Study of the Renal Stones Composition using Computed Tomography among Saudi Population

Mahasin Gamalalddin[1], Zuhal Yassin[2], Walaa Saleh [3]

[1]Al-Ghad International Colleges of Applied Medical Sciences, Riyadh, KSA

[2]Al-Ghad International Colleges of Applied Medical Sciences, Riyadh, KSA

[3]Al-Ghad International Colleges of Applied Medical Sciences, Riyadh, KSA

Abstract: ***The main objective of this study was to determine the chemical composition of the renal stones using computed tomography (CT) among Saudi population. It is a descriptive and prospective study of 30 Saudi patients with renal stones came to the radiology department for abdominal CT at King Fahd Hospital of the University in Al-Khobar. The study was conducted in the period from Oct to Dec 2017. Data was obtained include age, gender, body mass index (BMI) and chemical composition analysis of stones using CT-KUB helical scan without contrast. The study revealed that calcium stone has the highest prevalence (60%) followed by the uric acid stones (27%). The prevalence of the renal stones is high among the patients between 30- 50 year old, male gender and normal BMI. There is no significant difference (P > 0.05) between chemical composition and patient`s variables (age, gender and BMI).***

Keywords: Renal stone, Chemical composition, Computed tomography, Calcium

1. Introduction

Kidney stones can contain a variety of crystalline and noncrystalline materials. Knowing the composition of a stone influences clinical decisions. The stone composition may also influence the choice of urologic intervention [Gary, 2017].
Knowledge of chemical composition of renal stones in addition to clinical management, it has a benefit in better understanding of physicochemical principles underlying the formation of calculi. This may help to give advice and suggestions for the people and patients to carry out preventive measures in reducing the risk of prevalence and recurrence of urolithiasis in this region respectively. [Durgawale et. al, 2010].

Stone chemical composition can be determined by radio-densities (Computed Tomography attenuation values or Housefield Units). A study was done by [Ibrahim et al, 2014] indicated that The Hounsfield density was a convenient radiographic measure that correlated well with the chemical composition. A significant correlation between the stone size and Housefield Unit values was also demonstrated.

2. Materials and Method

This was a descriptive and prospective study of 30 patients came to the radiology department for abdominal CT at King Fahd Hospital of the University in Al- Khobar. The study was conducted in the period from Oct to Dec 2017. Data includes age, gender, BMI and chemical composition of the stones were obtained.
Analysis was performed after helical (CT-KUB) without contrast. During study the patient lie supine in CT scan couch, feet first in comfort position with Pillow under the knees and upper extremities raised above the head.

3. Results and Discussion

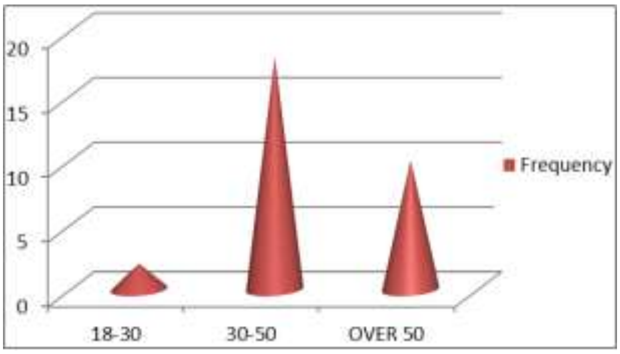

Figure 1: Distribution view of age

This figure explains the distribution of the patients regarding age. The age group between 30-50 years old has the highest frequency compared to the other groups (60%). Internationally, this group is considered the most seriousness groups to form stones.

High prevalence of the renal stones among the patients between 30- 50 years old is compatible with the study was done by [Shirazi, et. al, 2009] titled: Personal Characteristics and Urinary Stone.

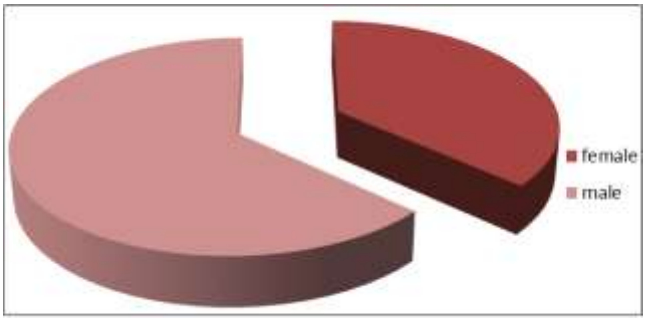

Figure 2: Distribution view of gender

According to figure (2) which explains the distribution of the patients depends on gender, the male patients have higher frequency (63%) than the female patients. This is because of larger muscle mass as compared to women and complicated urinary tract, as compared to those of females. The prostate gland in men enlarges with age, leading to a condition known as benign prostate hypertrophy; it can result in difficulty in emptying the bladder.

