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"ROLE OF UNENHANCED COMPUTED TOMOGRAPHY KIDNEY, URETER, BLADDER (CT KUB) IN THE DIAGNOSIS OF INCIDENTAL FINDINGS"

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ABSTRACT

Introduction: Incidental findings refer to results that are irrelevant to the actual purpose of performing a diagnostic assessment. The superiority of Unenhanced Computed Tomography is that detects ureteral stones, identifies extra-urinary abnormalities, and does not require intravenous contrast.

Objectives: The objective of the study is to better understand the role of Unenhanced CT while evaluating the detection of incidental findings and to determine the medical importance of incidental findings.

Material and Method: From March 2023 to August 2023, a cross-sectional study with consecutive sampling was conducted in the radiology department of the tertiary care hospital Hayatabad Medical

Complex Peshawar, Pakistan. The Institutional Research and Ethics Review Board (IREB) of the Hayatabad Medical Complex Peshawar, Pakistan gave its clearance for the study. Participants' ages ranged from 20 to 70.

Results: Of the total 320 patients, 48 (15%) patients had Incidental findings of which 30 were males and 18 were females.19 patients included the genitourinary, 28 the non-genitourinary, and 1 had both the genitourinary and non-genitourinary Incidental findings. The most frequent genitourinary findings were renal cyst 7. In contrast, the most common non-genitourinary findings were appendicitis 5, which was shown to happen most frequently in those between the ages of 20 to 29. The most affected age group was 30 to 39. ER Physician 31 sent the majority of patients to CT KUB, as compared to Urologists.

Conclusion: The number of incidental findings found by MDCT during the KUB examination for possible kidney stones was much higher than that reported in other study papers. Unenhanced computed tomography is a successful tool for identifying incidental findings and has an immense effect on how patients are managed. Radiology technologists and radiologists' knowledge, skills, and genuine interest play a critical role in diagnosing abnormalities other than kidney stones.

Keywords: Incidental Findings, Genitourinary, Non-genitourinary, Gynecological, Gastrointestinal

Introduction:

The term "incidental findings" refers to results that are irrelevant to the actual purpose of performing a diagnostic assessment [1] With an average lifetime rate of 12%, urolithiasis is one of the most common and recent diseases among urologic illnesses [2], [3]. Renal stones place a tremendous financial burden on both emerging and developed countries [4]. Only 3% of kidney stones are silent [5]. Nearly 8% of individuals without symptoms have urolithiasis [6]. Urolithiasis is more common in wealthy nations and is associated with affluence than other diseases including type 2 diabetes, hypertension, and obesity [7]**.** Urolithiasis is the most prevalent urologic condition in Asia. Variations in heredity, age, weather, diet, ethnicity, and metabolic illnesses are responsible for these variations in incidence among different locations [8]. Urolithiasis is more prevalent among white individuals in hotter nations. Males reach their peak at ages 40 to 60; females do so at ages 30. The prevalence risk for children under 18 is up to 3% [6]. In men, urolithiasis occurs three times more frequently [9]. A typical ER indication is acute flank pain [10]**.** Urolithiasis is very prevalent in different parts of Pakistan, with a peak recorded frequency of 12% [11]. When compared to Europe (5-9%), Canada (12%), and the United States (13%), Asia (1-5%) appears to have a lower risk of kidney stone development in adults. The Middle Eastern region has been indicated to have the most cases of kidney stone patients (e.g., 20% in Saudi Arabia and Sudan, Egypt, the United Arab Emirates, and Iran). This is likely due to the region's hot weather and a greater chance of dehydration, which is a significant environmental factor in kidney stone development. Older men are more likely to get the condition than women (2 to 1), and only 1% to 2% of patients with urinary lithiasis are youngsters [12]. Other specialties in addition to urologists have been known to order CT KUB [13]. In the 1990s, unenhanced computed tomography (CT) was initially developed for stone imaging [14]. Non-enhanced computed tomography of the kidneys, ureters, and bladder (CT KUB) in an emergency is the gold standard for the detection of urolithiasis [15]**.** Due to its accessibility, simple usage, and high sensitivity, CT KUB is the primary test for evaluating urolithiasis [16]**.** It was said to have a 94%–99% specificity range and a 95%–98% sensitivity range. NCCT's broad use is constrained by its high ionizing dosage, high rate of accidental findings, and expensive cost [3]. However, using a thinner slice thickness improves kidney stone identification on unenhanced CT [17]**.** About 10% of CT KUB exams reveal an additional source of the patient's pain [18].

