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# Feature Extraction by Gray Level Co-occurrence Matrices Parameters in Computed Tomography of Renal Cell Carcinoma

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**Abstract:** Renal cell carcinoma (RCC) is the most primary malignancy occurrence in the kidney. More than 60,000 cases of kidney cancer in the world are identified and 14,000 cases are death is caused by this disease in the world. Most of the innovated research work has done in order to cure RCC in the primary stage itself but there is no use of Radiotherapy and Chemotherapy. Finally, the clinical image investigator has the full authorization of identification of the origin of RCC .The computed Tomography (CT) is of multidetector used to investigate the slice of images of RCC in the early . Successful comparison is made between one imaging techniques with the two clinical investigation directly. The Urologist always has a discussion with the Radiologist to avoid the surgical treatment. The Feature extraction of those imaging and clinical data gives 100% accuracy of 11/17 parameters. The degree of correspondence of invasive and non-invasive diagnosis of RCC 98% true.

**Keywords:** Renal cell carcinoma, Benign , Computed Tomography, Feature extraction, GLCM

## I. INTRODUCTION

Over the last 5 decades there has been a growing drift to define small renal cell masses present in the kidney in which the area of interest is not known by anyone. The masses present below 4cm in diameter are any interest of region is the origin of the renal cell carcinoma in world wide.The reason for this task is a different imaging modality has undertaken to investigate the incidence of cell carcinoma. The ultrasound is a screening test and the RCC incidence opinion is highly based on the experienced clinician. Even though there is a lot of problem facing in this incidence, they have given a different opinion to analyze the RCC.Finally; the challenge has taken by an urologist not to suggest the surgical treatment after discussion with the Radiologist. The CT imaging technique gives the clear picturization of the images. The urologist asked the radiologist to give more and more exploration explanation for not only the incidence of RCC but also the clear analysis of mass present in it. The cystic type of fluid mass delineates and differentiates the solid mass of RCC. Bidirectional information is gathered for the RCC incidence in the kidney, between the urologist and Radiologist. There is a parallel reviewing analysis of RCC between them. Initial stage carcinoma can be successfully treated with surgery is more favorable. Later on the advanced stage of renal cell carcinoma prediction leads to critical and failure of Radiotherapy and chemotherapy. Even though before the arrival of imaging techniques, the urologist and the patient are facing lot of problems in diagnosis. Emerging of the imaging modalities in clinical increases the urologist in smiling face. The information explored with the help of CT is high favorable to prognosis and avoid surgery.The protocol of the CT imaging and Biopsy is detailed in figure. 1.

The radiologist should provide a high-quality imaging investigation, is very important. The experienced radiologists provide the clear information of RCC with a high quality imaging examination and also exclude the simulator of renal neoplasm. The radiologists should provide important key points during their therapeutic decision-making in their reports:

- 1) sign of strand fat in the renal
- 2) disturbance in the metabolic behavior after contrast administration, visualize to characterize benign SRM in CT,
- 3) the complete need of studies , imaging and biopsy
- 4) accurate and standard measurement of metastasis diameters of the SRM,
- 5) signs of active tumor tissue after conventional treatments(Renal mass partially removed),
- 6) Differential prognosis of residual tumor with complications
- 7) Protruding of renal mass in the kidney margin causes riot and used to achieve hemostasis.

## 8) Signs of disturbance occurring in the neighboring organs

The Precise prognosis of a renal cell mass depends on many factors clinically. There is some clinical issues, the urologist have to report to the radiologist

- 1) presence of a ancestral disorders,
- 2) presence of infection urological tract
- 3) consequences of the renal mass prognosis
- 4) presence of any prior information of calculi/nodule and any treatments,
- 5) presence of persistent pain in the abdomen
- 6) presence of irregular pain near the hip or margin of kidney area,
- 7) presence of kidney disease
- 8) presence of irregularity in excretory wastages.
- 9) finally confirmed RCC in biopsy examination.

The invasive (Biopsy) and non-invasive (CT Imaging) methods of comparison of features are successfully 98% accurate.

