Role of Multidetector CT in Assessment of Inflammatory Renal Diseases
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Abstract

Background: Inflammatory renal diseases are generally well depicted with Multidetector CT. Although Computed Tomography (CT) is not routinely indicated in uncomplicated renal infection, it is of value in establishing the diagnosis in equivocal cases, in evaluating high-risk patients, and in determining the extent of disease. Contrast material enhanced study is essential for complete evaluation of patients with renal inflammatory disease to demonstrate alterations in renal excretion of contrast material that occur as a result of the inflammatory process. Abnormalities in renal perfusion associated with acute pyelonephritis are best depicted during homogeneous enhancement of the renal parenchyma in the nephrographic phase. Delayed CT scans obtained during the excretory phase are frequently more helpful than early CT scans in defining the extent of the disease process, and identifying its complications such as abscess formation, xanthogranulomatous pyelonephritis, emphysematous pyelonephritis, scarring and renal failure, and confirming the presence of urinary obstruction. CT scanning is the diagnostic modality of choice in assessment of perinephric abscess because it is more sensitive, accurate in defining the precise location, size, degree, and extent of the loculation in relation to other retroperitoneal structures. It may also show renal enlargement; focal parenchymal decreased attenuation; fluid, gas, or both in and around the kidneys; focal thickening of the Gerota fascia; and obliteration of adjacent tissue planes. In assessment of renal corticomedullary abscess, CT scanning is the most useful modality in diagnosing intrarenal abscess and planning operative procedures for treatment.

Objective: Our purpose is to evaluate the sensitivity of Multidetector CT in assessment of renal inflammation, defining the extent of the disease, establishing the diagnosis of equivocal cases and detection of associated complications.

Patients and Methods: Thirty two patients with suspected renal inflammations were examined by Multidetector CT. Non contrast study was performed to 16 patients because of their elevated renal functions using a multidetector CT with reconstruction. Multiphasic CT imaging was performed for 16 patients using a multidetector CT with reconstruction. Results were correlated with severity of clinical presentation, associated risk factors, imaging findings and complications.

Results: MDCT was performed for 32 patients referred to Radiology Department from Various Departments (Urology, Nephrology, and others). Non contrast study shows (31.3%) chronic pyelonephritis, (25%) acute pyelonephritis, (25%) emphysematous pyelonephritis, (12.5%) xanthogranulomatous pyelonephritis, (6.3%) renal abscess. Multiphasic post contrast CT study shows (37.5%) perinephric abscess, (25%) chronic pyelonephritis, (12.5%) acute pyelonephritis, (18.8%) renal abscess and (6.3%) renal tuberculosis.

Conclusion: In cases with suspected renal inflammation, Multidetector CT is the modality of choice for evaluating patients for identifying the extent of the disease and detection of associated complications.

Key Words: Renal inflammation – MDCT.

Introduction

RENAL inflammations include acute pyelonephritic (Figs. 1,6), renal abscess, perinephric abscess, emphysematous pyelonephritis, xanthogranulomatous pyelonephritis, and renal tuberculosis. Inflammatory renal diseases are generally well depicted with multidetector CT. Although Computed Tomography (CT) is not routinely indicated in uncomplicated renal infection, it is of value in establishing the diagnosis in equivocal cases, in evaluating high-risk patients and in determining the extent of disease [1].

Contrast material-enhanced study is essential for complete evaluation of patients with renal inflammatory disease to demonstrate alterations in renal excretion of contrast material that occurs as a result of the inflammatory process. Delayed CT scans obtained during the excretory phase are frequently more helpful than early CT scans in
defining the extent of the disease process, and identifying its complications such as abscess formation, xanthogranulomatous pyelonephritic (Fig. 5), emphysematous pyelonephritis, scarring (Fig. 2) and renal failure and confirming the presence of urinary obstruction. Abnormalities in renal perfusion associated with acute pyelonephritis are best depicted during homogeneous enhancement of the renal parenchyma in the nephrographic phase. This phase appears to be more sensitive than the cortico-medullary phase in the detection of subtle lesions, particularly if the medulla is predominantly affected [1].

