ORIGINAL ARTICLE

Diagnostic Accuracy of Doppler Ultrasound in Detecting Tumor Thrombus in Inferior Vena Cava (IVC) in Renal Cell Carcinoma

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ABSTRACT

Objectives: To determine diagnostic accuracy of Doppler Ultrasound in detecting inferior vena cava tumor thrombus in cases presenting with renal cell carcinoma taking histopathology as gold standard.

Materials and Method: After informed consent, a total of 125 renal cell carcinoma patients were included in the study. Patients' demographic data was entered in proforma in each case.

Setting: The study was conducted at the Department of Diagnostic Radiology Lahore General Hospital, for a period of six months from 21-05-2014 to 20-11-2014 , Lahore.

Research Design: Qualitative , descriptive and cross sectional.

Sampling Technique: Convenient/Non probability sampling. All patients underwent Doppler ultrasound to assess the involvement of the inferior vena cava by tumor thrombi. Tumour specimen was sent to hospital pathology department for its histopathological analysis. The results of Doppler ultrasound were conpared with the findings of histopathology as gold standard.

Results: The mean age of subjects was 46.80±17.01 years. In this study 73 (58.4%) patients were male and 52 (41.6%) were female. Color Doppler Ultrasound revealed that out of total 125 patients, 91 (72.8%) had positive findings while 34 (27.2%) had negative findings, whereas, according to the results of the histopathology 90 (72.0%) patients showed a positive result while 35 (28.0%) had a negative result. Setting histopathology as a gold standard, the overall diagnostic accuracy of Color Doppler Ultrasound came out to be 91.2% The sensitivity was 94.44% and specificity 82.86% of Color Doppler Ultrasound. The negative and positive predictive values were found as 93.41% and 85.29% respectively.

Conclusion: Diagnostic accuracy of Doppler ultrasound is high (sensitivity =94.44% and Specificity = 82.86%) in detecting tumor thrombus in inferior vena cava in cases of renal cell carcinoma by taking histopathological findings as gold standard. Due to good diagnostic accuracy of Coloured Doppler ultrasound it can be used as a preferred investigation to CT scan for accurate diagnosis.

Keywords: Thrombus, renal cell carcinoma, Doppler ultrasound

INTRODUCTION

Renal cell carcinoma (RCC) accounts for 90% - 95% of malignant neoplasms arising from the kidney. Recent advances in diagnosis and surgical /systemic therapies have significantly altered the way RCC is managed. RCC is the most common primary renal malignant neoplasm in adults accounting for 2% - 3% of thel malignant diseases. It is the seventh most common cancer in men and the ninth most common in women.[1, 2] Intravenous tumor thrombus has been reported in up to 11.3%, in up to 8.1% of cases tumor thrombus extend into the inferior vena cava (IVC) or right atrium.[3] Most cases of RCC are incidentally diagnosed on radiographic investigation done for other reasons.

The classic triad of hematuria, abdominal pain, and the presence of a palpable mass is present in ≤ 10% of cases.[4] Moreover, Imaging has an important role in the staging of RCC; its role in diagnosis and monitoring is expanding. CT is the preferred modality for analysis of renal tumors; Ultrasonography is utilized in patients with renal insufficiency or contrast sensitivity.[5] and is particularly used for screening and primary investigation. Percutaneous biopsy is also considered as part workup of renal masses.[6, 7]

A local study reported that the sensitivity and specificity of Doppler ultrasound in detecting IVC tumor thrombus is 100% each[8]. Another study

reported that sensitivity and specificity of Doppler was 66.7%, 100.0%, respectively. Moreover, the

Doppler sensitivity for detection of these cavo arterial thrombus was 68.8%.3 The above statistics for diagnostic accuracy are not in agreement to each other so there is a clear controversy in the results.

MATERIAL AND METHODS
Study was carried out in Radiology department, Lahore General Hospital, Lahore for period of six month from 21-5-2014 to 20-11-2014.
Study Design: quantitative, descriptive and cross sectional
Sampling Technique: Convenient/Non probability sampling.
Inclusion criteria: Both genders from 18-80 years of age having renal cell carcinoma referred to radiology department were included.
Exclusion Criteria: Those with a history of DVT and those who were not fit for surgery were removed from the study A total **of** 125 patients were included, after taking their consent, for determining the sensitivity and specificity of Doppler ultrasound in detecting venous tumor thrombus at 66.7% and 100% respectively 8 .At a confidence interval of 95% and 8.5% desired precision, 95% 2 of all kidney cancers are renal cell carcinomas (RCC). Using Non- probability, purposive sampling, both genders from 18-80years of age having renal cell carcinoma referred to radiology department were included while those with a history of DVT and those who were not fit for surgery were removed from the study. Patients' demographic data was entered into a proforma in each case. All patients underwent Doppler ultrasound to assess the involvement of the inferior vena cava by tumor thrombus. Tumour specimen was sent to hospital pathology department for its histopathological analysis. The results of Doppler ultrasound were confirmed with the findings of histopathology. The data was taken on a proforma and was analyzed through SPSS version 18. the mean and standard deviation for variables, i.e. age. percentage and frequency were calculated for qualitative variables. Negative predictive values and positive predictive values sensitivity and specificity of Doppler USG were calculated taking histopathology findings as gold standard.

RESULTS
SPSS version 18 was used to enter the data and simple percentages were calculated.

The average age of subjects was 46.80±17.01 years ranging from 18.0 and 80.0 years.

Out of these, 58 (46.4%) patients were in age group of 18-45 years and 67 (53.6%) patients were in 46-80 years of age.