An effective segmentation method of anatomical kidney organ is aided in computer diagnosis (Daw-Tung Lin et al., 2006). Conversion of color images to gray level occurrence is detailed in this. (Kang et al., 2009). Gray level based similar on neighboring organs contrast and labeling method of organs position is proposed (Gao Yan et al., 2010). A research methodology of differentiation between solid renal tumors and CT imaging (Zhang J,2007). RCC correlation of CT imaging <3cm is the initial stage of tumor occurrence (Bosniak et al., 1998, Silverman S.G et al., 1994 & 2006). Separate left and right kidney boundary and its dice similarity coefficient is obtained (Daw-Tung Lin et al., 2006). An initial image segmentation of renal boundary of CT image gives the identical pixels (Zhang Y J, 2009). An initial origin of solid renal mass is identified always as <4cm in kidney (Remzi et al., 2006). A active contour model of boundary detection of renal proposed and dice similarity coefficient is determined (Gomalavalli et al., 2016). A fine needle biopsy sometimes gives the nondiagnostic result and once again the biopsy is repeated for the patients recovery (Leveridge et al., 2011)

Having a final formal association between urologist and radiologist for this research paper, the goal of the two supplementary sections submitted for the RCC prognosis and advises given by the radiologist to manage the SRM in RCC.

## II. MATERIALS AND METHODS

Imaging and Biopsy were played the supreme role in comparison features of them with reference to the Hounsfield standard. From last 3years Statistical analysis (Pandharipande et al.,2010) was performed to determine the significance of CT criteria in differentiating RCC from benign lesions and also in comparison of Imaging Malignancy features and Biopsy features.

### A. Patients

Our institution and medical institution Board of ethics committee approved the respective study and ignored the informed consent requirement. Reviewed the records of all percutaneous biopsy renal mass performed with respect to CT (Gervais et al., 2003) guidance from 2014 to 2017. More over 101 cases were handled during this year, out of this only 55 cases are compared with images of renal biopsy (Heilbrun et al., 2012), acceptance is 100% true and the other cases are avoided due to the other renal lesion except Malignancy. The avoided images are also benign, fat content etc., Only if the region of interest (ROI) of image and biopsy same then only features are same datas otherwise slight variation occurs.

### B. CT Examinations

All CT examinations were performed with Philips Brilliance 16/ GE Light speed VCT OF 120KV, 220 to 250 mAs of slice thickness 2mm. All patients undergone T CT, which include arterial phase, venous phase and delayed phase. The scan delay time for each patient is varied from 60 to 90 seconds. The iodinated IV contrast media given for the enhancement of image visualization. All images were sent to the PACS section for interpretation on workstations.

### C. Analysis of CT image

Experienced Radiologist of 7 to 8 years were reviewed for interpretation of images at the PACS section, who is responsible to measure tumor in a particular region with the correlation of Hounsfield unit. Arising of CT imaging technique (Kim et al., 2002) makes the pathologic results as blinded. Quick response is best then the pathology reports. The quantitative and qualitative assessment of tumor lesion is evaluated by the radiologist. The tumor lesion is of ball and bean shaped lesions. The contour

detection of ball shaped renal mass (Dunnick et al., 1992) is superior than the bean shaped lesions. The qualitative assessment of tumor enhancement is determined by visually. The degree of enhancement is vary for the hypo dense (cyst) and hyper dense (carcinoma). Tumor attenuation is the value of Hounsfield unit, where the content of cell present. The strength of tumor cells represents the Hounsfield unit. It is kept as the reference for the imaging and Biopsy. TIME is a measure of success and diagnostic efficacy surely have proven early predictions and documented utility of CT to be true.

*D. Renal Image segmentation*

Renal segmentation is the detection of renal mass (Dyer et al., 2008) in the kidney. As it mentioned uses, Active Contour Detection method with additional constraints. The following assumptions are taken into account:

- 1) Region (where the interest is hide),
- 2) Contour design (Smooth snake model),
- 3) Prior knowledge of shape (i.e. the geometrical structure of interest),
- 4) curving figure, presented in energy functional form:

$$E(C) = \lambda_1 R_1(C) + \lambda_2 R_2(C) + \lambda_3 R_3(C) + sur$$

Where  $R_1(C)$  is the region,  $R_2(C)$  provides the information about the boundaries,  $R_3(C)$  is the geometrical model and sur ensures the smoothness of the surface Level

*E. Benign*

Indeterminate cysts are based on attenuation and contrast enhancement whose Hounsfield unit is less than 80HU. The diagnosis of renal mass present in the initial stage of fluid content is the benign. Benign may be extended to solid mass (Frank et al., 2003) content (RCC). The difference between Benign and Malignant is illustrated in table 1.