This superiority of Unenhanced CT is caused by its capacity to detect ureteral stones despite their size, location, or chemical composition, identify extra-urinary abnormalities such as appendicitis, diverticulitis, gynecological abnormalities such as hemorrhagic cysts or ovarian torsion that mimic renal colic and does not require intravenous contrast [19]. Particularly for stones less than 5 mm in

size, these diagnostic performances are also noticeably superior [20]. One of the main drawbacks of CT presently is the radiation dose [21]. The ideal CT KUB dose is three times higher than IVU, determined to be between 3-5 mSv (millisievert) [22]. Another benefit of Unenhanced CT is that it provides a general view of the other abdominal organs and the peritoneal cavity with the potential to detect other incidental pathological processes that may receive importance for treatment over the management of urinary tract stones, with rapid identification and consequently early management leading to a better prognosis. and guiding the management plan in the right direction [23]. The American College of Radiology and the European Association of Urology currently propose using low-dose CT in patients with severe infection and skepticism about having urinary stones, however, the American Urological Association no longer makes any sensible recommendations [24]. Through this study, we hope to better understand the role of Unenhanced CT while evaluating the detection of incidental findings and to determine the medical importance of incidental findings.

MATERIAL AND METHOD

From March 2023 to August 2023, In the radiology department of the tertiary care hospital Hayatabad Medical Complex Peshawar, Pakistan a cross-sectional study with consecutive sampling was conducted. The Institutional Research and Ethics Review Board (IREB) of the Hayatabad Medical Complex Peshawar, Pakistan gave its clearance for the study. The study comprised both in-patients and out-patients (male and female) with incidental findings who visited the radiology department and agreed to provide consent. Participants' ages ranged from 20 to 70. Patients who had undergone surgery in the past for renal or ureteral stones, patients who lacked clinical history, or were younger than 20 years old and unwilling to grant consent, were eliminated. 320 CT KUB patients' collective data were gathered. The patient underwent Unenhanced CT KUB on a 128-slice GE CT scanner in accordance with the standard protocol. The examination was carried out in the supine position with the patient's full bladder through the symphysis pubis and 1 cm above the liver. The scan's parameters were 120 kV and 250-300 mA, 0.5 rotation with the Standard Algorithms, 4 mm slice thickness, and a field of view (FOV) that was adjusted for the patient's size. For correct assessment, axial, coronal, and sagittal pictures are collected. A soft-tissue window with 2 mm coronal and sagittal reconstruction was also created. In order to verify any potential distal ureteric calculi, further images were acquired with the patient lying on his back. At the picture archiving and communication system (PACS) workstations, the CT KUB scans were seen. An experienced radiology resident and a consulting radiologist with extensive expertise in radiology imaging prepared the appropriate radiological reports. Any disagreement is resolved by a shared understanding. The radiology team members consulted before producing their last result. Using a data collection form, all patients who had Incidental findings were noted for each imaging. All study data forms were routinely verified for precision, comprehensiveness, and uniformity, and any found mistakes were immediately fixed. Each filled form was organized and then coded with a special research identity.

Genitourinary (GU) and non-genitourinary (non-GU) results were distinguished among individuals who had incidental findings. Additionally, the incidental findings were divided into significant and insignificant groups. The conditions that needed the referring doctor's immediate attention for additional treatment or investigation were within the group of significant findings. The patients were then separated into those who required immediate medical attention, such as for acute inflammatory diseases like appendicitis, cholecystitis, or fluid collection like pleural effusion. These categories included GU and non-GU groups as well as major or minor diagnoses. Deferred treatments were indicated for findings such as lymph nodes and tumors. Depending on the result and expected medical image, additional workup with contrast-enhanced examinations or MRI was advised in such patients. Findings of little clinical significance were categorized as benign lesions that would need treatment later. Examples include cholelithiasis, hernias, and simple cysts. Findings deemed benign and unlikely to call for further testing or treatment were those of no clinical significance. These are

ancient fractures that have been repaired or have not been repaired. For the purpose of verifying the patient's incidental findings, all pertinent radiological exams and laboratory results were examined. Clinical history was examined in the patient's medical record files and radiological referral papers.

