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TO COMPARE THE DIAGNOSTIC ACCURACY OF STONE SCORE AND CHOKAI SCORE IN PREDICTING THE PROBABILITY OF URETERAL STONES IN PATIENTS PRESENTING WITH FLANK PAIN BY TAKING CT SCAN AS A GOLD STANDARD IN EMERGENCY DEPARTMENT

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Abstract:

Introduction: *Ureteric colic (also known as renal colic) is a common reason for presentation to emergency departments (ED). Stone formation in the urinary tract affects about 5–10% of the population in industrialized countries and ureteric colic accounts for approximately 0.6% of total ED visits.*

Objective: *To compare the diagnostic accuracy of STONE score and CHOKAI score in predicting the probability of ureteral stones in patients presenting with flank pain by taking CT Scan as a gold standard in emergency department.*

Study Settings: *Emergency Department, Sindh Institute of Urology & Transplant (SIUT).*

Duration: *17 Jan, 2019 to 16 July, 2019.*

Study Design: *This was a Cross Sectional study.*

Subject and Methods: *After including the patients in study, patients were divided in to two groups through lottery method. Patients in Group A were subjected to STONE score and patients in Group B were subjected to CHOKAI score. Patients having STONE score >8 were labeled as having ureteral stones. While for CHOKAI score, a score of >6 were used to label the ureteral stones. All the study patients underwent CT scanning for confirmation of diagnosis of ureteral stones.*

RESULTS: *As per findings on Chokai Score, 64 (18.23%) patients had ureteric stones. As per findings on stone score, 40 (11.36%) patients had ureteric stones. As per findings on CT Scan, 80 (22.79%) were dignosed for ureteric stones. As per diagnostic accuracy of chokai score, sensitivity was 44.44%, specificity was 48.57%, PPV was 18.23%, NPV was 77.21% and accuracy was 47.72%. As per diagnostic accuracy of stone score, sensitivity was 33.33%, specificity was 46.56%, PPV was 11.40%, NPV was 77.21% and accuracy was 44.30%.*

CONLCUSION: *As per our results, we have come to the conclusion that the use of the STONE clinical score validates patients as low, moderate, and high risk for ureteral stone.*

Key Words: *Ureteric Colic, Chokai Score, Stone Score, CT Scan*

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INTRODUCTION:

Ureteric colic (also known as renal colic) is a common reason for presentation to emergency departments (ED). [1] Stone formation in the urinary tract affects about 5–10% of the population in industrialized countries1 and ureteric colic accounts for approximately 0.6% of total ED visits. [2] Ureter stones featuring acute flank pain and hematuria are commonly encountered in the emergency department (ED). Non-contrast helical computed tomography (CT) is often used to diagnose ureteral stones because of its high sensitivity and specificity. [3] The usage of diagnostic CT for patients with suspected ureteral stones increased about 10 times from1996 to 2007 without an associated change in the proportion of diagnosis of ureteral stones. [4] In addition, ureteral stones often recur; therefore, serial and cumulative radiation exposure and a consequent risk of cancer fromdiagnostic CT are of concern, especially in young patients who are more radiosensitive. [5]

Recently in 2017, Fukuhara et al. developed a new scoring system CHOKAI score. These authors have concluded that CHOKAI score is better than STONE score in predicting the probability of ureteral stones. The CHOKAI score also has 0-13 score and score >6 is a cut off value for prediction of ureteral stones [6,7]. On CT scan the authors found frequency of ureteral stones in 98.6% patients with CHOKAI score >6 and in 95.6% patients with STONE score >8. [8] The authors concluded that CHOKAI score is better than STONE score in predicting the probability of ureteral stone disease. To our best knowledge only one study has been conducted on valuation of CHOKAI score and has done its comparison with STONE score. The aim of the proposed study is to compare the effectiveness of CHOKAI score with STONE score in predicting the probability of ureteral stones in patients presenting with flank pain in emergency department of Sindh Institute of Urology and Transplantation (SIUT) Karachi. This study will help us to determine which score is better either STONE or CHOKAI score. This will help us to select a better scoring system in future in determining the probability of ureteral stones in patients presenting with flank pain.

MATERIAL AND METHODS:

STUDY DESIGN: cross sectional study.

SETTING: Department of Urology, Sindh Institute of Urology and Transplantation (SIUT) Karachi.

DURATION OF STUDY: 17 Jan, 2019 to 16 July, 2019.