CT is the mainstay of diagnostic imaging for xanthogranulomatous pyelonephritis (Fig. 5) as it allows a confident diagnosis and gives information about the extra renal extent of the disease [2].

CT has major role in assessment of renal tuberculosis; it provides an accurate evaluation of amount of residual functioning parenchyma and extra renal spread and also early manifestation as calyceal erosion or papillary necrosis [3].

CT scanning is the diagnostic modality of choice in assessment of perinephric abscess because it is more sensitive, accurate in defining the precise location, size, degree, and extent of the loculation in relation to other retroperitoneal structures [4].

In assessment of renal corticomedullary abscess (Figs. 3, 4), CT scanning is the most useful modality in diagnosing intrarenal abscess and planning operative procedures for treatment [5]. It shows poorly defined, wedge-shaped, hypodense area that may involve liquefaction and focal renal involvement. The characteristic appearance consists of a low-attenuation (0-20 Hounsfield units), distinctly margined, parenchymal lesion that fails to enhance after contrast administration. Other features may include perirenal fluid and inflammatory stranding with thickening of Gerota fascia [6].

**Aim of the work:**

The aim of this study is to evaluate the role of Multidetector CT (MDCT) in detection, characterization of renal inflammatory diseases, defining the extent of the disease process and identifying complications such as renal abscess and renal failure.

**Patients and Methods**

The present study included 32 patients who were referred to the Radiology Department in Cairo University Hospitals from Various Departments Urology, Nephrology, and others) for radiological evaluation of their clinical problems with suspected kidney inflammations. These patients were investigated by MDCT.

These patients were 17 males and 15 females with average age about 51 year and ranging between 30 and 72 years. We had the patients full clinical data (including the complaint of loin pain, burning micturation, hematuria, fever and history of repeated urinary tract infection) and through physical examination (general and local abdominal examinations).

All patients were subjected to routine laboratory investigations including urine analysis (for blood cells or pus) and serum analysis (for kidney functions: Urea and creatinine) as well as other related investigations as serum sugar in diabetic patients.

All patients associated risk factors are included; diabetes mellitus, renal stones, immunosupression and ureteral obstruction.

Treatment modalities were specified into 4 categories: Medical treatment only, percutaneous drainage, surgical drainage (open surgery), and nephrectomy.

The outcome was classified as cure and clinical improvement. Patients were cured when clinical and laboratory findings normalized at discharge from hospital.

When the clinical status improved, but conservative medical treatment were not normalized at discharge from hospital the outcome was classified as clinical improvement.

**Protocol of MDCT technique:**

Sixteen (16) patients underwent multiphasic CT scanning for the kidneys and urinary tract following a scanning protocol that included non-contrast phase, Corticomedullary Phase (CMP), Nephrographic Phase (NP) and Excretory Phase (EP) scanning. Another sixteen (16) patients with impaired creatinine level, they underwent into non contrast study only. These patients were examined in the period from January 2014 to August 2015.

The examination was performed in the cranio-caudal direction with a foursection multi-detector row CT scanner (Light Speed GE Medical Systems) or sixty-four section multidetector CT scanner (Toshiba Medical Systems, Aquillion). Patients
were lying supine in feet first position at complete rest. Hands were placed behind head. All instructions were given to the patient about table movements, voice messages, sensation of contrast injection, timing and manner of breath holding.

Scanning was initially performed pre-contrast injection, then the late arterial Cortico-Medullary Phase (CMP) using “smart preparation” or “sure start” techniques in GE and Toshiba machines respectively.

Automatic pump was used and connected to the machines. Approximately 100-120ml of a nonionic contrast material was injected at a rate of 3-4ml/sec through a 16/18-gauge cannula placed in an antecubital vein. The patients were given 500-750mL of water to drink over a 15-20 minute period before the start of the examination. The range of scanning from D 11 vertebra till the aortic bifurcation using 1.25-mm section thickness, pitch 1:1.5, table speed of 7.5mm per rotation, gantry rotation of 0.8 second and 140kVp, 200-300mA. The entire range was scanned during breath holding. Nephrographic Phase (NP) then obtained 70-80 seconds post contrast injection with breath holding, range of scanning from D 1 vertebra till the ischiorectal fossae using 1.25-mm section thickness, pitch 1:1.5 and table speed of 7.5mm per rotation, gantry rotation of 0.8 second and 140kVp, 200-300mA.

