

# NON CONTRAST HELICAL CT SCAN FOR ACUTE FLANK PAIN: NON CALCULUS URINARY AND EXTRA URINARY CAUSES

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## ABSTRACT

**Objective:** To determine the value of non contrast helical CT in the diagnosis of non calculus renal and extraurinary causes of acute flank pain.

**Design:** A prospective descriptive study.

**Place and duration of study:** Radiology Department, Aga Khan University Hospital Karachi from January 2005 to June 2005.

**Subjects and methods:** 130 consecutive patients with acute flank pain underwent Noncontrast enhanced helical CT scan (NHCT). 100(73%) were male and 30(23%) were female. Scans were observed for noncalculus renal and extraurinary causes of acute flank pain.

**Results:** Out of 130 patients, 30 patients were excluded. In 23(23%) patients non calculus causes of pain were diagnosed. In 5 (5%) patients incidental findings were recorded which were most likely not cause of pain. Three patients had non calculus renal abnormalities which included renal cell carcinoma, horseshoe kidney adult polycystic kidney disease.

**Conclusion:** The accurate and timely diagnosis of an obstructing ureteral calculus, a non calculus urinary abnormality or an extra urinary tract pathology, establishes non contrast helical CT as the diagnostic study of choice for the evaluation of patients with flank pain.

**KEY WORDS:** Non contrast helical CT scan, Acute flank pain, Non calculus, Extra urinary.

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## INTRODUCTION

In 1995, the use of non contrast helical CT (NHCT) to evaluate patients with acute flank pain and hematuria was reported by Smith et al. Since then NHCT has been in vogue for

evaluation of acute flank pain.<sup>1,2</sup> The reported sensitivity and specificity of NHCT has been 96% and 99% respectively for detection of ureteric calculi.

The patients who present to emergency room with flank pain may have many causes. Most common causes of flank pain are ureteric colic, appendicitis, cholecystitis etc. The emergency room physician usually orders NHCT for suspected ureteric calculi. It is the ability of NHCT to detect extra urinary causes<sup>3,4</sup> in addition to ureteric calculi, which has led different researchers to study this aspect.

The NHCT is rapid, non invasive, accurate and able to demonstrate non calculus urinary and extra urinary causes, which if detected early can reduce morbidity, cost of treatment and hospital stay. The purpose of our study was to determine the value of non contrast helical CT in the diagnosis of noncalculus renal and extraurinary causes of acute flank pain.

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## PATIENTS AND METHODS

This was a prospective study done over a period of 6 months from January 2005 to June 2005. One hundred thirty consecutive patients with acute flank pain underwent Noncontrast enhanced helical CT scan (NHCT). One hundred (73%) were male and 30(23%) were female. All patients referred for NHCT from emergency room of Aga Khan University hospital were included in this study. Patients with history of trauma, pregnancy and less than 15 years of age were excluded.

NHCT were performed on Cti/pro helical CT scanner (GE medical system Milwaukee, WI). No oral or intravenous contrast material was given. Scanning was started from upper pole of kidneys to the symphysis pubis. Scanner settings were kvp 120 – 140 and mAs 200-300. Slice thickness 5mm, pitch of 1.5 and reconstruction interval 5mm.

Prone scanning done whenever there was confusion between ureterovesical junction calculus and vesical calculus. Image interpretation was done by two consultant radiologists with experience of genitourinary and CT imaging. Interpretation was done on hard copy images and on the console. Images were interpreted for findings of non calculus urinary abnormalities and extraurinary abnormalities in addition to urinary calculi and secondary signs of obstruction.

Table-I: Non Calculus Urinary and Extraurinary Causes

<i>Disease</i>	<i>No. of patients</i>
Renal cell carcinoma	1
Horseshoe kidney	1
Adult polycystic kidney disease	1
Acute pancreatitis	2
Chronic pancreatitis	1
Cholilithiasis	5
Bilateral psoas abscess	1
Leaking aortic aneurysm	1
Ovarian mass	5
Splenic abscess	1
Retroperitoneal fibrosis	1
Appendicitis	1
Diverticulitis	1
Retroperitoneal hemorrhage	1

The other radiological, biochemical and serological investigations along with histopathology and surgical findings were observed for the confirmation of diagnosis. Clinical follow up was done for a period of three months in all patients.

## RESULTS

Out of 130 patients 30 patients were excluded from the study in which confirmation of diagnosis was not possible. Final study group included 100 patients. In 47(47%) patients ureteric calculi or secondary signs of obstruction were present. In two patients (2%) only secondary signs of obstruction were present representing recent passage of calculus.

In 23 (23%) patients non calculus causes of pain were diagnosed. In 5 (5%) patients incidental findings were recorded which were most likely not cause of pain. Three patients had non calculus renal abnormalities which included horseshoe kidney, adult polycystic kidney disease and renal cell carcinoma. Extraurinary causes are given in Table-I. Five patients had incidental findings which included ascites in three, hepatic cyst and hemochromatosis in one each.

## DISCUSSION

NHCT has been established as an investigation of choice in the diagnosis of urolithiasis and will continue to replace the classic radiographic techniques in imaging the patients with acute flank pain and suspected renal colic.<sup>1</sup> NHCT is obviously a limited study without oral and intravenous contrast assigned to assess urolithiasis but it can reveal many non calculus urinary and extra urinary abnormalities causing flank pain and some times can reveal findings not causing pain but have significant diagnostic value for the patient.

