

Images of Ultrasonography or Abdominal Computed Tomography Scanning in Cases of Malignant Kidney Tumors

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Abstract

Background: The malignant kidney tumor is a urinary tract tumor with the highest mortality and morbidity compared to other urinary tract tumors. The role of USG radiology and CT scan is essential for diagnosing malignant kidney tumors.

Objective: To examine the diagnostic value of USG radiology and CT scan in diagnosing malignancy of kidney tumor and its accuracy in assessing renal tumor operability.

Methods: This study was a retrospective observational study using secondary data of radiological examination including ultrasonography, CT scan and other postoperative results derived from medical records. Data analysis was conducted descriptively.

Results: The sensitivity score of USG, CT scan, and USG and CT scan was 60%, 82%, and 83% respectively. Sensitivity value of ultrasound examination was 60% and CT Scan was 82%. The incompatibility of ultrasound with pathology results was found in the case of hydronephrosis with the stone of 64%, stone of 18%, cyst of 18 %, on CT Scan hydronephrosis with stone (83%) Pyelonephritis (17%). The incompatibility of USG and CT Scan with operating results was 8%.

Conclusion: Incompatibility of USG results with anatomic pathology results was found in cases of hydronephrosis accompanied by stones, kidney stones, and benign lesions (cysts). Incompatibility of CT Scan results with anatomic pathology results was found in cases of hydronephrosis accompanied by stone and pyelonephritis.

Keywords: Malignant Kidney Tumor, Ultrasonography, Abdominal CT Scan

Introduction

Malignant kidney tumors are the third most common tumor in the field of urology, however, malignant kidney tumors have the highest mortality of 40% compared to other urological tumors. There were an approximately 58,240 new cases of malignant kidney tumors and 13,040 patients died in USA (2010). This malignancy is commonly found in elderly. Males are more often affected 1.5 times than women. Many diagnostic kidney

tumors are approximately of 25-40% incidentally.^{1,2} The cases of renal tumor in Renal Cell Carcinoma (RCC) cases between 2006-2011 were 29 patients; stage I of 1 (3%), stage II of 14 (48%), stage III of 4 (14%) and stage IV of 10 (34%) in Dr. Soetomo General Hospital Surabaya.³

The role of radiology is to differentiate renal tumor characterization that leading to a benign or malignant lesion. That role is important for management, due to the role of FNAB and biopsy of renal tumors are not routinely performed on all renal tumors. The biopsy is performed in certain circumstances if there was a renal tumor with the presence of malignancy primers outside

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the kidneys, unresectable renal cancer cases, comorbid surgery, suspicion of an infection, and in the case of indeterminate cystic renal mass.⁴⁻⁶ The sensitivity value of radiological examination to detect renal tumor was; ultrasonography had 79% sensitivity in lesion below 3 cm, CT Scan had 95% sensitivity and MRI was comparable with CT Scan in detecting tumor with a sensitivity of 95%.^{1,7,8}

The role of radiology for the determination of operable and inoperable tumors is important due to the management of different renal tumor therapies in operable tumors performed by radical nephrectomy and in inoperable tumors performed palliative surgery/cytoreductive nephrectomy to reduce pain and improve the quality of life of patients.²

The management of malignant and non-malignant kidney tumors is different, whereas FNAB is not recommended for determining the diagnosis. The determination of the malignancy is based on clinical and radiological examination. Radiological examination is quite instrumental in the diagnosis and its operability of the renal tumor. Therefore, we aimed to examine about the diagnosis value of radiology examination in this ultrasonography (USG) and CT scan in diagnosing malignancy of renal tumor and the accuracy of USG radiography and CT scan in assessing renal tumor operability.

Methods

The subjects of the study were all medical records of patients with kidney tumor at Dr. Soetomo Teaching Hospital Surabaya from January 2009 to February 2014 that fulfilled the inclusion criteria (complete and accessible renal tumor medical record), exclusion criteria (medical record of incomplete kidney tumor) and the patients have signed informed consent.

This study was a retrospective observational study using secondary data derived from medical records. We obtained 40 medical records that fulfilled the criteria then we collected clinical data, radiology examination results including USG, CT scan and postoperative results. Data analysis was performed descriptively. This research was approved by ethical clearance from Dr. Soetomo Teaching Hospital.

Results

Forty subjects were enrolled in this study consisted of 30 males (75%) and 10 (25%) females. Subjects aged 10-20 years of 2 subjects (5%), 21-30 years of 3 subjects (7.5%), 31-40 years of 7 subjects (17.5%), 41-50 years of 7 subjects (17.5%), 51-60 years of 10 subjects (25%), 61-80 years of 11 subjects (27.5%). The age range of subjects was between 12-76 years with the mean age of 50 years. There were patients with kidney tumor with a size of <4 cm as many as 2 subjects (5%), size 4-7 cm as many as 6 subjects (15%), size >7 cm of 32 subjects (80%). The sample of USG examination that had anatomical pathology result of malignant kidney tumor were 17 subjects. The image of USG on malignant kidney tumor found 16 subjects in the form of a solid lesion (94%), increased color doppler flow imaging as many as 5 patients (29%), calcification of 3 patients (17%), complex cysts as many as 2 patients (11%) and irregular edge of 2 patients (11%).