Excretory Phase (EP) then obtained 3 minutes up to 8-10 minutes post contrast injection with range of scanning from D 1 vertebra till the ischiorectal fossae using 1.25-mm section thickness, pitch 1:1.5 and table speed of 7.5mm per rotation, gantry rotation of 0.8 second and 140kVp, 200-300mA.

Results

The present study was conducted on 32 patients; 17 males (53.1%) and 15 females (46.9%). The mean and standard deviation values of age were 49.5 (11.1) years with a minimum of 30.0 years and a maximum of 72.0 years.

The most common complaint were loin pain and burning micturition which were found in all cases (100.0%) followed by repeated UTIs (96.9%). The least common complaint was weakness and lethargy (40.6%). 56.2% of cases had complaint for at least 14 days. 50.0% of the patients had elevated renal function, 65.6% of the patients had diabetes mellitus, and in 7 cases the results of urine analysis were not available but, out of remaining 25 case, 68.8% had pyuria (pus >10 HPF in urine).

90.6% of the cases had unilateral affection while only 9.4% had bilateral affection. 65.6% of the cases had diabetes mellitus while 59.4% had stones. 78.1% of the cases had HU (1 to 30), 6.2% had HU (31 to 550) while 15.6% had HU (~1000 to 0). 37.5% of the cases had enlarged kidney. Hypodense areas were found in 43.8% of the cases with IV contrast. The most common pathology type was chronic pyelonephritis complicated by abscess (31.2%). Most of the lesions were diffuse (87.5%). The most common complication was renal fascia involvement (93.8%). The least common was extension to psoas muscle (87.5%). In 2 cases of chronic pyelonephritis the plan of management were unknown. Of the remaining 7 cases, 55.6% underwent only medical treatment. In single case of both emphysematous pyelonephritis and renal TB the plan of management were unknown. Of the remaining 3 cases of emphysematous pyelonephritis, 50% underwent nephrectomy. The most common diagnosis was chronic pyelonephritis (28.1%). The least common diagnosis was renal TB (3.1%). There was no statistically significant difference between prevalence of Diabetes mellitus and immunosupression in the two groups. Cases with no contrast showed higher prevalence of renal stones and uretral obstruction than cases with IV contrast. There was no statistically significant difference between HU in the two groups.

Cases with no contrast showed statistically significantly higher prevalence of enlarged kidney than cases with IV contrast. As regards pathology type, there was a statistically significant difference between the two groups. Cases with IV contrast showed higher prevalence of renal TB and chronic pyelonephritis complicated by abscess. Cases with no contrast showed higher prevalence of Emphysematous pyelonephritis, xanthogranulomatous pyelonephritis, acute and chronic pyelonephritis. There was no statistically significant difference between pathology distributions in the two groups.

There was no statistically significant difference between renal fascia involvement as well as peri-renal fat stranding in the two groups. There was a statistically significant difference between the two groups. Cases with IV contrast showed higher prevalence of perinephric abscess, renal abscess as well as renal TB. Cases with no contrast showed higher prevalence of acute, chronic pyelonephritis, Emphysematous pyelonephritis and xanthogranulomatous pyelonephritis.
Fig. (1): Female patient 45 years old with left focal acute pyelonephritis: A) Axial non contrast phase, B) Axial nephrographic phase and C) Axial excretory phase focal area of poorly perfused renal parenchyma with smudged related fat planes.

Fig. (2): Male patient 60 years old with right focal chronic pyelonephritis: A,B) Axial nephrographic phase and C) Coronal excretory phase shows focal reduction of renal parenchymal thickness with irregular outline.