CT IMAGING PARAMETERS OF BENIGN CYSTIC AND MALIGNANT				
PARAMETERS	BENIGN CYSTIC	P-Value	MALIGNANT	P-Value
ENTROPY	0.9173	0.0432	0.9947	0.0455
ENERGY	1.02715	0.0403	1.0020	0.0406
CONTRAST	1.4464	0.0010	1.7175	0.0012
HOMOGENITY	0.9741	0.0235	0.9693	0.0365
CORRELATION	0.9603	0.0005	0.8707	0.0004
SUM ENTROPY	0.8392	0.0550	0.8270	0.0654
DIFFERENCE AVERAGE	0.1024	0.1020	0.1253	0.0990
INVERSE DIFFERENCE	1.1739	0.0056	1.0894	0.0001
INFO_CORRELATION 1	-0.6792	0.0098	-0.3747	0.4594
INFO_CORRELATION 2	0.8764	0.0088	0.7149	0.5362

Table 1 Parameters of Benign Cyst and Malignant

Benign may be extended to solid mass content .Benign is always represent as Hypodenser medium of fluid type content the affect is very less and curable.

**F. Renal cell carcinoma**

The diagnosis of renal mass lesion present in the kidney states the Malignancy Tumor. The strengthening of tumor content cells in the kidney, extends to metastasis stages and then to necrosis, finally debris.

For the diagnosis of renal cell carcinoma, the radiotherapy and chemotherapy are free handed.CT imaging techniques arise to provide detailed interior explanation. The imaging characteristics of RCC various from cystic to solid mass, from homogeneous to heterogeneous and necrotic to debris, from small to large, and from initial origin to extensive. The content based appearance of small RCC is a homogeneously hyperdense/hypo dense mass, with an attenuation value of 80 HU or more. The input, output image of malignant and Parent boundary segmented (Gomalavalli et al., 2016) are seen in figure 1 (a, b, c, d). The neighboring organs like liver lungs are affected by the protruding of malignant cells results in low Jaccard similarity (coefficient is in figure 1 (e , f).However, a small proportion of RCC are hypodense (black), and the amount of enhancement is minimum.

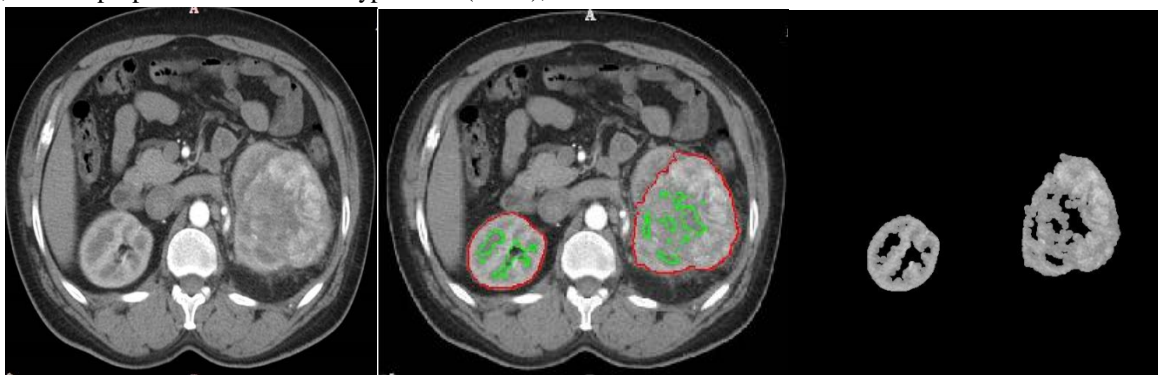


Figure 1 (a) Input image Figure 2 (b) Boundary Segmented Figure 2 (c) Output image

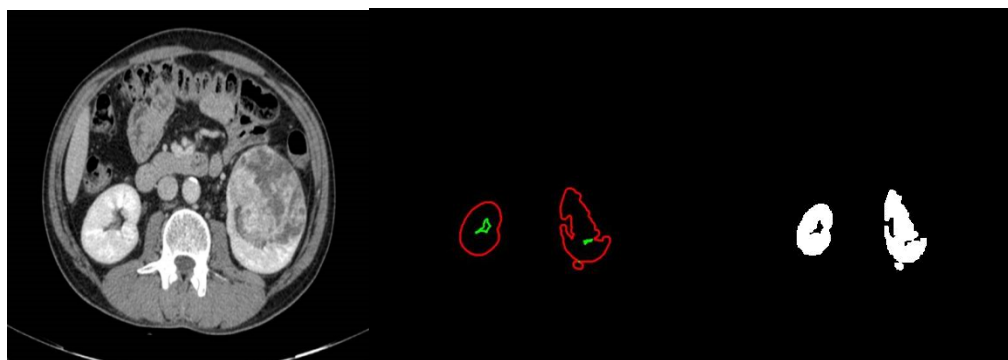


Figure 1 (d) input image Figure 1 (e) Parent Boundary Segmented Figure 2 (f) Neighboring organ affected of area 3045,4086