NHCT show non calculus abnormalities in 10% to 25% of patients with renal colic.<sup>3-5</sup> In a recent study Chen MY and Zagoria RJ have identified extra urinary lesions in 45% of patients.<sup>6</sup> Increasing familiarity of clinicians and radiologists has been described as a cause of increasing rate of detection of extra urinary abnormalities.<sup>6</sup>

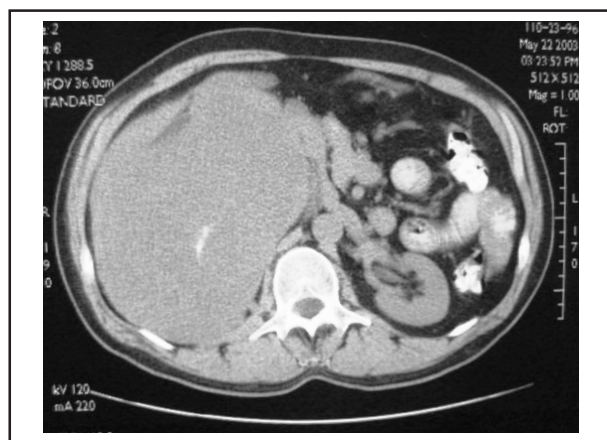


Fig-1: Unenhanced helical CT showing large mass with calcification arising from right kidney.

This proved to be renal cell carcinoma.

**Renal abnormalities:** The non calculus renal abnormalities in our study were renal cell carcinoma, horse shoe kidney and polycystic kidneys. The horse shoe kidney and polycystic kidneys were not described in other studies.<sup>7</sup>

The detection of renal cell carcinoma was unusual, not describe in other studies (Fig-1). The urinary abnormalities described in other studies<sup>8,9</sup> include crossed fused ectopia, horse shoe kidneys, adult poly cystic kidney disease, acute pyelonephritis, pyonephrosis, xanthogranulo- matous pyelonephritis, and ureteral obstruction from non calculus causes, cystitis. These urinary causes have most of the times more serious consequences than urolithiasis alone and many of these require more urgent therapy. While CT is limited with regard to detection of pyelonephritis, the diagnosis can be suggested if the clinical history is appropriate and findings such as perinephric stranding, renal enlargement and, possibly, hydronephrosis are present. It is also important to document the presence of intra- or extrarenal fluid collections, although the ability to detect intrarenal fluid collections may be very limited. In the appropriate clinical setting of pain without a genitourinary tract explanation, imaging with intravenous contrast material can increase the sensitivity for detection of intrarenal abscess. Indeed, pyelonephritis and its associated secondary complications are not uncommon in patients with obstructing

ureteral calculi and may require emergent treatment (i.e., nephrostomy placement). Spontaneous perforation of a ureter, calyceal fornix, pyelocaliceal diverticulum or renal pelvis can occur.<sup>8</sup> The kidneys of patients with acute renal infarct secondary to renal arterial occlusion may appear unremarkable during the very early stages on nonenhanced CT images; however, when infarction involves large regions of an involved kidney, the kidney may become enlarged, with preservation of its reniform shape.<sup>9</sup> Renal venous thrombosis may manifest on nonenhanced CT images as ipsilateral renal enlargement with edema in the perinephric space.<sup>9</sup> A ureteral transitional cell carcinoma, while uncommon, should also be considered, especially if there are signs of chronic obstruction; careful inspection of the ureters may be necessary. Many of these entities may require follow-up imaging with intravenous contrast material to establish a definite diagnosis.

**Extra urinary diseases:** Extra urinary diseases in our study were leaking aortic aneurysm, acute pancreatitis, chronic pancreatitis, retroperitoneal fibrosis, bilateral psoas abscesses, retroperitoneal hemorrhage, ovarian masses, cholelithiasis diverticulitis, splenic abscess, and appendicitis (Fig-2).

The incidental findings were hemochromatosis, hepatic cyst and ascities. Significant extraurinary diseases described in literature other than seen in our study are.<sup>10-13</sup>

Small bowel obstruction, crohn's disease, hernia, volvulus, intussusception, cholecystitis, choledocholithiasis, endometriosis, hydrosalpinx and bone metastases. Pneumonia may also

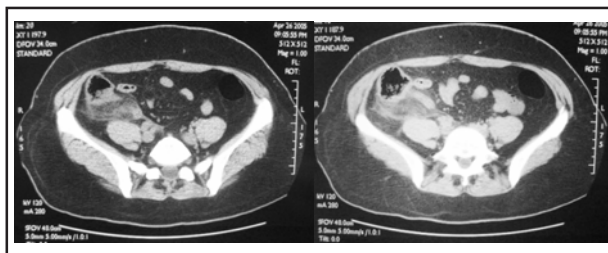


Fig-2: Unenhanced helical CT showing enlarged inflamed appendix with inflammatory infiltrate in the surrounding mesenteric fat.

cause abdominal pain similar to renal colic and may be detected if lung bases are included. The primary limitation of nonenhanced CT is the use of ionizing radiation. This is particularly of concern in children and pregnant patients, although radiation dose should generally also be of concern in young adults.

In our study detection of leaking aortic aneurysm, bilateral psoas abscesses, retroperitoneal fibrosis, appendicitis, pancreatitis, retroperitoneal hemorrhage and diverticulitis led to early treatment hence delay in management was avoided. The increased use of non enhanced helical CT for flank pain has led to more detection of alternate diagnosis apart from ureteric calculi.<sup>14</sup> The role of un enhanced helical CT (UHCT) in the evaluation of acute flank pain suggestive of urinary tract calculi is increasingly appreciated in the last few years. Recent studies have identified the advantages of UHCT in recognizing alternative findings within or outside the urinary tract.<sup>15</sup>

## CONCLUSION

The accurate and timely diagnosis of an obstructing ureteral calculus, a non calculus urinary abnormality or an extra urinary tract pathology, establishes non contrast helical CT as the diagnostic study of choice for the evaluation of patients with flank pain.

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