Fig. (3): Female patient 65 years old with left chronic pyelonephritis with abscess formation extending into perinephric space and to left psoas muscle: A) Axial non contrast phase, B) Axial nephrographic phase, C) Coronal non contrast phase and D) Coronal nephrographic phase shows large hypodense abscess at left renal posterior aspect extending along left psoas muscle with markedly smudged fat planes.
Fig. (4): Female patient 45 years old with left renal abscess formation with perirenal space extension: A) Axial nephrographic phase, B) Coronal nephrographic phase and C) Coronal excretory phase shows hypodense abscess at left renal upper aspect extending along left peri nephric space with markedly smudged fat planes.

Fig. (5): Female patient 45 years old with right xanthogranulomatous pyelonephritis: A,B) Axial non contrast phase show enlarged right kidney with large stones backpressure changes low attenuation tissue infiltration.

Fig. (6): Female patient 30 years old with left acute pyelonephritis: A,B) Axial nephrographic phase, C) Coronal nephrographic phase and D) Sagittal nephrographic phase show multiple swollen focal wedge like regions showing reduced enhancement compared with the normal portions of the kidney.
Table (1): Descriptive statistics of imaging findings in the study sample.

<table>
<thead>
<tr>
<th></th>
<th>APN</th>
<th>CPN</th>
<th>Renal abscess</th>
<th>Perinephric abscess</th>
<th>XGP</th>
<th>EPN</th>
<th>TB</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of cases %</td>
<td>6 (18.8%)</td>
<td>9 (28.1%)</td>
<td>4 (12.5%)</td>
<td>6 (18.8%)</td>
<td>2 (6.2%)</td>
<td>4 (12.5%)</td>
<td>1 (3.1%)</td>
</tr>
<tr>
<td>Renomegaly</td>
<td>2 (33.3%)</td>
<td>2 (22.2%)</td>
<td>3 (75%)</td>
<td>0 (0%)</td>
<td>2 (100%)</td>
<td>3 (75%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Stones</td>
<td>4 (66.7%)</td>
<td>5 (55.6%)</td>
<td>2 (50%)</td>
<td>2 (33.3%)</td>
<td>2 (100%)</td>
<td>4 (100%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Focal</td>
<td>4 (66.7%)</td>
<td>0 (0%)</td>
<td>1 (25%)</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Diffuse</td>
<td>2 (33.3%)</td>
<td>9 (100%)</td>
<td>3 (75%)</td>
<td>6 (100%)</td>
<td>2 (100%)</td>
<td>4 (100%)</td>
<td>1 (100%)</td>
</tr>
<tr>
<td>Unilateral</td>
<td>5 (83.3%)</td>
<td>9 (100%)</td>
<td>4 (100%)</td>
<td>6 (100%)</td>
<td>2 (100%)</td>
<td>2 (50%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Bilateral</td>
<td>1 (16.7%)</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
<td>2 (50%)</td>
<td>1 (100%)</td>
</tr>
</tbody>
</table>

Table (2): Descriptive statistics of complications in the study sample.

<table>
<thead>
<tr>
<th>Complications</th>
<th>n, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Renal fascia involvement</td>
<td>30 (93.8%)</td>
</tr>
<tr>
<td>Perirenal fat stranding</td>
<td>29 (90.6%)</td>
</tr>
<tr>
<td>Extension to psoas muscle</td>
<td>7 (21.9%)</td>
</tr>
<tr>
<td>Abscess formation</td>
<td>13 (40.6%)</td>
</tr>
<tr>
<td>Delayed excretory function (IV contrast)</td>
<td>6 (37.5%)</td>
</tr>
</tbody>
</table>

Table (3): Descriptive statistics of management in the study sample (no. %).