SAMPLE SIZE:

Sample size is 351 patients. By using sample size calculator for sensitivity andspecificity taking values for sensitivity82.3%[8], Specificity 82.47%[8], margin of error forsensitivity is10% and specificity 4.3% and prevalence of disease is 16% calculatedsample size came out 351.

SAMPLING TECHNIQUE: Non probability, Consecutive sampling

SAMPLE SELECTION:

Inclusion criteria:

- Patients presenting in the emergency department chiefly complaining of back, flank, or lower abdominal pain from atleast 2 days.
- Patients having age >20 years to 75 years.
- Both male and female patients.

Exclusion Criteria:

- Patients with active malignancy.
- Patients with abnormal vital signs (subjective or objective fever or hypotension).

DATA COLLECTION PROCEDURE:

After approval from the research evaluation unit of College of Physicians and Surgeons of Pakistan (CPSP), patients who were presented in emergency department of Sindh Institute of Urology and Transplantation with complain of back, flank or abdominal pain was included in this study until a sample size of 351 patients were completed. Informed consent was taken from all patients before including them in this study. All patients were informed regarding study protocols and outcomes before including them in study.

DATA ANALYSIS PROCEDURE:

Data analysis was carried out by using SPSS v23.0. Mean and standard deviations were calculated for quantitative variables like age and duration of pain and categorical variables like gender and findings on CHOKAI score and STONE score and CT scan. 2x2 tables were used to calculate Sensitivity, specificity, positive predictive Value, negative predictive value and diagnostic accuracy for STONE score and CHOKAI score by taking CT scan as gold standard. Stratification with respect to age, gender and duration of pain was addressed. Post-stratification 2x2 table was used to calculate sensitivity, specificity, positive predictive Value, negative predictive value and diagnostic accuracy for STONE score and CHOKAIscore by taking CT scan as gold standard.

RESULTS:

As per descriptive statistics, mean and SDs for age was 54+15.50. Mean and SDs for duration of pain was 3+0.71. (Table No. 1). As per age groups, 100 (28.49%) patients were recorded in 20-35 years age group. 113 (32.19%) patients were recorded in 36-50 years age group. 138 (39.31%) patients were recorded as 51-75 years age group. (Table No. 2). As per gender groups, 257 (73.21%) patients were recorded as male patients, 94 (26.78%) patients were recorded as female patients. (Table No. 3). As per findings on Chokai Score, 64 (18.23%) patients had ureteric stones. (Table No. 4). As per findings on stone score, 40 (11.36%) patients had ureteric stones. (Table No. 5). As per findings on CT Scan, 80 (22.79%) were dignosed for ureteric stones. (Table No. 6). As per diagnostic accuracy of chokai score, sensitivity was 44.44%, specificity was 48.57%, PPV was 18.23%, NPV was 77.21% and accuracy was 47.72%. As per diagnostic accuracy of stone score, sensitivity was 33.33%, specificity was 46.56%, PPV was 11.40%, NPV was 77.21% and accuracy was 44.30%.

TABLE 1: Stratification of findings on chokai score with respect to age (n=351)

Age	Findings on Chokai Score	Findings on CT Scan		Total	Statistics
		Positive	Negative		
20-35 Years	Positive	26	74	100	Sensitivity=52% Specificity=50.67% PPV=26.00% NPV=76% Accuracy=51%
	Negative	24	76	100	
36-50 Years	Positive	10	103	113	Sensitivity=29.41% Specificity=46.35% PPV=8.85% NPV=78.76% Accuracy=43.81%
	Negative	24	89	113	
51-70 Years	Positive	13	125	138	Sensitivity=28.89% Specificity=45.89% PPV=9.42% NPV=76.81% Accuracy=43.12%
	Negative	32	106	138	

TABLE 2: Stratification of findings on chokai score with respect to gender (n=351)

Gender	Findings on Chokai Score	Findings on CT Scan		Total	Statistics
		Positive	Negative		
Male	Positive	47	210	257	Sensitivity=43.93% Specificity=48.40% PPV=18.29% NPV=76.75% Accuracy=47.7%
	Negative	60	197	257	
Female	Positive	20	74	94	Sensitivity=54.05% Specificity=50.99% PPV=21.28% NPV=81.69% Accuracy=51.60%
	Negative	17	77	94	

TABLE 3: Stratification of findings on chokai score with respect to duration of pain (n=351)

