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ORIGINAL ARTICLE

Comparison of ureteric stone size, on bone window versus standard soft-tissue window settings, on multi-detector non-contrast computed tomography

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KEYWORDS

Urinary calculi;
Computed tomography;
Soft-tissue window setting;
Bone window setting

ABBREVIATIONS

CT KUB, non-contrast enhanced CT of the kidney, ureter and bladder;

Abstract ***Objective:*** To compare the difference in mean stone size, as measured on bone window vs standard soft-tissue window setting using multi-detector computed tomography (MDCT) in patients with a solitary ureteric stone.

Patients and methods: In all, 60 patients presenting to the emergency and outpatient departments of a University Hospital from May 2015 to October 2015 and fulfilling the inclusion criteria were included in the study. A 64-slice MDCT was used to assess the locations and size of the ureteric stones. A consultant radiologist independently analysed the MDCT scans of all the patients. The mean difference in stone size was calculated between both window settings in axial and coronal planes.

Results: The mean (SD) age of the patients was 37.13 (11.9) years. Males constituted ~68% of the cohort and 32% were female. In all, 85% of the patients had left ureteric stones and 15% had right ureteric stones. The mean (SD) stone size, as measured on the soft-tissue window setting was 6.68 (2.01) mm, and on the bone window setting was 4.8 (1.9) mm. The mean (SD) difference in stone size between the two

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MDCT, multi-detector CT;
MET, medical expulsive therapy;
US, ultrasonography

window settings was +1.85 (0.55) mm. The two means were compared using Student's *t*-test, and the difference was found to be statistically significant ($P < 0.05$).

Conclusion: The stone size measured using the soft-tissue window setting on a MDCT is significantly different from the measurement on the bone window setting.

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Introduction

Acute flank pain due to suspected reno-ureteric stone is a common clinical presentation in the accident and emergency and urology outpatient departments. It is crucial to accurately diagnose the presence of stones and associated complications such as obstruction, infection, and renal failure [1]. Early and accurate diagnosis of urolithiasis is instrumental in preventing obstruction and related complications.

Non-contrast enhanced CT of the kidney, ureter and bladder (CT KUB) is now an established imaging method in the evaluation of suspected acute renal colic [2]. It is well established that CT KUB is a diagnostically superior, safer, quicker, and more cost-effective investigation for acute renal colic. Accurate determination of maximum stone size is crucial in clinical decision-making for intervention or use of medical expulsive therapy (MET) [3].

The pre-set window setting in abdominal CT is soft tissue; however, there is an option of changing it to the bone setting. The drop-down box allows selection of pre-sets for 'Window' and 'Level' to optimise the display of specific tissues or pathologies on CT scans. Currently, the standard is to measure stone size on the soft-tissue window setting on CT KUB. There is still significant controversy in size estimation using soft-tissue and bone windows. Argüelles Salido et al. [4] whilst comparing actual surface size and bone window CT scan size when using the European Association of Urology formula or scanner software did not find a statistically significant difference. They also noted that measurements in the soft-tissue window tended to significantly overestimate the surface size, whilst the plain radiography underestimated it slightly but significantly. Recently, Zorba et al. [5] assessed the role of stone volume in predicting stone clearance. They noted that stone diameter alone lead to heterogeneity within the group and stone volume may be used in addition to size to determine a more definite homogeneous group to predict stone passage more precisely.

Patients presenting with acute ureteric colic secondary to a ureteric stone require a decision on management between MET and interventional treatment. Stone size is the most critical factor in deciding the management option. The current practice to measure stone size on the soft-tissue window setting on CT KUB is variable. We therefore conducted the present study to determine the difference in the measurement of stone size between soft-tissue and bone window settings on multi-detector CT (MDCT) KUB.

Patients and methods

This cross-sectional study was conducted over a period of 6 months following Ethics Review Committee approval. Adult patients aged >16 years, from both genders presenting to the Emergency Department or Out-patient clinic, undergoing MDCT KUB for ureteric colic/flank pain, and having single ureteric stone, and available for follow-up until stone-free were included in the study. We included 60 patients fulfilling the study criteria. MDCT scans of all those patients whose stones were retrieved completely as a single unit were independently analysed by a consultant radiologist using a picture-archiving computer system (PACS™). The CT scans of these patients were reviewed and measurements recorded on soft-tissue and bone windows. Stone measurements were done on axial and coronal planes, on ×4.0 magnified standard soft-tissue window and ×4.0 magnified bone window settings. All reported results on mean stone size were done on the coronal reconstructed sections. Each stone was measured in two dimensions, along its maximum diameter and the other one perpendicular to it. Then the mean difference in stone size was calculated between both window settings in the axial and coronal planes. All the collected data were entered into a pre-designed proforma.

Data were entered and analysed using SPSS version 19. The mean ± SD was calculated for age and stone size measured on the soft-tissue and bone window settings. Frequencies and percentages were calculated for gender and side of stone. Student's *t*-test was used to compare the mean difference in stone size and a $P \leqslant 0.05$ was considered to indicate statistical significance. Effect modifiers were controlled through stratification of age and gender to see the effect of these on outcome variables and a post-stratification *t*-test was used taking $P \leqslant 0.05$ as significant. The mean difference was calculated by subtracting the mean value of the soft-tissue and bone window settings. Stratification of outcome variables, i.e. mean stone size on soft-tissue window and mean stone size on bone window, was done with age and gender, and none of these were found to have a statistically significant effect.

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