There were renal malignant tumor patients that were performed by CT Scan with the anatomical pathology of the renal malignant tumor as many as 27 patients. CT Scan images on malignant kidney tumor was found in 27 patients in the form of malignant lesion of more than 20 Hounsfield units (100%), in the form of lesions solid as many as 22 patients (81.5%), pelvicalyceal system deformity of 11 patients (17%), complex cysts of 2 patients (11%) and the irregular edge of 2 patients (11%).

We found the results of anatomical pathology in renal malignant tumors by 40 patients; 22 patients with renal cell carcinoma (55%), 8 patients with transitional cell carcinoma (20%), 8 patients with squamous cell carcinoma (2.5%), each one patient with malignant small round cell tumor (2.5%) and Mucinous adenocarcinoma (2.5%). This study obtained the sensitivity of USG examination by 60% and CT Scan of 82%. Twenty-eight patients were tested for USG examination. There was an appropriate diagnosis of a renal tumor in 17 patients and an unsuitable diagnosis on a renal tumor in 11 patients, thus there was incompatibility of 40% and compatible of 60%.

Table 1. Incompatible Distribution of USG Examination with the Findings of Anatomical Pathology Results

USG Results Diagnosis	Frequency	Percentage
Hydronephrosis with stones	7	64%
Stone	2	18%
Benign lesions (cysts)	2	18%

We found incompatibility USG results with histopathologic in 11 patients. There was a diagnosis of hydronephrosis with stones found in 7 patients (64%), stones in 2 patients (18%), and benign lesions (cysts) in 2 patients (18%) (table 1).

Table 2. Distribution of CT Scan Adjustment in Malignant Kidney Tumors

	CT Scan Results	
	Compatible	Incompatible
Anatomy Pathology Result of Malignant Kidney Tumor	27 (82%)	6 (18%)

Thirty-three patients with abdominal CT scan were found. There was an appropriate diagnosis of a renal tumor in 27 patients and an incompatible diagnosis of a renal tumor in 6 patients, thus the compatibility was 82% and 18% of incompatibility. We found incompatibility of CT Scan with histopathology in 6 patients (table 2).

Table 3. Incompatible Distribution of CT Scan Examination with the Findings of Anatomical Pathology Results

CT Scan Results Diagnosis	Frequency	Percentage
Hydronephrosis and stone	5	82 %
Pyelonephritis	1	18%

The diagnosis of hydronephrosis and stone was found in 5 patients (82%) and pyelonephritis in 1 patient (18%) (table 3).

Table 4. Characteristics Distribution of Kidney Tumor Findings from Operating Result

	Frequency	Percentage
Limited to capsules	24	60.0
Penetrating the capsule	11	27.5
Attachment to surrounding organs	5	12.5
Lymphadenopathy	4	10.0
Angioinvasi/Thrombus	4	10.0
Metastasis	1	2.5

There were 35 renal malignant tumor patients performed by radical nephrectomy. The tumor limited to the capsule was found in 24 patients (60%), 11 patients had tumor penetrated the capsule (27.5%), there were five patients who performed cytoreductive nephrectomy,

there was an attachment to the surrounding organs of 5 patients (12.5%), lymphadenopathy of 4 patients (10%), angioinvasion and/or thrombus of 4 patients (10%) and metastasis in the lung in a patient (2.5%) (table 4).

Table 5. Compatibility Distribution of USG and CT Scan Result with Operating Findings

	Frequency	Percentage
Compatible	25	92
Incompatible	2	8

Twenty-seven patients with CT Scan of a renal malignant tumor found similar surgical findings of 25 patients (92%) and 2 patients (8%) were not in accordance with the findings of the surgery (table 5).

Discussion

Seventeen renal malignant tumor patients who were performed by ultrasound examination had anatomical pathology result of the malignant kidney tumor. It was similar to a study that obtained malignant kidney tumors with a solid component of 97%, increased color doppler flow imaging and only 3% of all subjects obtained complex cyst.⁹ The presence of an irregular edge and complex cyst was obtained by wall thickening and the presence of central calcification. Other studies found heterogenous enhancement (71%), homogenous enhancement (29%), irregular edge (31%), and calcification (14%).¹⁰