Results:

Aside from urolithiasis and blockage, 48 (15%) of the 320 evaluable patients who had CT KUB for suspected urolithiasis also had incidental abnormalities. There were 48 patients with Incidental findings, 30 (62.5%) males, and 18 (37.5%) females. The most affected age group was 30 to 39, with 14 (29.2%), followed by 40 to 49 and 20 to 29 with 11 (22.9%), 50 to 59 with 10 (20.8%), and 60 to 70 with 2 (4.2%). Urban households (27, 56.3%) and joint families (34, 70.8%) were found to be more affected than rural residences (21, 43.8%) and nuclear families (14, 29.2%). The professions most impacted are housewives with 15 (31.3%) and business with 14 (29.2%), while labor and students are affected to a lesser extent with 8 (16.7%) and 6 (12.5%), respectively. Patients with a healthy weight are 28 (58.3%), followed by those who are overweight 15 (31.3%), obese (3), and underweight (2). Clinically, there were 24 patients (50%) with flank pain, 14 (29.2%) with general abdominal discomfort, 2 (4.2%) with lower urinary tract symptoms, 7 (14.6%) with a combination of flank pain and LUTS, and 1 (2.1%) with hematuria. ER Physician 31 sent the majority of patients to CT KUB (64.6%), as compared to Urologist 17 (35.4%). The majority of cases sent by emergency room doctors are male 23 (47.9%), a significant number of flank pain symptoms are found at the age of 20-29 8 (16.7%), and appendicitis occurs most frequently at the age of 20-29 4 (8.3%), according to a cross-tabulation test between gender and patients referred, age and clinical symptoms, and age and appendicitis. According to statistical analysis using the Chi-Square, the sign value is <0.05, indicating that (Ho) is rejected and that there is a correlation between age and appendicitis, age and clinical symptoms, and gender in patients who are referred.

Of the 48 patients who had incidental findings, 19 (39.6%) included the genitourinary system, 28 (58.3%) the non-genitourinary system, and 1 (2.1%) the genitourinary and non-genitourinary systems in which the patient was suffering from both pyelonephritis and cholecystitis disease. The most frequent genitourinary finding was a renal cyst 7, which was followed by a renal mass 3, an extra-renal pelvis 2, a horse-shoe kidney 2, pyelonephritis 2, an atrophic kidney 1, an ectopic kidney 1, and hydrocele 1 as shown in Table- 1. In contrast, the most common non-genitourinary finding was appendicitis 5, which was followed by pleural effusion 4, ovarian cyst 3, cholecystitis 2, cholelithiasis 2, hernia 2, pelvic phleboliths 2, firearm injury 2, mesentery lymph nodes 1, diverticulosis 1, spondylosis 1, fracture 1, and degenerative changes 1 as mentioned in Table- 2.

Figure 1: Incidental findings Distributions

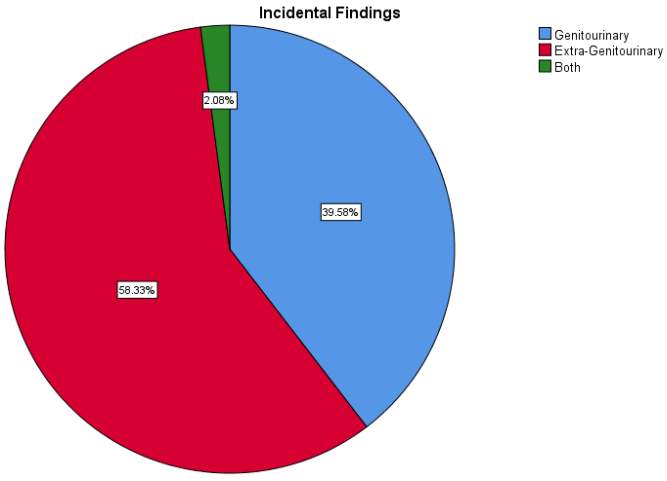

Table 1: Genitourinary Findings and its clinical significance.

Genitourinary (GU)			
Incidental Findings	**Frequency**	**Percentage**	**Clinical Significance**
Renal cyst	7	14.6%	DT
Extra-Renal pelvis	2	4.2%	LCI
Renal Mass	3	6.3%	II
Horseshoe kidney	2	4.2%	DT
Atrophic kidney	1	2.1%	NCI
Duplex collecting system	1	2.1%	DT
Pyelonephritis	2	4.2%	II
Sponge Kidney	1	2.1%	LCI
Ectopic kidney	1	2.1%	NCI
Hydrocele	1	2.1%	II

II, requires Immediate Intervention; DT, Deferred Treatment; LCI, Little Clinical Importance; NCI, No Clinical Importance

Table 2: Non-genitourinary findings and its clinical significance.