<table>
<thead>
<tr>
<th></th>
<th>Medical only</th>
<th>PCD</th>
<th>Surgical</th>
<th>Nephrectomy</th>
<th>Unknown</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perinephric abscess</td>
<td>0 (0%)</td>
<td>3 (50%)</td>
<td>3 (50%)</td>
<td>2 (33.3%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Renal abscess</td>
<td>0 (0%)</td>
<td>2 (50%)</td>
<td>2 (50%)</td>
<td>1 (25%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Acute pyelonephritis</td>
<td>5 (83.3%)</td>
<td>1 (16.7%)</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Chronic pyelonephritis</td>
<td>5 (55.6%)</td>
<td>1 (11.1%)</td>
<td>0 (0%)</td>
<td>1 (11.1%)</td>
<td>2 (22.2%)</td>
</tr>
<tr>
<td>Xanthogranulomatous</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
<td>2 (100%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Emphysematous</td>
<td>0 (0%)</td>
<td>1 (25%)</td>
<td>0 (0%)</td>
<td>2 (50%)</td>
<td>1 (25%)</td>
</tr>
<tr>
<td>TB</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
<td>1 (100%)</td>
</tr>
</tbody>
</table>

Table (4): Descriptive statistics and results of comparison between imaging findings in cases with and without IV contrast.

<table>
<thead>
<tr>
<th>Imaging findings (n, %)</th>
<th>IV contrast (n=16)</th>
<th>No contrast (n=16)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enlarged kidney</td>
<td>3 (18.8%)</td>
<td>9 (56.2%)</td>
<td>0.028*</td>
</tr>
<tr>
<td>Pathology type:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Renal TB</td>
<td>1 (6.2%)</td>
<td>0 (0%)</td>
<td>0.015*</td>
</tr>
<tr>
<td>Emphysematous pyelonephritis</td>
<td>0 (0%)</td>
<td>4 (25%)</td>
<td></td>
</tr>
<tr>
<td>Xanthogranulomatous pyelonephritis</td>
<td>0 (0%)</td>
<td>2 (12.5%)</td>
<td></td>
</tr>
<tr>
<td>Acute pyelonephritis</td>
<td>2 (12.5%)</td>
<td>4 (25%)</td>
<td></td>
</tr>
<tr>
<td>Chronic pyelonephritis</td>
<td>4 (25%)</td>
<td>5 (31.2%)</td>
<td></td>
</tr>
<tr>
<td>Chronic pyelonephritis complicated by abscess</td>
<td>9 (56.2%)</td>
<td>1 (6.2%)</td>
<td></td>
</tr>
<tr>
<td>Pathology distribution:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Focal</td>
<td>2 (12.5%)</td>
<td>2 (12.5%)</td>
<td>1.000</td>
</tr>
<tr>
<td>Diffuse</td>
<td>14 (87.5%)</td>
<td>14 (87.5%)</td>
<td></td>
</tr>
</tbody>
</table>

*: Significant at p≤0.05.

Table (5): Descriptive statistics and results of comparison between complications in cases with and without IV contrast.

<table>
<thead>
<tr>
<th>Complications (n, %)</th>
<th>IV contrast (n=16)</th>
<th>No contrast (n=16)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Renal fascia involvement</td>
<td>15 (93.8%)</td>
<td>15 (93.8%)</td>
<td>1.000</td>
</tr>
<tr>
<td>Perirenal fat stranding</td>
<td>15 (93.8%)</td>
<td>14 (87.5%)</td>
<td>0.500</td>
</tr>
<tr>
<td>Extension to psoas muscle</td>
<td>6 (37.5%)</td>
<td>1 (6.2%)</td>
<td>0.041*</td>
</tr>
<tr>
<td>Abscess formation</td>
<td>10 (62.5%)</td>
<td>3 (18.8%)</td>
<td>0.012*</td>
</tr>
</tbody>
</table>

*: Significant at p≤0.05.

Discussion

Although Computed Tomography (CT) is not routinely indicated in uncomplicated renal infection, it is of value in establishing the diagnosis in equivocal cases, in evaluating high-risk patients, and in determining the extent of disease. Unenhanced CT is useful in demonstrating gas, calculi, parenchymal calcifications, hemorrhage, and inflammatory masses. However, a contrast material-enhanced study is essential for complete evaluation
of patients with renal inflammatory disease to demonstrate alterations in renal excretion of contrast material that occur as a result of the inflammatory process [1].