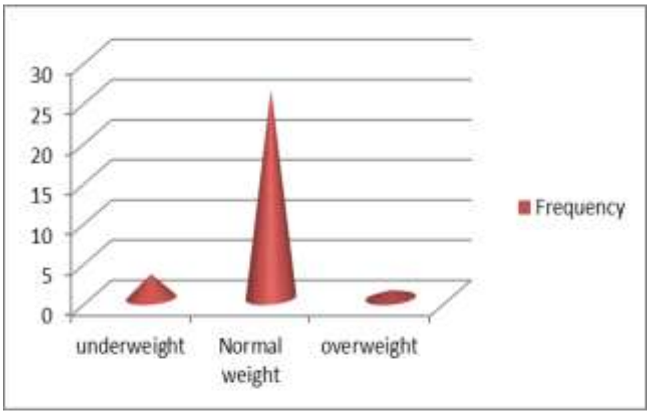

Figure 3: Distribution view of BMI

Regarding figure (3) which shows the distribution of the patients depend on BMI, the most affected group was patients with the normal weight, 26 cases (78%) which was unexpected. This is contrary with the same previous study done by [Shirazi, et. al, 2009]. It indicated that the prevalence of renal stone is highest among the patients with high BMI. The result of our study may be due to the smaller sample size.

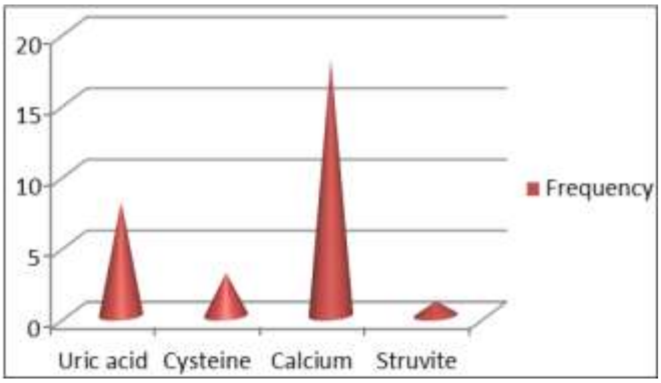

Figure 4: Distribution view of chemical composition

Regarding the chemical composition of the stones, figure (4), (60%) of the stones is calcium followed by the uric acid stones (27%). The result is compatible with the study was done by [Park et al, 2009] indicated that the most common kidney stones among patients were composed of calcium oxalate. The result is contrary with study was done by [Babiker, 2017] in Sudan indicated that that most chemical composition of renal stone among Sudanese population was uric acid. This difference indicates that the composition of the renal stones differ according to the geographic area. Stone with calcium components is an indicator of metabolic derangement including hypercalciuria, hyperparathyroidism. Calcium stones indicated poor water intake coupled with higher temperature due to climate change results in dehydration.