Fat content in renal,no differentiation of benign and RCC. Furthermore, a small RCC can be hyperdense. If the lesion is depicted only on enhanced CT, delayed scanning can also be used. Based on the radiologist interpretation, can classify the benign and RCC.Each pixel present in the images gives the attenuation value.A typical cells proliferation in abnormal fashion results in the RCC lesion.Depending upon the content of cell present the Hounsfield Unit (HU) varies.CT image contrasts vary with respect to the window size.Eventhough the coverage area of RCC is small or larger in size,the HU does not vary,i.e. it is constant.As per the clinical diagnosis the HU value is interpreted and displayed.The range of Hounsfield Unit determines the strength of malignancy.

**III. BIOPSY**

Indeterminate renal mass lesion present <4cm diameter is the acceptance and recovery of Biopsy.Last few years, in part due to the development in the new imaging technique pathology section, the sign for renal mass biopsy (Maturen et al., 2007) have increased and confirmed as RCC. During high surgical risk to avoid the biopsy is invented for further solid mass present in kidney. Biopsy is cost effective, play a greater role in decision modeling therapy and management of Indeterminate RCC (Motzer et al., 1996). An

indeterminate renal mass is one which cannot be prognosis confidently as malignancy or benign. Benign disease is more frequently occurs compared to malignancy. Biopsy utilizes the needle procedure in order to avoid the surgical treatment. Sometimes after biopsy the imaging technique of initial stage malignancy is confirmed as benign. Apart from there is a death stage of necrotic arises to severe state of tumor. Sometimes the biopsy produces non diagnostic results to malignancy. Renal Biopsy (Belang et al., 2007) differentiates the infected cystic, metastasis and malignancy, which are the cause of indeterminate renal masses.

#### IV. FEATURE EXTRACTION OF RENAL CANCER

The parameters determined with the help of CT imaging segmentation (Davis 1975) and clinical Biopsy method gives the matching features is tabulated in table 2. The accurate identical images produce the same value of parameters. The accuracy value of Biopsy correlate with the CT imaging parameters (Maturan et al, 2009). The Gray level co-occurrence parameters are basic parameters for image processing mainly display the important values.

The graphical representation is made for the similar parameters and shown in the figure 3 plot of invasive and non-invasive. From the plot we can understand that the data's obtained are more or less equivalent to each other. This indicates the CT imaging provides the non-invasive method of identification of malignant with the clinical appliances.

MATCHING PARAMETERS OF INVASIVE AND NON INVASIVE METHODS				
PARAMETERS	CT IMAGING (NON INVASIVE)	<i>P-Value</i>	IMAGING OF CLINICAL BIOPSY (INVASIVE)	<i>P-Value</i>
ENTROPY	0.9173	0.0632	0.9738	0.0454
ENERGY	1.02715	0.0403	1.0031	0.0511
CONTRAST	1.4464	0.0210	1.4602	0.0300
HOMOGENITY	0.9741	0.0535	0.9739	0.0450
CORRELATION	0.9603	0.0105	0.9001	0.0301
SUM ENTROPY	0.8392	0.0532	0.8210	0.0522
DIFFERENCE AVERAGE	0.1024	0.1000	0.1171	0.0970
INVERSE DIFFERENCE	1.1739	0.0502	1.0966	0.0500
INFO_CORRELATION1	-0.6792	0.0065	-0.4542	0.0072
INFO_CORRELATION2	0.8764	0.0044	0.7333	0.0055