Duration of Pain	Findings on Chokai Score	Findings on CT Scan		Total	Statistics
		Positive	Negative		
≤ 2 Days	Positive	28	143	171	Sensitivity=41.79% Specificity=48% PPV=16.37% NPV=77.19% Accuracy=46.78%
	Negative	39	132	171	
> 2 Days	Positive	36	144	180	Sensitivity=46.75% Specificity=49.12% PPV=20% NPV=77.22% Accuracy=48.61%
	Negative	41	139	180	

TABLE 4: Stratification of findings on stone score with respect to age (n=351)

Age	Findings on Stone Score	Findings on CT Scan		Total	Statistics
		Positive	Negative		
20-35 Years	Positive	14	86	100	Sensitivity=36.84% Specificity=46.91% PPV=14% NPV=76% Accuracy=45%
	Negative	24	76	100	
36-50 Years	Positive	10	103	113	Sensitivity=29.41% Specificity=46.35% PPV=8.85% NPV=78.76% Accuracy=43.81%
	Negative	24	89	113	
51-70 Years	Positive	15	123	138	Sensitivity=31.91% Specificity=45.69% PPV=10.64% NPV=76.81% Accuracy=43.37%
	Negative	32	106	138	

TABLE 5: Stratification of findings on stone score with respect to gender (n=351)

Gender	Findings on Stone Score	Findings on CT Scan		Total	Statistics
		Positive	Negative		
Male	Positive	47	210	257	Sensitivity=43.93% Specificity=48.40% PPV=18.29% NPV=76.75% Accuracy=47.7%
	Negative	60	197	257	
Female	Positive	08	86	94	Sensitivity=28.57% Specificity=46.25% PPV=8.51% NPV=78.72% Accuracy=43.32%
	Negative	20	74	94	

TABLE 6: Stratification of findings on stone score with respect to duration of pain (n=351)

Duration of Pain	Findings on Stone Score	Findings on CT Scan		Total	Statistics
		Positive	Negative		
≤ 2 Days	Positive	25	146	171	Sensitivity=39.06% Specificity=47.8% PPV=14.62% NPV=77.19% Accuracy=45.91%
	Negative	39	132	171	
> 2 Days	Positive	14	166	180	Sensitivity=25.45% Specificity=45.57% PPV=7.78% NPV=77.22% Accuracy=42.50%
	Negative	41	139	180	

DISCUSSION:

In the present study, the following valuable findings were observed. First, the CHOKAI score simplified with integer coefficients proved to be a useful screening tool for predicting ureteral stones and excluding alternative causes of renal colic. Second, the optimal cut-off value for Japanese patients in the STONE scoring system would be 8 points. Third, the diagnostic performance of the simplified CHOKAI score was superior to that of the STONE score with the optimal cut-off in our cohort. To date, four papers (one original study and three external validation studies) have reported the diagnostic performance of the STONE score; however, none of them achieved both an LR+ of N10 and an LR− of b0.1 [9,12]. In our study, the STONE score also did not achieve an LR+ of N10 and LR− of b0.1, and its diagnostic performance at the optimal cut-off value of 8 was LR+ of 4.662 (95% CI, 1.661–13.09) and LR− of 0.215 (95% CI, 0.127–0.363). Generally, an LR+ of N10 and LR− of b0.1 are considered to provide strong evidence with which to rule out a diagnosis or not to rule out [13]. In contrast, the CHOKAI score fulfilled this condition, achieving an LR+ of 15.49 (95% CI, 2.31– 103.9) and an LR− of 0.049 (95% CI, 0.046–0.193) at the optimal cutoff value of 6, though both 95% CIs in the CHOKAI score crossed these thresholds of LR+ N10 and LR− b0.1. These results strongly support that the simplified CHOKAI score should be a screening model for Japanese patients with suspected ureteral stones. The optimal cut-off of the STONE score for our cohort was 8 in the present study. In the original study by Moore et al. patients are classified into three risk groups based on the STONE score: low probability (score of 0–5), moderate probability (score of 6–9), and high probability (score of 10–13), with the cut-off point at which ureteral stones were ruled in and out being a score of 6 [14]. The optimal cut-off value may need to be changed in countries or geographical areas in which the racial factor is minimal when using the STONE score. In a study by Schoenfeld et al. in which patients of African ancestry constituted only 6.9% of all the patients, the optimal cut-off value of the STONE score was set to be 8. It is generally well known that ureterolithiasis is one of the most common diseases in urology and has been growing in number worldwide. Ureterolithiasis has multifactorial and heterogeneous etiologies. Race, sex, body weight, body mass index, diet, volume of fluid intake, geographic localization, and climate changes are considered to contribute collaboratively to stone pathogenesis [10]. However, each of the causative factors might well contribute variably from country to country. In fact, the odds ratio of each of the four predictive factors (duration of pain, occult blood in urine, sex, and gastrointestinal symptoms), which are common between the CHOKAI and STONE scores, was different [11]. We must emphasize that our study sample may be more homogenous than the patient populations encountered in other settings. For example, none of the patients in our study sample were of African ancestry. In this context, the CHOKAI score, whether original or simplified, might not always hold true outside of Japan. Strictly speaking, such criticism could be applicable to any predictive models that have been developed based on a certain group of patients. Though the diagnostic performance of the CHOKAI score outperformed that of the STONE score in this study, US findings contributed to this result. Daniels et al. suggested that adding US findings to the STONE score improved sensitivity and specificity in low- and moderaterisk patients [15]. The CHOKAI score, similar to the STONE score, may be helpful in reducing radiation exposure to diagnostic Xrays in the differential diagnosis of renal colic though this will require future studies in which patients with high CHOKAI scores do not undergo CT imaging to ensure the safety and clinical utility of this diagnostic approach.