Moreover, 73 (58.4%) patients were male and 52 (41.6%) were females in this study.

Color Doppler Ultrasound showed that out of total 125 patients, 91 (72.8%) patients had positive findings while 34 (27.2%) had negative findings, Whereas, according to the results of the histopathology 90 (72.0%) patients showed a positive while 35 (28.0%) had a negative result.

The similarity for positive results of both Color Doppler Ultrasound and histopathology was seen for 85 (94.4%) patients, while for negative results, both procedures gave same findings for 29 (82.9%) patients. In 6 (17.1%) patients, ultrasound showed a positive result and histopathology showed a negative result. Whilst for 5 (5.6%) patients, ultrasound showed negative result but histopathology gave a positive one.

Considering histopathology as the gold standard, the diagnostic accuracy of Color Doppler Ultrasound was 91.2% , the sensitivity 94.44%, specificity 82.86% and the positive and negative predictive values came out to be 93.41% and 85.29% respectively.

The sensitivity of Color Doppler Ultrasound for18-45 years age group was 100% with relatively lesser sensitivity of 89.36% for 46-80 years age group. The specificity for 18-45 years age group was 80% and for 46-80 years age group it was 85%. The positive predictive values were almost same for both age groups (93.48% and 93.33% respectively). The negative predictive value for younger age group (18-45 years) was much higher (100% vs 77.27%) than the older group(46-80 years). The overall diagnostic accuracy of Color Doppler Ultrasound was higher in younger age group (18-45 years) than older(46-80 years) group (94.83% vs. 88.06%).

The sensitivity of Color Doppler Ultrasound for males was 93.33% and for females 95.56%. The specificity for males was much lesser being 78.57% compared to female group being 100%. The positive predictive value was also lesser in male group compared to females (87.5% and 100% respectively). The negative predictive value for males was however higher (88.0% vs 77.78%) than females. The overall diagnostic accuracy of Color Doppler Ultrasound was 94.83% in males whereas 96.15% in females.

DISCUSSION

Renal cell carcinoma has a tendency to spread as tumor thrombus into the renal vein and inferior vena cava (IVC). Some of the commonly used Imaging procedures for identification of and to assess spread of renal vein and IVC thrombus include CT, ultrasound (US), MR and venacavography.9 Therefore we opted for this study to see diagnostic accuracy of Color flow Doppler Ultrasound in detecting IVC renal Tumor taking histopathology as gold standard.

Studies show highly compatible results with ours indicating similar results that middle aged to elderly aged people are highest at risk of developing this disease, though it may also effect children without any difference in sex.10One international study reviewed number of international publications focusing on demographic and epidemiological trends of this disease and found that the greatest incidence occurs in the 60 years, with 80% of them in the fourth and seventh decade of life .11

Another review constituting most of the ethnic and geographical regions across the world suggested that the overall incidence in males was about twice that of females, regardless of their racial/ethnic origins. In comparison to males, the incidence rate was more comparable among females across racial/ethnic groups, except for the lesser rates among Asian/Pacific Islanders.12 In another study, the estimated survival in 5 years, in men, was reported to be slightly lower than females (54% vs. 57%). In our study, 73 (58.4%) patients were male and 52 (41.6%) were females.13

Some studies present varying findings and prove USG to be an unreliable method. In one series of 431 patients, conventional sonography has the sensitivity of 68% and the CT and sonography were suggested as unreliable methods in delineating the cephalic extent of thrombus.9However in our study we found that Color Doppler Ultrasound showed that from 125 patients, 91 (72.8%) patients had a +ve result while 34 (27.2%) had a –ve result, Whereas, according to histopathology 90 (72.0%) patients showed a positive result while 35 (28.0%) had a negative result. The diagnostic accuracy of Doppler Ultrasound was 91.2% setting histopathology as the gold standard. The specificity and sensitivity of Color Doppler Ultrasound was 94.44% and 82.86% respectively. The positive and negative predictive values of Color Doppler Ultrasound were reported as 93.41% and 85.29% respectively.

Other studies, however, strongly support our rationale and report that contemporary imaging techniques have contributed significantly to the detection and staging of renal cell carcinoma. The accuracy of current imaging methods in detecting renal cell carcinoma approaches 100%. The initial detection of renal masses can be achieved by many imaging methods, including excretory urography, ultrasound (US), or CT scan.14,15 One Pakistani study also reported that the sensitivity and specificity of Doppler ultrasound in detecting this renal venous tumor thrombus was 100% each.8 Yet another publication reported that the specificity and sensitivity of coloured Doppler to be 66.7% and 100.0%, respectively. Moreover the sensitivity of coloured Doppler for detection of this cavoatrial thrombus was 68.8%.3

Thus the evidence emerging through our study, in consensus with majority of international studies shows the significant and accurate role of imaging in general and ultrasonography in particular, as dependable tools for diagnosis of this disease. Many imaging techniques are available to help stage renal cell carcinoma, including CT scan, MR imaging, US, renal angiography (RA), digital subtraction angiography (DSA), and inferior venacavography (IVCG). The choice often depends on the local preference of the physician, risk factors for the patient, the strengths of the imaging methods, and the stage of a tumor under examination.14 Further studies should, hence, be conducted to compare these techniques with each other and establish the evidence based status of each method.

CONCLUSION

Diagnostic accuracy of Doppler ultrasound is high (sensitivity =94.44% and Specificity = 82.86%) in detecting tumor thrombus of the inferior vena cava in cases presenting with renal cell carcinoma by taking histopathological findings as gold standard. Due to good diagnostic accuracy of Colour Doppler ultrasound it can be used as a complementary investigation to CT scan for accurate diagnosis.

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