Table 2 Parameters of CT imaging and Imaging of Clinical Biopsy

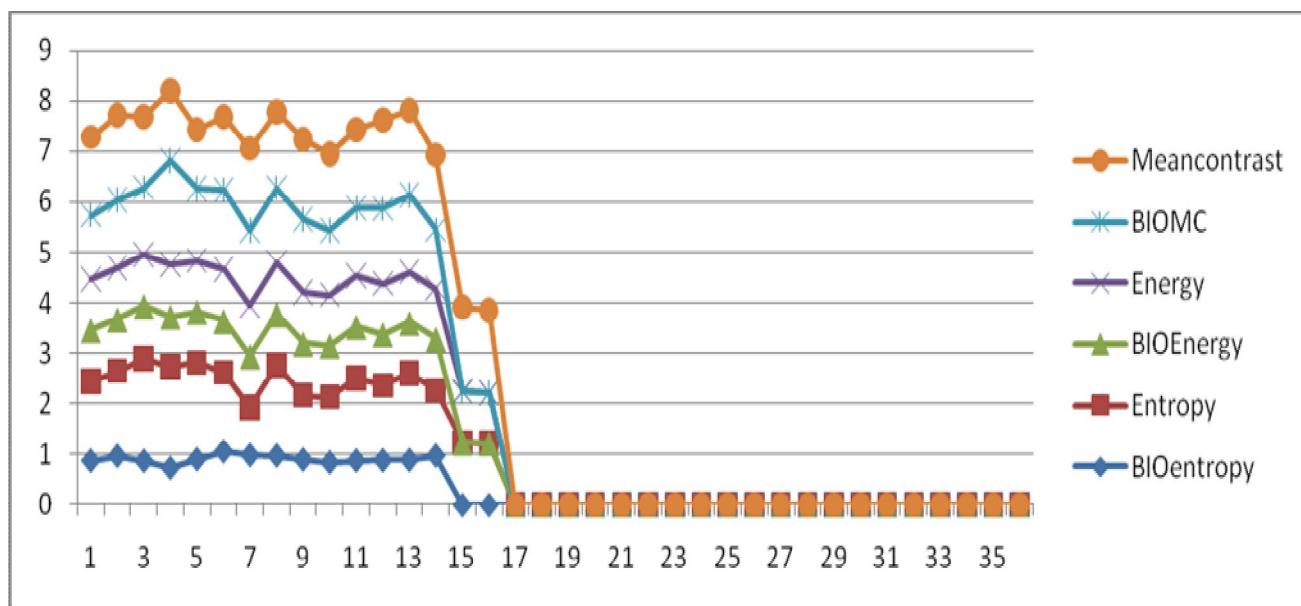


Figure 3(a) combined parameters of matching CT and Biopsy

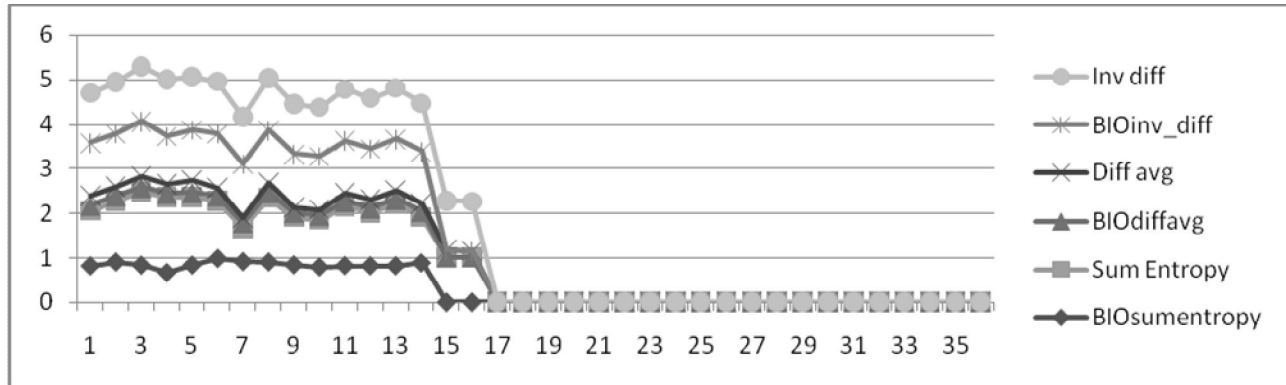


Figure 3(b) combined parameters of matching CT and Biopsy

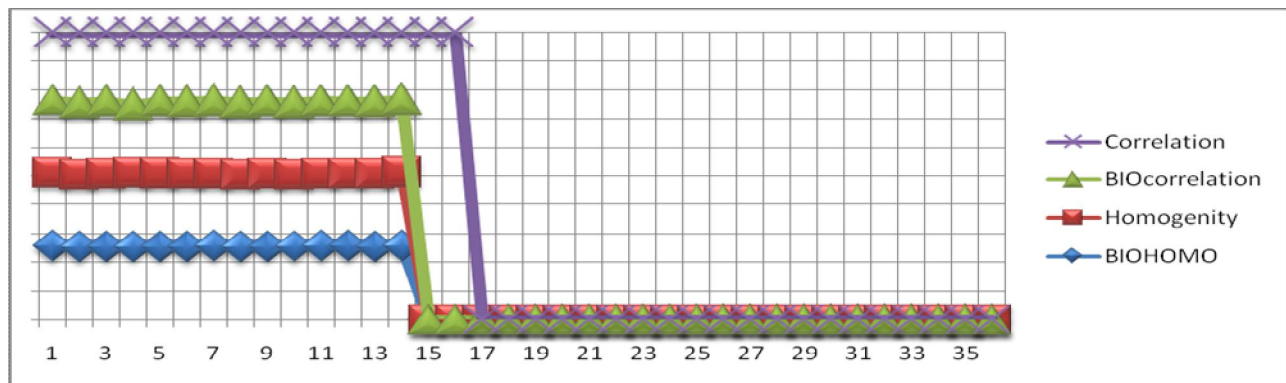


Figure 3(c) combined parameters of matching CT and Biopsy

**A. Advantages**

- 1) Renal mass tumor is identified
- 2) Gas and other structures are clear
- 3) Better needle visualization
- 4) Differentiation between Benign and Malignancy
- 5) No size difference but ROI is different
- 6) High quality image, experienced radiologist and avoiding surgical treatment.
- 7) A significant association

**B. Limitations and future Extension**

- 1) Staging error occurs because of limitations of imaging techniques.
- 2) Some of the five parameters are not meeting the same range of values because imaging ROI and the Biopsy ROI is in different meet.
- 3) Extension of mass protruding in the neighboring organs like, lung, liver and blood vessels causes hemostasis
- 4) For patients the iodinated IV contrast material is allergy, which cannot tolerate.
- 5) Limitations of Biopsy has been the rate of non-diagnostic results.
- 6) Quantitative analysis of initial stage renal mass collapsed with the benign cystic.
- 7) Fat content makes no differentiation in CT criteria

**V. RESULTS AND DISCUSSIONS**

Totally 282 cases out of this 78 cases are biopsy malignancy, 130 cases are imaging malignancy and 76 cases are of benign. When biopsy is repeated for the imaging malignancy samples in 18 of the initial 78 non diagnostic samples, (15%) were RCC. From this confirmed the non diagnostic biopsy cannot be considered as evidence of benign. Imaging guided biopsy exceeds the needle biopsy. CT imaging techniques of diagnosis, detection of renal mass in kidney is a challenge succeeded in imaging .Needle biopsy investigation can be misread as non malignancy, after someday extends to metastasis viewed in CT imaging techniques.

