# DETERMINATION OF URINARY CALCULI COMPOSITION USING DUAL ENERGY CT

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## ABSTRACT:

To assess the incidence of the various types of urinary calculi composition using dual- energy CT. This study aims to determine the urinary calculi size, location, characteristics, and the radiation exposure for DECT KUB. It is a cross-sectional study performed from June 2018 until December 2019 at the Department of Radiology HTAA. A total of 170 patients were selected using a purposive sampling method. The research featured 67% of males and 33% of females. Among the patients, 131 were Malays, 32 were Chinese, and 7 were Indians. The mean age was about 54.5. A total of 44 (26%) of urinary calculi was in the form of uric acid. Out of the 126, (74%) were non-uric acid type; calcium oxalate and calcium hydroxyapatite formed 78 (46%), and cystine constituted the remaining 48 (28%) of the urinary calculi. Most of the urinary calculi, with a total of 71 (42%), were less than 5 mm in size, and 77 (45%) were located in the lower pole of the kidney. The mean average of radiation exposure for DECT KUB was 11.5 mGy. DECT KUB is not only highly sensitive and specific for urinary calculi diagnosis, but it can also characterize the urinary calculi chemical composition. This method could assist in medical intervention of urinary calculi (uric acid) that could be treated medically and may not require any surgery.

## INTRODUCTION:

Urinary calculi is a common health issue which contributed significantly to patient's morbidity and to the health care cost of patients. If left untreated without proper treatment, obstructive urinary calculi most likely may cause infection to the obstructed urinary tract, subsequently becoming predispose to urosepsis, pyelonephritis, ureteric strictures, renal insufficiency and may contribute to end-stage renal disease. The options of urinary calculi treatment depend on its composition, which can only be decided once it had been removed. When this happens, it is too late to have an effect from any treatment decision henceforth. To address this, dual-energy CT (DECT) was employed to evaluate the types of urinary calculus. It is acknowledged that DECT is effective in distinguishing uric acid calculus from other calculus types with 92 percent up to 100 percent accuracy. In addition, DECT not only provides excellent morphological details, but it can also provide reliable and quantitative material information, which can be very functional in genitourinary imaging. However, dual-energy CT is not routinely used in clinical practice. Thus, this study aimed at evaluating the dual-energy computed tomography's roles in the management of patients suffering from urinary calculi.

## METHODS:

1. A cross-sectional study.
2. Performed at the Department of Radiology, Hospital Tengku Ampuan Afzan (HTAA).
3. From June 2018 until December 2019.
4. Patients who underwent computed tomography (CT) KUB dual-energy protocol were traced from the Radiology Information System (RIS).
5. Patients for this study were selected using the purposive sampling method.

**Inclusion Criteria:**

i. Known case of urinary calculus.
ii. Male and female adult.

**Exclusion Criteria:**

i. Pregnancy.

## CONCLUSION:

Researchers have also successfully demonstrated that DECT was efficient in characterizing the urinary calculi's chemical composition. Although it is not sufficiently well established to be used in clinical practice, it will be an indispensable diagnostic tool for urinary calculi assessment. It assesses the anatomical information such as number, location, maximum diameter, CT density and also characterizes the chemical structure of the urinary calculus, which may determine the method of intervention. Identification of extra urinary abnormalities, will further aid in the planning of management. Hence, DECT will be able to be a one stop centre in the analysis of urinary calculus in the future.

## REFERENCES:

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## RESULT:

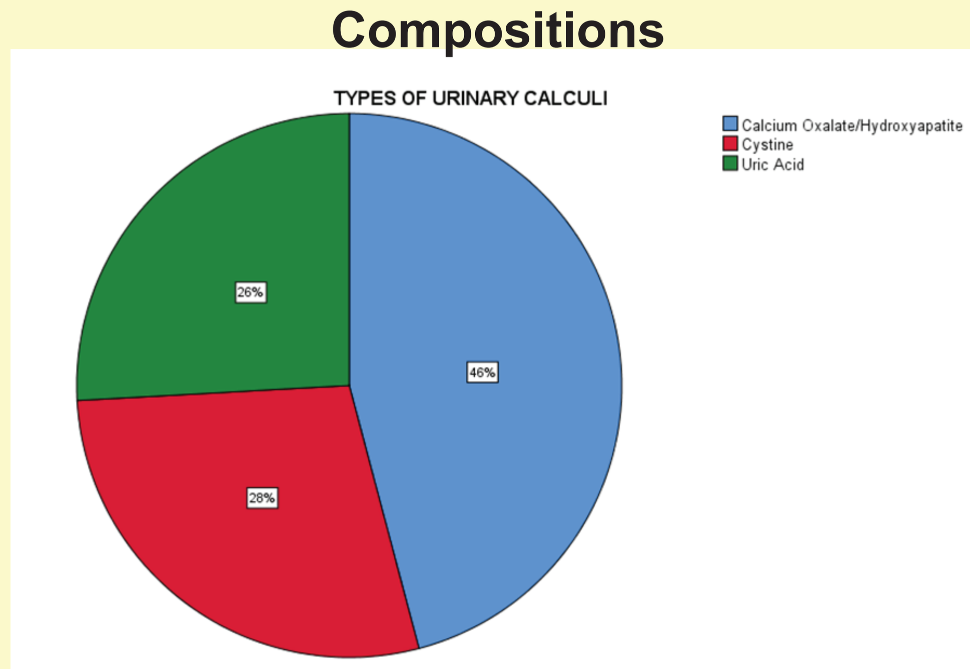
### Sociodemographic Characteristic of Patients

