج الحصوات عن طريق منظار الكلى ... والتنبؤ بحدوث المضاعفات آثناء آو بعد العملية.