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ORIGINAL ARTICLE

Diagnostic Accuracy of Magnetic Resonance Imaging in Detecting Clear Renal Cell Carcinoma, Taking Histopathology as Gold Standard

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ABSTRACT

Background: Presurgical staging and characterization of renal masses can be accomplished with magnetic resonance imaging (MRI).

Objective: Present study aims to determine the diagnostic accuracy of magnetic resonance imaging in detecting clear renal cell carcinoma, taking histopathology as gold standard.

Study design: Descriptive, cross-sectional study.

Study duration and settings: Study was conducted at department of Diagnostic Radiology, Jinnah Hospital, Lahore from 4th June 2018 to 3rd December 2018.

Material and methods: A total of 133 patients with clear renal cell carcinoma on ultrasonography having age 20-60 years of either genders were enrolled. Patients with pregnancy, previous nephrectomy and contraindicated for MR studies were excluded. MRI abdomen was performed in every patient using the 1.5 Tesla MR system with gradient strength of 33mT/m. MRI findings were correlated with histopathology findings.

Results: MRI of abdomen pelvis was performed in all patients and there were 68 True Positive and six False Positive results observed . Among 59 patients whose MRI was negative, 06 patients (False Negative) found clear renal cell carcinoma on histopathology, but True Negative patients had no clear RCC (p=0.0001).Overall sensitivity, specificity, positive predictive value, negative predictive value and diagnostic accuracy of diagnostic accuracy of magnetic resonance imaging in detecting clear renal cell carcinoma was 91.89%, 89.83%, 91.89%, 89.83% and
90.98% respectively

Conclusion: This study concluded that magnetic resonance imaging is a highly sensitive and accurate non-invasive modality for diagnosing clear cell renal cell carcinoma..

Keywords: Renal cell carcinoma, magnetic resonance imaging, sensitivity

INTRODUCTION

About 90% of all kidney cancers are renal cell carcinomas, which are the most prevalent solid lesions.[1,2] Smoking, being overweight, and having high blood pressure are all examples of etiological variables. RCC risk rises in families having a history of kidney cancer in a first-degree relative. Cigarette smoking and obesity are the best ways to prevent cancer.[3,4]

Medical history (a detailed evaluation of one's previous health conditions) is used to identify any potential risk factors in the diagnosis process.[5] A tumour or an organ enlargement might be detected by palpating the abdomen during a physical checkup. Using ultrasonography or computed tomography, a radiologist can perform a percutaneous biopsy in order to sample the tumour for pathological diagnosis.[6]

Most kidney lesions are found by chance in ultrasound or computed tomography (CT) scans, and they generally occur without any symptoms. It is estimated that 2–3 percent of all adult malignancies globally are caused by renal cell carcinoma (RCC).[8,9] Each RCC subtype's prognosis, metastatic rate, and response to targeted therapy vary.[10] Non-enhanced CT's low soft-tissue contrast limits renal lesion differentiation. Contrast agents increase multiphasic CT4 and MRI detection and discrimination of RCC subtypes (MRI).[11,12] Presurgical staging and characterization of renal masses can be accomplished with magnetic resonance imaging (MRI). Due to an increase in the number of clinical cross-sectional studies, more and more renal masses are being detected. In order to provide appropriate care and aid in staging and prognosis, accurate characterisation of renal masses is required.[13,14]

A total of 110 patients and 121 tumours were found in the investigation. The tumours were on average 2.4 cm in diameter, with 50% of them being clear cell. While defining clear cell as scores of 4 or above had a 78 percent sensitivity and 80 percent specificity, scoring 3 or greater had an 80% specificity rate.[15]

We hope to learn more about the diagnostic accuracy of magnetic resonance imaging in the detection of clear renal cell carcinomas by carrying out this investigation.. The existing body of literature on this topic is really thin, and I've been unable to locate any local studies, so my research will be an important contribution to what's already out there. Furthermore, surgeons will be able to adapt their pre-operative protocols to the patient's needs as a result.

MATERIAL AND METHODS

After receiving approval from ethical committee, this study was conducted at department of diagnostic radiology, Jinnah Hospital, Lahore from 4th June 2018 to 3rd December 2018. Sample size of 133 cases has been calculated with 95% confidence level, desired precision 10%, prevalence of clear renal cell carcinoma as 50%[15], 10% margin of error, sensitivity and specificity of MRI in clear renal cell carcinoma as 78%[15] and 80%[15] respectively. Total 133 patients fulfilling the inclusion criteria were selected. All patients having age between 20-60 years with renal cell carcinoma (hypoechoic, hyperechoic relative or isoechoic) that is clearly visible on ultrasound were included. This research did not include patients who had undergone a nephrectomy in the past or who had an MR incompatible prosthesis or implant.

All abdomen MRIs were performed using 1.5 Tesla MR system with a gradient strength of 33mT/m. MR imaging exams were carried out with the patient supine and a phased-array body coil to improve the signal-to-noise ratio. This contains coronal turbo, spin echo, axial dual-echoes in-phase and opposed phase gradient echo Tl weight pictures, and coronal 3D fat-suppressed GRE Tl weighted images acquired both before and after intravenous contrast administration. A 20-24-second breath hold was used for each sequence. Each patient was surgically resected and the histology report was received from the central laboratory of the hospital, where the patients were being cared for. Histopathology and MRI findings were connected.

