Summary and Conclusion

Radiographic imaging is very important in the diagnosis of urinary stones and in detecting the proper line of management.

UTP and ultrasonography being universally available were routinely used for the diagnosis and follow up of patients with urinary stones. Currently, the most safe, accurate and rapid method for diagnosis of urinary stones is NCHCT.

The objective of our work is to evaluate the role of NCHCT in detecting urinary stones, stone volume and stone composition. Knowing all these factors will help us in detecting the proper line of management either by ESWL or by surgery.

This study was carried out on 142 patients divided into two main groups. The first group included 47 patients with 50 staghorn stones and studied for detecting the stone volume and composition. The second group included 95 patients with flank pain and were studied for detecting the presence or absence of urinary stones.

Patients were examined with the following procedures:

A- The first group:

I- Radiological ⟶

1- UTP.
2- Ultrasonography.
3- NCHCT with 3D reformatted images.
4- IVU in 28 cases.

II- Laboratory ⟶

1- Serum creatinine.
2- Complete urine analysis.
3- X-ray diffraction of the stones.

B- The second group:

1- UTP
2- NCHCT
3- CTU in 18 cases.
4- PCN antegrade in one case.

The results of NCHCT density in the first group were compared with the chemical composition of the stone to correlate the stone density with its chemical composition.

We found that NCHCT is highly significant in predicting the chemical composition of the stone by measuring the mean density in (HU). It can differentiate uric acid stones, calcium oxalate monohydrate stones > 91%, calcium oxalate monohydrate stone 75-90% and calcium oxalate mixed with uric acid stones. However, NCHCT can not differentiate calcium phosphate stone mixed with struvite from the group of mixed urinary stones because they had the same range of HU.

3D reformatted CT images gives us very important informations about the stone volume and the stone branches which is important in detecting the line of management. NCHCT detect the stone volume with accuracy of 96% and bias ranged from 3.4-4%.

Our study demonstrated that NCHCT is the most safe, accurate and rapid method in the diagnosis and follow up of urinary stones in patients with flank pain. NCHCT can delect urinary stones with sensitivity of 96%, specificity of 95% and overall accuracy of 96%.

CT urography is important to differentiate stone pelvic ureter from phleboli and in visualization of the pelvicalyceal system and ureters before treatment of urinary stones by ESWL or

ureteroscope to detect the infundibulopelvic angle, infundibular length, infundibular width or distal ureteric narrowing. These factor will affect the stone clearance rate after treatment.

We recommend the following imaging algorithm for patients complaining from flank pain:-

1. A definite stone is identified on the symptomatic side by NCHCT. No further imaging studies.

2. No urinary stones, ureteral dilatation and absent perinephric stranding. Urinary stones are excluded.

3. No uretral stone but there is unilateral ureteral dilatation or perinephric stranding on the symptomatic side. It may be due to recentely passed stone or may be a very small stone may be present but not visible on the images. If any signs or symptoms of infection are present, pyelonephritis or pyonephrosis must be considered.

4. No urinary stones but there is unilateral nephromegaly or moderate pernephric stranding. It may be due to pyelonephritis, renal vien thrombosis, renal infarction or renal tumour. CT should be repeated using intravenous contrast material for further evaluation.

5. No definite stone but there is a suspicious calcification along the course of the ureter. Overlapping reconstruction can help us beginning above and extending below the level of calcification. If still indeterminate we search for tissue rim sign, if positive indicates a ureteral stone if negative tissue rim sign (not exclude the presence of stone), IV contrast should

be used to detect the relation between the calcification and the ureter.

6. If the results of NCHCT is indeterminate whatever the cause, IV contrast can be used and repeat the CT scan.

We also recommend the following management algorithm for patients with urinary stones:-

1- Patients with small urinary stones < 6mm. We recommend medical treatment waiting for spontaneous passage.

2- Patients with stones up to 2 cm. (or small stones with failed medical treatment) with normal pelvicalyceal system we recommend ESWL. If no response use PCNL.

3- In case of partial staghorn stones we use PCNL then ESWL for the residual stone. If complete staghorn stone use open surgery.

4- In patients with ureteral stones, for lumbar ureter stones ESWL is prefered or ureteroscopeor push it in the kidney then PCNL.

5- For patients with iliac ureter stones they are treated by ESWL or by ureteroscope.

6- For patients with pelvic ureter stones ureteroscope is prefered or ESWL.

Finally, we concluded that:

1. NCHCT is the most safe, rapid and accurate method in detecting urinary stones in patients with flank pain with sensitivity of 96%, specificity of 95% and overall accuracy of 96%.

2. 3D reformatted images can detect the stone volume with accuracy of 96%. It also helps in accurate mapping of the stone with its branches.

3. NCHCT by measuring the (HU) density of the stone help us in differentiating the chemical composition of stones except for mixed struvite with phosphate stone and mixed urinary stones.

4. CTU is required sometimes to differentiate stone pelvic urter from pelvic phlebolith and also to study the anatomy of the pelvicalyceal system and ureters before urological intervention to detect the proper line of management.