Renal inflammations that included in this study were; acute pyelonephritis, chronic pyelonephritis, renal abscess, peripheric abscess, emphysematous pyelonephritis, xanthogranulomatous pyelonephritis, and renal tuberculosis. The present study included 32 patients who were referred to the Radiology Department in Cairo University Hospitals from Various Departments (Urology, Nephrology, and others) for radiological evaluation of their clinical problems with suspected kidney inflammations. These patients were investigated by MDCT. These patients were 17 males and 15 females with their ages ranging between 30 and 72 years. Sixteen [16] patients underwent multiphasic CT scanning for the kidneys and urinary tract following a scanning protocol that included non-contrast phase, Corticomedullary Phase (CMP), Nephrographic Phase (NP) and Excretory Phase (EP) scanning. Another sixteen (16) patients with impaired creatinine level, they underwent into non contrast study only. These patients were examined in the period from January 2014 to August 2015.

Regarding the CT technique, careful consideration is necessary to ensure the optimal detection of the pathological changes. The current CT protocol of initial evaluation of renal infections consists of pre-and post contrast scans unless the patient have an contraindication to contrast medium [7].

There are four distinct phases of renal enhancement that can be imaged depending on acquisition time. The timing of these phases varies with the speed of intravenous contrast material injection. We routinely inject 100-120mL of nonionic contrast medium at a rate of 3-4mL/sec. The arterial phase is about 15-25 seconds after the start of intravenous contrast medium injection and is marked by maximum opacification of the renal arteries. The Corticomedullary Phase (CMP) starts about 30-40 seconds after the start of contrast medium injection. There is intense enhancement of the renal cortex, while the medulla remains relatively less enhanced. The Nephrographic Phase (NP) begins at 80-120 seconds after the start of contrast medium injection. It produces homogeneous enhancement of the renal parenchyma. This is the best phase for detection of subtle parenchymal lesions [8].

The excretory or urographic phase (EP) starts at 180 seconds (3 minutes) after the start of contrast medium injection. It allows opacification of the calyces, renal pelvies, and ureters, while the intensity of the nephrogram progressively declines [8].

All images obtained throughout the different phases of the examination were then sent to remote work station via local network connections. After confirmation of the presence or absence of any type of renal inflammation certain criteria should be fulfilled. They include their characterization of renal inflammatory diseases, locations, extensions, relation to collecting system, peri-nephric spread, and identifying complications. Acute pyelonephritis is a supplicative inflammation of the renal interstitial tissue. Although uncomplicated acute pyelonephritis is usually diagnosed and treated on the basis of clinical findings, CT is increasingly being requested for evaluation of poor response to treatment, for detection of potential complications, and for diagnosis of underlying predisposing factors. Patients with poorly controlled diabetes, HIV infection, and immunocompromised state are especially prone to developing complications such as a renal abscess or spread of infection to the perinephric space [9].

CT imaging is often the modality of choice for the evaluation of APN and renal abscesses. It is superior to intravenous urogram or renal Ultrasonography (US) in detecting renal parenchymal abnormalities like perinephric stranding, inflammatory masses, decreased or delayed cortical enhancement, kidney enlargement or gas formation, all of which may indicate more severe APN [9].

In our study, we find that diabetic patients and patients with renal stones were significantly associated with increased risk of APN and renal abscesses, similar to [10].

The difficulty in diagnosis of renal and perinephric abscess has been well documented in previous study; Choelho et al., [11]. The patients often had vague symptoms with long duration and physical findings did not always reflect the severity of the infection. The spectrum of clinical signs and symptoms remains essentially unchanged, with loin pain and burning micturation (100%), repeated UTIs (96.9%), and fever (71.9%) being the most common presentation. In our study, most patients had symptoms with a duration more than 14 days (56.2%) reflecting significant delay in the recognition of renal abscess and perinephric abscess. Choelho et al., [11] noted similar rates of misdiagnosis. There was a remarkable similarity among patients characteristics, predisposing conditions, and abscess localization (renal and perinephric) in our series and previous study; Choelho et al., [11].
In our study the perinephric abscess on CT scan appear of a nearly around (20 Hounsfield Unit) with a thick wall that enhance after introduction of intravenous contrast material (the ring sign), as described by Kim and Moss, [12].