A computer programme called SPSS 20.0 was used to evaluate the collected data. Mean and standard deviation were used for age, size of lesion and duration of disease. Frequency and percentage were used for gender and clear of renal cell carcinoma. The contingency 2×2 table was formed to determine the specificity, sensitivity, PPV, NPV, MRI diagnostic accuracy in identifying clear renal cell carcinoma considering gold standard of histopathology. Effect modifiers such as gender, age, size of lesion and duration of disease were controlled by stratifications.

RESULTS

It was found that the average participant's age was 44.46 years old, with a range from 20 to 60. Table 1 shows that 94 (77.68 percent) of the patients were between the ages of 41 and 60. Detail of disease duration, size of tumour is also given in Table 1. Total sensitivity, specificity, PPV, NPV and diagnostic accuracy of MRI in diagnosing clear renal cell carcinoma was 91.89%, 89.83%, 91.89%, 89.83% and 90.98% respectively as shown in table 2. Stratification of diagnostic accuracy with age groups, gender, duration of disease and size of tumour is shown in Table 3.

Table 1: Comparison of BCVA in both interventional groups before and after surgery

Parameters	Characteristics	No. of Patients	%age
Age	20-40	39	29.32
	41-60	94	70.68
	Mean ±SD	44.46 ± 9.35 years	
Gender	Male	75	56.39
	Female	58	43.61
Duration of disease	≤6 months	52	39.10
	>6 months	81	60.90
Tumour Size (cm)	≤7	80	60.15
	>7	53	39.85

Table 2: MRI's accuracy in diagnosing clear renal cell carcinoma, compared to histopathology

MRI	Sensitivity	Specificity	PPV	NPV	Accuracy
Renal cell carcinoma	91.89%	89.83%	91.89%	89.83%	90.98%

Table 3: Stratification of diagnostic accuracy with age (20 -40 years & 41-60), gender (male & female), duration of disease (≤6 months & >6 months) and tumour size (≤7 cm & >7 cm)

Parameter	Cutt-off	Sensitivity	Specificity	PPV	NPV	Accuracy	P-Value
Age	20-40	85.0%	89.47%	89.47%	85.0%	87.18%	0.001
	41-60	94.44%	90.0%	92.73%	92.31%	92.55%	0.001
Gender	Male	95.56%	96.67%	97.73%	93.55%	96.0%	0.001
	Female	86.21%	82.76%	83.33%	85.71%	84.48%	0.001
Duration of disease	≤6 months	90.91%	90.0%	86.96%	93.10%	90.38%	0.001
	>6 months	92.31%	89.66%	94.12%	86.67%	91.36%	0.001
Tumour Size (cm)	≤7	94.87%	92.68%	92.50%	95.0%	93.75%	0.001
	>7	88.57%	83.33%	91.18%	78.95%	86.79%	0.001

DISCUSSION

Since cross-sectional imaging techniques have become more common, up to 80% of tumours have been detected by chance. The use of MRI for the diagnosis and treatment of RCC has grown in recent years. A major benefit of MRI is its ability to detect and classify diseases, making it an excellent tool for treating disease and identifying potential therapeutic targets.[16]

An overall diagnosis accuracy of 91.89 percent in detecting clear renal cell carcinoma can be achieved using magnetic resonance imaging (MRI). Over the course of the investigation, 110 patients had a total of 121 mass lesions found. There were 50 percent of the tumours that were clear cell, and the average tumour diameter was 2.4 cm. Scores of 4 or greater defined clear cell, while scores of 3 or larger defined clear cell with 95% sensitivity and 58% specificity.[15]

MRI is superior than CT scanning for non-ionizing radioactive radiation and tissue preservation, whereas CT is poorer in these areas. There are several methods of MRI that can be used to detect haemorrhage, intracellular fat, and intracystic architecture, including diffusion-weighted imaging, arterial spin labelling, and MR spectroscopy (to name just three), making it particularly useful for cystic and solid masses. RCC detection with CT has been shown to have limitations.[17] To date, MRI for renal imaging has only been used in cases where ultrasonography or computed tomography (CT) failed to provide a definitive diagnosis or to determine whether or not tumour thrombi existed.[18] When it comes to evaluating kidney malignancies that have spread into the inferior vena cava, MRI has supplanted venacavography as the gold standard. With a sensitivity and specificity of about 90 percent, Spiral computed tomography (CT) is regarded to be inferior in this case versus MRI.[19]

T1-weighted MRI shows that ccRCC is not more pronounced than the surrounding renal parenchyma in terms of signal intensity.[20] In contrast to pRCCs or chrRCCs, which show a smaller change in signal intensity following contrast delivery, ccRCCs, which are hypervascular tumours, show a larger heterogeneous enhancement after contrast administration.[21] DW imaging may not be able to distinguish between ccRCC and non-ccRCC subtypes using apparent diffusion coefficient (ADC) values because of inconsistent results in the literature. [22]

CONCLUSION

This study discovered that clear cell renal cell carcinoma can be detected non-invasively using magnetic resonance imaging, which is very sensitive and accurate. It has also significantly enhanced our capacity to accurately stage renal cell carcinoma patients, which has improved patient care.

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