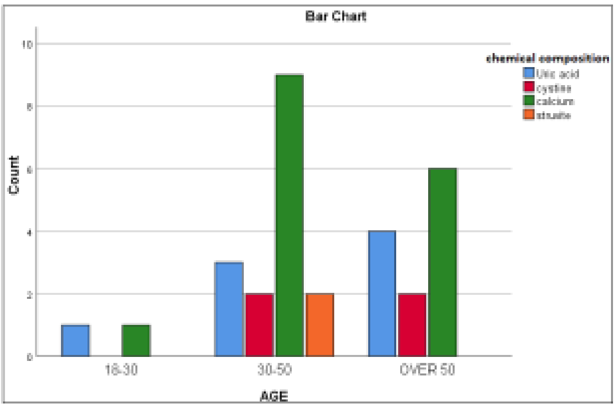

Figure 5: AGE * Chemical composition

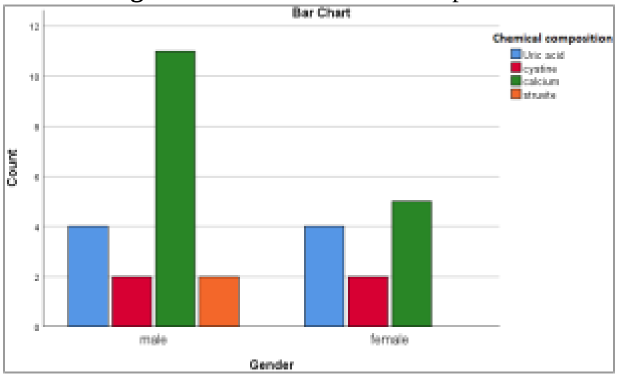

Figure 6: Gender * Chemical composition

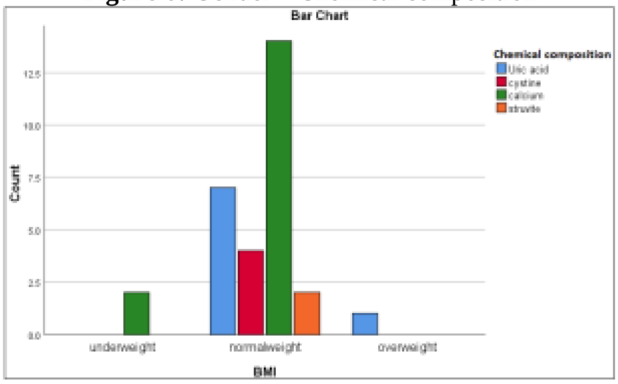

Figure 7: BMI * Chemical composition

Regarding the correlation between chemical composition and patient`s variables using cross tabulation, Figure (5), (6) and (7), it is shown that calcium stones are the common among all age groups, both genders and two BMI groups (underweight and normal weight) using cross tabulation.

Table 1: Chi square test between chemical composition and age

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	3.164ᵃ	6	.788
Likelihood Ratio	4.133	6	.659
Linear-by-Linear Association	.400	1	.527
N of Valid Cases	30		

Table 2: Chi square test between chemical composition and gender

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	2.279ᵃ	3	.517
Likelihood Ratio	2.919	3	.404
Linear-by-Linear Association	1.769	1	.183
N of Valid Cases	30		

Table 3: Chi square test between chemical composition and BMI

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	4.583[a]	6	.598
Likelihood Ratio	5.239	6	.514
Linear-by-Linear Association	2.429	1	.119
N of Valid Cases	30		

The differences between chemical composition and patient`s variables were not significant (P> 0.05) using chi- square test as are shown in table (1), (2) and (3). This is may be due to small sample a size.

4. Recommendations

- Further studies with larger sample size are recommended for precise results.
- Drinking a large amount of water is recommended for all human being to prevent dehydration, which is one of the reasons that lead to stone.

References

[1] Babiker M. 2017, Study of Renal Stone Composition using Computed Tomography, SUST Repository. http://repository.sustech.edu/handle/123456789/174
[2] Durgawale P, Shariff A, Hendre A, Patil S, Sontakke A 2010, 'Chemical analysis of stones and its significance in urolithiasis', Biomedical Research, Volume 21, Issue 3.
[3] Gary C. 2017, *Interpretation of kidney stone composition analysis*, UpToDate, https://www.uptodate.com/contents/interpretation-of-kidney-stone-composition-analysis
[4] Ibrahim H, Wilson N , Abdul Wahab M, Heneidy H, 2014, 'Computed tomography evaluation of urinary stones densities compared to in vitro analysis of its chemical composition', International Journal of Medical Imaging, 2(6): 141-145.
[5] Pak CY, Poindexter JR, Adams-Huet B, Pearle MS 2003, 'Predictive value of kidney stone composition in the detection of metabolic abnormalities', PubMed, 115(1):26-32.
[6] Shirazia F, Shahpourianb F, Khachiana A, Hosseini F, Houshiarradd A, Heidari S, Sanjari M, 2009, 'Personal Characteristics and Urinary Stones*' Hong Kong Journal of Nephrology*, Volume 11, Issue 1, Pages 14-19.

Author Profile

Mahasin Gamalalddin Yaqob Hassan: received the B.Sc. in Medical Diagnostic Radiological Technology from Sudan University of sciences and Technology, 2007, M.Sc. in Medical Diagnostic Ultrasound from Al-Zaiem Al-Azhari University, 2011 and PHD in Medical Diagnostic Ultrasound from the National Ribat University, Khartoum. She worked at University of Hail, KSA as a lecturer, 2012-2017. Now, she is working as Assistant Professor at Alghad International College- Riyadh, KSA - Department of Radiological Sciences.

Zuhal Yassin Ali Hmad: received the B.Sc. (2007), M.Sc (2014) and PHD (2017) in Medical Diagnostic Radiological Technology from Sudan University of Sciences and Technology. She worked at National University- College Of Medical Imaging Sciences and Karary University- College Of Medical Radiological Sciences, Khartoum as a lecturer. Now, she is working as Assistant Professor at Alghad International College- Riyadh, KSA - Department of Radiological Sciences.

Walaa Saleh Almnameen: Internship student at Alghad International College- Riyadh, KSA - Department of Radiological Sciences- 2018.