In our study the renal abscess on CT scan consists of a low attenuation around (0-20 Hounsfield units), distinctly margined, parenchymal lesion that fails to enhance after contrast administration and have an enhancing rim similar to description of Benson et al., [13].

CT is a more sensitive and specific technique for detection of renal abscess and perinephric abscess in all the previous studies, with diagnostic performance within the range of 90%-100%. As it defines the abscess contents, provides information about the renal capsule and Gerota’s fascia and allow precise delineation of small collections (1-2cm) [14].

The improvement and wide spread availability of CT of the retroperitoneum imaging in recent decades improved the diagnosis and treatment of renal and perinephric abscesses [15]. In our series, all cases of renal and perinephric abscess were initially managed by medical treatment alone shows no improvement due to their large size, and proceeded to interventional management. As, reported by Choelho et al., 2007 [11]. However other reports present good results with medical treatment for renal abscess, mainly in cases of early diagnosis, favorable clinical condition, and abscess diameter less than 5cm Wang et al., [16].

Xanthogranulomatous pyelonephritis and emphysematous pyelonephritis are two rare, atypical and severe forms of renal parenchyma infection [17]. CT scan is now the best tool to diagnose these infections, and it is also important to establish the presence and extension of extra-renal involvement [18].

Xanthogranulomatous pyelonephritis represents 1% of all renal infections. The disease is four times more frequent among women between the fiftieth and sixtieth decades of life, but can occur at any age. In the majority of cases the disease is unilateral, and the right kidney is more often involved [19]. In our study, the patients were patients between the fiftieth and sixtieth decades of life, the disease was unilateral affecting the right kidney however, due to our small number of cases there is no gender predominance. The most frequent findings in the XGPN CT scan are calculi, hydronephrosis, kidney enlargement and hypodense areas, with parenchyma destruction [20].

In our patients with XGPN, loin pain, tenderness, recurrent UTI, DM, fever, and lower urinary tract symptoms were the dominant findings in the primary examinations, in addition to CT findings comparable to CPN findings regarding the kidney enlargement and stones; similar to Afgan et al., [21].

In our series, cases of XGPN, shows spread beyond the perinephric space occur into the posterior and anterior pararenal spaces; considered as stage II and shows psoas muscle extension considered as stage III. As reported in Rosado et al., [22].

Patients with emphysematous or xanthogranulomatous pyelonephritis usually require surgical excision and total nephrectomy is the commonly used procedure [23]. Out of 32 cases of renal and perinephric space infection, emphysematous, xanthogranulomatous pyelonephritis, and TB in our study, there are 4 cases of unknown management, otherwise; 10 (31.2%) patients had complete resolution with conservative management, percutaneous drainage was required in 8 (25%) with single case failure and proceeded to nephrectomy, five (15.6%) cases required surgical drainage with single case failure and proceeded to nephrectomy and eight (25%) patients had complete destruction of renal parenchyma with non functioning kidney and extensive retroperitoneum spread, requiring nephrectomy. Rai et al., 2007 [23] study shows out of 29 cases of renal and perinephric space infection and emphysematous pyelonephritis, 16 (55%) patients had complete resolution with conservative management, percutaneous drainage was required in nine (31%), four (14%) patients had complete destruction of renal parenchyma with presence of gas in kidney and retroperitoneum, requiring nephrectomy in three cases and one died. In our study, we have single case of renal TB which shows thin rims of calcifications surrounding low attenuation areas of focal cortical inflammation, as described by Figueiredo et al., [24] with spread to the adjacent psoas muscle as described by Zissin et al., [25].

Finally non-contrast CT imaging will be able to rule out an obstructed collecting system requiring urgent decompression and drainage but it is not ideal for diagnosing complicated renal inflammation, renal abscesses or APN. The major advantage of earlier CT imaging to be performed and hence appropriate interventions to be carried out at an earlier time [26].