A total images of malignant and of benign masses images measuring 50X50 pixels are transferred into a GLCM and Run length parameters. The extracted features are shown in table 1. Similarly the comparison between the non biopsy images and biopsy images is done. Based on sigma stat 4.0 software, among the extracted GLCM features eight features are selected as best. Eight features can correctly correlate the same values of the between CT imaging and biopsy are very obvious in figure 3(a),(b) & (c). From the figure the origin of values and the end of value of the features are same step of CT imaging (non biopsy) and biopsy, which clearly indicates the shun of biopsy. Nowadays, many of the radiologists are expert in identification of the stages of renal tumor in the earlier stage. The computed tomography image is the best imaging modality of accuracy 98.9%, with the sensitivity of 99.3%.

## VI. CONCLUSION

- A. CT is the imaging modality used for evaluation of indeterminate renal mass for malignancy
- B. Comparing with the imaging techniques the contrast media iodinated iv contrast media is allergy for the patient.
- C. CT gives the interior and elaborate visualization information to avoid the renal biopsy.
- D. Neighboring organs (liver,lungs etc.,) are affected by the protrudence of renal mass lesions

Renal Biopsy is the concluded section of renal mass lesion present in the kidney with respect to the CT imaging technique.

## VII. ACKNOWLEDGEMENT

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## VIII. CONFLICT OF INTEREST

None Declared

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