Using data from a large, randomized, comparative effectiveness trial, we evaluated the performance of the STONE score, a clinical decision rule derived to

predict the presence of ureteral stone on CT scan. We compared the performance of the STONE score with that of physician gestalt, using several metrics of test performance, including discrimination, calibration, risk stratification, and test characteristics such as sensitivity, specificity, and likelihood ratios. The STONE score successfully categorizes patients into low-, moderate-, and high-risk groups, with corresponding probabilities of ureteral stone ranging from 13% to greater than 70%. The authors of the original study suggested that the STONE score could potentially be used to defer CT because patients with a high STONE score Using data from a large, randomized, comparative effectiveness trial, we evaluated the performance of the STONE score, a clinical decision rule derived to predict the presence of ureteral stone on CT scan. We compared the performance of the STONE score with that of physician gestalt, using several metrics of test performance, including discrimination, calibration, risk stratification, and test characteristics such as sensitivity, specificity, and likelihood ratios. The STONE score successfully categorizes patients into low-, moderate-, and high-risk groups, with corresponding probabilities of ureteral stone ranging from 13% to greater than 70%. The authors of the original study suggested that the STONE score could potentially be used to defer CT because patients with a high STONE score Using data from a large, randomized, comparative effectiveness trial, we evaluated the performance of the STONE score, a clinical decision rule derived to predict the presence of ureteral stone on CT scan. We compared the performance of the STONE score with that of physician gestalt, using several metrics of test performance, including discrimination, calibration, risk stratification, and test characteristics such as sensitivity, specificity, and likelihood ratios. The STONE score successfully categorizes patients into low-, moderate-, and high-risk groups, with corresponding probabilities of ureteral stone ranging from 13% to greater than 70%. The authors of the original study suggested that the STONE score could potentially be used to defer CT because patients with a high STONE score Using data from a large, randomized, comparative effectiveness trial, we evaluated the performance of the STONE score, a clinical decision rule derived to predict the presence of ureteral stone on CT scan. We compared the performance of the STONE score with that of physician gestalt, using several metrics of test performance, including discrimination, calibration, risk stratification, and test characteristics such as sensitivity, specificity, and likelihood ratios. The STONE score successfully categorizes patients into low-, moderate-, and high-risk groups, with corresponding probabilities of ureteral stone ranging from 13% to greater than 70%. The authors of the original study suggested that the STONE score could potentially be used to defer CT because patients with a high STONE score Using data from a large, randomized, comparative effectiveness trial, we evaluated the performance of the STONE score, a clinical decision rule derived to predict the presence of ureteral stone on CT scan. We compared the performance of the STONE score with that of physician gestalt, using several metrics of test performance, including discrimination, calibration, risk stratification, and test characteristics such as sensitivity, specificity, and likelihood ratios. The STONE score successfully categorizes patients into low-, moderate-, and high-risk groups, with corresponding probabilities of ureteral stone ranging from 13% to greater than 70%. The authors of the original study suggested that the STONE score could potentially be used to defer CT because patients with a high STONE score Using data from a large, randomized, comparative effectiveness trial, we evaluated the performance of the STONE score, a clinical decision rule derived to predict the presence of ureteral stone on CT scan. We compared the performance of the STONE score with that of physician gestalt, using several metrics of test performance, including discrimination, calibration, risk stratification, and test characteristics such as sensitivity, specificity, and likelihood ratios. The STONE score successfully categorizespatients into low-, moderate-, and high-risk groups, with corresponding probabilities of ureteral stone ranging from 13% to greater than 70%. The authors of the original study suggested that the STONE score could potentially be used to defer CT because patients with a high STONE score Using data from a large, randomized, comparative effectiveness trial, we evaluated the performance of the STONE score, a clinical decision rule derived to predict the presence