CT is the modality of choice for evaluating patients with emphysematous pyelonephritis, xanthogranulomatous pyelonephritis, and acute bacte-
rial pyelonephritis. Findings include renal enlargement and destruction, small bubbly or linear streaks of gas, fluid collections, gas/fluid levels and tissue necrosis, with or without abscess. It also accurately assesses the extent of extrarenal disease, if present, and aids in surgical planning [26].

Conclusion:
In this study we were able to predict that MDCT plays an important role in diagnosis of different renal inflammations and their effect on renal function and associated complications.

We enhanced the role of MDCT in inflammatory renal diseases which include acute and chronic pyelonephritis, renal abscess, perinephric abscess, renal tuberculosis, emphysematous pyelonephritis, and xanthogranulomatous pyelonephritis.

We were able to predict that any patient complaining of loin pain, burning micturation, history of repeated UTIs and fever with duration of symptoms more than 14 days should examined by contrast enhanced multiphasic CT as long as there is no renal impairment.

Patients with impaired renal functions, non contrast CT is done as it is useful in demonstrating gas, calculi, parenchymal calcifications, hemorrhage, inflammatory masses, and will be able to rule out an obstructed collecting system requiring urgent decompression and drainage.

Diabetic patient uncontrolled by medical treatment with repeated history of UTIs and/or renal stones, should be considered as high risk patient, and close follow-up is recommended, once loin pain, burning micturation and fever developed contrast enhanced CT study or non enhanced CT study should done according to renal function levels.

References
Role of MDCT in Assessment of Inflammatory Renal Diseases


25. ZISSIN R., GAYER G., KOTS E., WERNER M., SHA-


الملخص العربي

تهدف هذه الدراسة إلى تقييم دور الأشعة المقطعية في أمراض إنتفاخ الكلى والتي تتضمن إنتفاخ الكلى بحوض الكلبي الحاد والمزمن، الخراج الكلوي، وحروق الكلية، والكلى المزمن، وإنتفاخ الكلى بحوض الكلبي الحاد والمزمن.

وفي هذه الدراسة نسعى للتعريف على تأثير مرحلة المرض إن كانت حادة أو مزمنة على الكلية المصابين من حيث الوظيفة وشكل الكلية، كما أُنا نسعى إلى التعرف على المشاكل المرتبطة بينها والتأكيد أيضا على العوامل المشتركة المساعدة في حدوث هذه الإنتفاخات تقييم المرضى الأكثر عرضة لها، وذلك تم إستخدام طريقة العلاج والمتابة لكل منها بالتدخل الجراحي أو المتابة بالعلاج. لقد تم فحص إناث وثلاً من مريضات مضافة 20 سنة إلى أكثر من 60 سنة، تم حقن ستة عشر مريضا بصورة في الوريد، منهم ستة مرضى خراج حول الكلية، ثلاث حالات إنتفاخ كلي مزمن، ثلاث حالات خراج كلي، حالتين إنتفاخ كلي حاد، حالة واحدة كل يل، وهنا أُنا أُنا ستة عشر مريضا آخران لم يتم حقنهم صنبورة وذلك لإزالة وظائف الكلية لديهم من، خمسة حالات إنتفاخ كلي مزمن، أربعة حالات إنتفاخ كلي حاد، أربعة حالات إنتفاخ حوض الكلبي النفاخي، حالتين إنتفاخ الكلبي بالورم الحبيبي الأسفل، حالة واحدة خراج بالكلية.

لقد تم فحص كل المرضى بالأشعة المقطعية ثم قمنا باستخدام الأصول الناتجة لتقييم بظيفة الكلية والتغير في شكلها والمشاكل المرتبطة في كل حالة.

وأثر الهدف من الدراسة تقدير المرضى الذين تم فحصهم فarily قادرين على تأكيد أن الأشعة المقطعية كان لها دور هام في تشخيص أنواع الإنتفاخات المختلفة وتغييرها على وظائف الكلية والمشاكل المصاحبة لها.