Non-Genitourinary (Non-GU)			
Incidental Findings	**Frequency**	**Percentage**	**Clinical Significance**
Appendicitis	5	10.4%	II
Cholecystitis	3	6.3%	II
Cholelithiasis	2	4.2%	DT
Pancreatitis	2	4.2%	II
Spine pathology			
Spondylosis	1	2.1%	DT
Fracture	1	2.1%	II
Degenerative Changes	1	2.1%	DT
Gynecological			
Ovarian cyst	3	6.3%	LCI
Adnexal cyst	1	2.1%	LCI
Gastrointestinal			
Hepatic cyst	1	2.1%	LCI
Mesenteric Lymph Nodes	1	2.1%	DT
Diverticulosis	1	2.1%	DT
Others			
Pleural Effusion	4	8.3%	DT
Pelvic Phelboliths	2	4.2%	NCI
Firearm Injury	2	4.2%	II
Hernia	2	4.2%	DT

II, requires Immediate Intervention; DT, Deferred Treatment; LCI, Little Clinical Importance; NCI, No Clinical Importance

Discussion:

A 128-slice GE MDCT scanner was employed in 15% of the incidental findings during the CT KUB evaluation, which is a little more than what Ummara Siddique et al. found [1]. This could be a result of radiologists' high awareness, extensive expertise, and deep interest in patient diagnoses to concentrate on possible causes that are in the patient's best interest. The function of radiology technologists is equally crucial since they examine all the vital body organs. If they spot something suspicious, they direct the radiologists' attention to it and note it in the radiological report. A 128-

slice MDCT scanner's exceptional quality allows for the detection of small abnormalities during the test because of its great spatial and temporal resolution. The American College of Radiology observed that the majority of incidental findings are likely benign and frequently have little to no clinical importance in the management of incidental findings [1]. There should be precise standards on when and how to analyze accidental outcomes because some of them may have detrimental effects. However, even if they may not be fatal, there are additional illnesses that are significant to be aware of. In our study, the majority of cases sent by ER physicians are male 47.9%, and a significant number of flank pain symptoms and appendicitis are found at the age of 20-29 with the percentage of 16.7%, and 8.3% respectively. It shows that the majority of male patients visits emergency room doctor and early age individuals are at high risk of flank pain and appendicitis.

Unenhanced CT has an additional advantage over the other imaging modalities in that it may uncover unexpected outcomes while performing a CT KUB scan for possible kidney stones. All CT scans, not just the KUB scan, have the potential to find other findings that are either less or more important for immediate intervention. As they progress from having little clinical significance to having much clinical significance, incidental findings of GU and non-GU are quite significant. There are some results in both GU and non-GU that require prompt intervention and appropriate follow-up care in order to avoid adversely affecting someone's life and creating additional issues. Due to the urgency of the situation, those incidental findings needed to be managed at the base level and communicated as quickly as possible to the relevant specialty. In order to induce variations in pathology for simple detection, some abnormalities also require deferred treatments and follow-up using alternative imaging modalities or injecting contrast material. Despite the fact that some results are not clinically significant, CT scans can still pick them up, and radiologists note them in radiological reports so the patient is at least aware of them which can be treated later.

Limitation of the Study:
The main limitation of the present study is that all the Computed Tomography examination was performed without injecting contrast agent and all the patient received no follow-up care. If the contrast agent was injected and these patients had been followed, then it is possible that the percentage of undiagnosed malignancies would be higher.

Conclusion:
The number of incidental findings found by MDCT during the KUB examination for possible kidney stones was much higher than that reported in other study papers. Unenhanced computed tomography is a successful tool for identifying incidental findings and has an immense effect on how patients are managed. The great spatial and temporal resolution of MDCT is also crucial for quickly and accurately diagnosing both major and minor abnormalities, and it can be divided into distinct sections for each section's convenience and to ensure that no abnormality is missed during the examination. Radiology technologists and radiologists' knowledge, skills, and genuine interest play a critical role in diagnosing abnormalities other than kidney stones.

Recommendation:
High-level additional research is required to examine more populations for more assessment, use contrast agents where necessary, and conduct patient follow-up till the end.

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Conflicts of interest:
No conflicts of interest are disclosed by the authors.

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