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CONCLUSION:

As per our results, we have come to the conclusion that the use of the STONE clinical score validates patients as low, moderate, and high risk for ureteral stone. This could help guide development of clinical decision rules for diagnostic studies and imaging in the future.

REFERENCES:

1. Sorokin I, Mamoulakis C, Miyazawa K, Rodgers A, Talati J, Lotan Y et al. Epidemiology of stone disease across the world. World J Urol. 2017;35(9):1301-20.
2. Dean T, Crozier J, Klim S, Kelly AM. Failed validation of risk prediction model for intervention in renal colic patients after emergency department evaluation. Anz J Surg. 2016;86(11):930-3.
3. Lukasiewicz A, Bhargavan-Chatfield M, Coombs L, Ghita M, Weinreb J, Gunabushanam G, et al. Radiation dose index of renal colic protocol CT studies in the United States: a report from the American college of radiology national radiology data registry. Radiology. 2014;271(2):445-51.
4. Westphalen AC, Hsia RY, Maselli JH, Wang R, Gonzales R. Radiological imaging of patients with suspected urinary tract stones: national trends, diagnoses, and predictors. AcadEmerg Med. 2015;18(7):699-707.
5. Kalender WA. Dose in x-ray computed tomography. Phys Med Biol. 2014;59(3):R129.
6. Moore CL, Bomann S, Daniels B, Luty S, Molinaro A, Singh D, et al. Derivation and validation of a clinical prediction rule for uncomplicated ureteral stone—the STONE score: retrospective and prospective observational cohort studies. BMJ. 2014;348:g2191.
7. Wang RC, Rodriguez RM, Moghadassi M, Noble V, Bailitz J, Mallin M et al. External validation of the STONE score, a clinical prediction rule for ureteral stone: an observational multi-institutional study. Ann Emerg Med. 2016;67(4):423-32.
8. Fukuhara H, Ichiyanagi O, Midorikawa S, Kakizaki H, Kaneko H, Tsuchiya N et al. Internal validation of a scoring system to evaluate the probability of ureteral stones: The CHOKAI score. Am J Emerg Med. 2017;35(12):1859-66.
9. Wang RC, Rodriguez RM, Moghadassi M, Noble V, Bailitz J, Mallin M, et al. External validation of the STONE score, a clinical prediction rule for ureteral stone: an observational multi-institutional study. Ann Emerg Med 2016;67:423–32. H. Fukuhara et al. / American Journal of Emergency Medicine 35 (2017) 1859–1866 1865
10. Fukuhara H, Ichiyanagi O, Kakizaki H, Naito S, Tsuchiya N. Clinical relevance of seasonal changes in the prevalence of ureterolithiasis in the diagnosis of renal colic. Urolithiasis 2016;44:529–37.
11. Fukuhara H, Ichiyanagi O, Kakizaki H, Tsuchiya N. Prognostic utility of seasonal changes for diagnosis of ureteral stones. Urolithiasis 2017;45:233–4.
12. Kim B, Kim K, Kim J, Jo YH, Lee JH, Hwang JE, et al. External validation of the STONE score and derivation of the modified STONE score. Am J Emerg Med 2016;34: 1567–72.
13. Deeks JJ, Altman DG. Diagnostic tests 4: likelihood ratios. BMJ 2004;329:168–9.
14. Moore CL, Daniels B, Singh D, Luty S, Gunabushanam G, Ghita M, et al. Ureteral stones: implementation of a reduced-dose CT

protocol in patients in the emergency department with moderate to high likelihood of calculi on the basis of STONE score. Radiology 2016;280:743–51.

15. Daniels B, Gross CP, Molinaro A, Singh D, Luty S, Jessey R, et al. STONE PLUS: evaluation of emergency department patients with suspected renal colic, using a clinical prediction tool combined with point-of-care limited ultrasonography. Ann Emerg Med 2016;67:439–48.