| Sociodemographic | n (%) |
|---|---|
| **Gender** | |
| Male | 114 (67) |
| Female | 56 (33) |
| **Ethnicity** | |
| Malay | 131 (77) |
| Chinese | 32 (19) |
| Indian | 7 (4) |

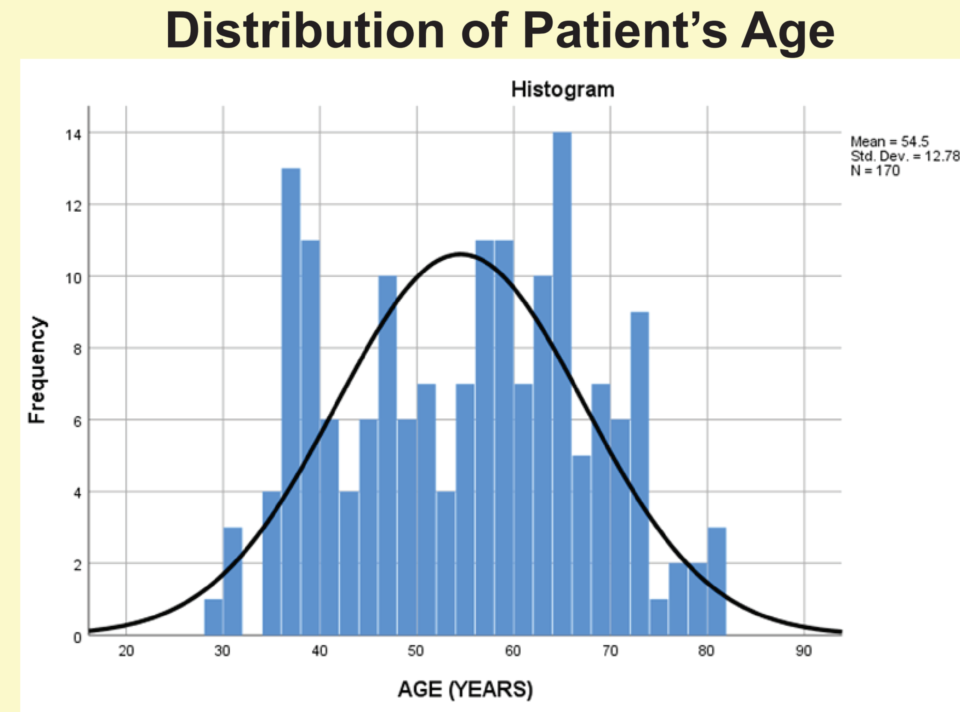
### Locations of Urinary Calculi

| | Uric Acid (n) | Non-Uric Acid (n) |
|---|---|---|
| **Renal** | | |
| Upper Pole | 4 | 7 |
| Interpole | 4 | 7 |
| Lower Pole | 20 | 57 |
| Renal Pelvis | 4 | 7 |
| Staghorn | 3 | 13 |
| **Ureter** | 5 | 28 |
| **Urinary Bladder** | 4 | 7 |

### Distribution of Types of Urinary Calculi Compositions




### Distribution of Patient's Age




### Size of Urinary Calculi

| Size | Uric Acid n (%) | Non Uric Acid n (%) | |
|---|---|---|---|
| | | Calcium Oxalate/ Hydroxyapatite | Cystine |
| **<5mm** | 12 (7) | 5(3) | 54 (32) |
| **5-15 mm** | 5 (3) | 17 (10) | 11 (6) |
| **>15mm** | 12 (7) | 49 (29) | 5 (3) |

### Analysis Urinary Calculi Characterization

| | Low Energy (HU) | High Energy (HU) | Mix Energy (HU) | Attenuation Ratio |
|---|---|---|---|---|
| **Uric Acid** | 230-644 | 226-708 | 227-689 | 0.9-1.04 |
| **Non-Uric Acid** | | | | |
| Calcium Oxalate/ Hydroxyapatite | 844-1796 | 620-1303 | 687-1451 | 1.37-1.54 |
| Cystine | 324-1351 | 267-1017 | 284-1117 | 1.15-1.23 |

### Radiation Exposure for DECT