RCC is the most common malignant kidney tumor by 80-85% of all malignant renal tumors.² whereas renal TCC or urothelial carcinoma (UC) is a malignancy derived from epithelial cells that contain the urinary tract of the renal pelvis to the orificium urethra. The upper urinary tract TCC is suspected to occur in 5% of all urothelial malignancies and approximately 10% of renal malignant tumors.¹¹ SCC in the kidney is a rare primary malignancy and only 1% was found in the malignant urinary tract. SCC in the urinary tract is more common in urethra and SCC is often associated with kidney stones.¹² Sarcoma in the kidneys is a rare tumor by 1% to 2% of all malignancy of renal tumors that usually found in adults aged >50.¹³ Renal sarcoma is rare however, it has higher mortality than other types of renal malignancies. The differentiation of sarcomas than

other malignancies are usually difficult, the findings that support the presence of sarcomas are a tumor derived from the capsule and develops into a large mass and the absence of lymphadenopathy that usually grows fast.² Ewing Sarcoma in the kidneys is an extraosseous Ewings sarcoma tumor that is commonly found in children and young adults by 6% of all cases. This tumor originates from neural crest cells that are derived from the PNET (primitive neuroectoderm tumor) class. This tumor resembles the RCC image and relative diagnosis is difficult thus it is required an immunohistochemical examination.¹⁴

The ultrasound examination was performed on 28 patients with true positive of 17 patients and false negative of 11 patients. Meanwhile, CT Scan examination was performed on 33 patients with 27 of true positive and 6 of the false negative. The sensitivity of USG examination was 60% and CT Scan was 82%, this result was different from the previous studies that obtained USG sensitivity of 79% and CT Scan sensitivity of 94%.^{1,7,9} Lower USG sensitivity compared to literature was caused by operator factor. There was incompatibility of USG findings on hydronephrosis with stone as many as 7 patients, however, CT Scan examination on 5 patients found a mass in the uteropelvic junction (UPJ). Benign lesions (cyst) was obtained on USG examination however, CT Scan obtained solid mass with cysts. Moreover, stones were found in two patients even though CT Scan did not see a mass. Five patients with hydronephrosis with

stone and a patient with pyelonephritis were found in CT scan examination even though it did not see a mass. The stone within the urinary tract was known to be a risk factor for malignancy of the urinary tract, i.e., urinary tract, urethra and jar. There was a study on 47 patients with stones and non-function kidney treated with nephrectomy that found 24 patients with a malignancy, however, 7 patients out of 24 patients were not seen from radiological examination.¹⁵ Raghavendran et al reported a correlation of some cases of stone and malignant renal function impairment. The exact mechanism of the correlation between the stones to malignancy was still unknown, however, the chronic inflammation and mucosal irritation caused by the stones were the contributing factors. Chronic infections, inflammation, and infections caused metaplasia of the collecting system, which eventually becomes a malignancy. Moreover, stones with recurrent urinary tract infections had a 2-times greater risk of malignancy than non-urinary tract infections. Although SCC and adenocarcinoma of the urinary tract were strongly associated with urinary tract stones, TCC was also associated with urinary tract stones. Kidney stones especially staghorn stones might complicate the vision of accompanying neoplasm lesion because the large stones obscured mucosal lesions seen in the radiology examination. It resulted in difficulties of malignancy diagnosis in patients with stones and infections, and histopathology examination and biopsy should be performed at the time of PNL to determine the presence and absence of malignancy in the kidney.¹⁶

There were 35 patients (60%) and 5 patients (12.5%) who were performed of citoreductive nephrectomy. We found 24 patients tumors in capsule, 11 patients had penetrated capsule, adhesions to surrounding organ in 5 patients (12.5%), lymphadenopathy in 4 patients (10%), angioinvasi and thrombus in 4 patients (10%) and metastasis in one patient (2.5%). Radical nephrectomy was performed on almost all patients because there was radioresistance and kemoresistance in RCC. Thus, there was no further therapy other than surgery. Patients in stage I to III was performed with radical nephrectomy meanwhile patients in stage IV was performed using citoreduktive nephrectomy due to an attachment to the surrounding organs, the enlargement of lymphnode multiple, thrombis, angioinvasion, and metastasis. The inoperability criteria were: 1. Large tumor sized >7 cm and adherence; 2. The presence

of bulky lymphadenopathy includes the presence of encasement in the renal vein or large blood vessels; 3. Comprehensive venous thrombosis requires caval venous reconstruction; 4. Expansion of important structures includes mesenteric veins; 5. Experiencing distant metastasis.¹⁷ The compatibility of USG and CT scan findings was 92% and only 8% were incompatible. Incompatibly were found in 2 patients with thrombus and angioinvasion however, the radiology description was not included. CT Scan accuracy was approximately 92%, this was similar to a study by Aysel et al. which stated MDCT accuracy for preoperative staging ranged more than 90%. The Tumor can formed to be benign tumors that not cause cancer and malignant tumors that can cause cancer.¹⁸

Conclusion

The sensitivity value of USG examination in detecting malignant kidney tumor is lower than the sensitivity value of CT Scan. Incompatibility of USG results with anatomic pathology results was found in cases of hydronephrosis accompanied by stones, kidney stones, and benign lesions (cysts). Incompatibility of CT Scan results with anatomic pathology results was found in cases of hydronephrosis accompanied by stone and pyelonephritis.

Ethical Clearance: This study received an ethical test from Dr. Soetomo General Hospital and faculty of medicine Universitas Airlangga.

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Conflict of Interest: There was no conflict of interest from this study.

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