

Diagnostic value of trans rectal ultra-sonography in comparison with MR imaging in detection and characterization of prostatic lesions

Nahla M. A. Hasan *, Khaled F. Zaky*, AbdElbaset A. Mohamed ^, Mohamed A. A. Elsherif *

Diagnostic Radiology Department, sohag Faculty of Medicine^ Urology Department, sohag Faculty of Medicine

Abstract

Aim: To evaluate the diagnostic accuracy of MRI techniques in detection and characterization of different prostatic lesions in comparison with TRUS.

Patient and Methods: This prospective study include TRUS and MRI prostate of 30 adult male patients presented by different prostatic lesions obtained by using 1.5T machine, using pelvic phased array coil and/or endorectal coil. Pulse sequences include conventional (T1W&T2W) , MR spectroscopic imaging (MRSI), diffusion-weighted imaging (DWI) and/or dynamic contrast-enhanced MRI (DCE-MRI). The mp MRI results are correlated with TRUS results and histopathological reports obtained after TRUS biopsies

Results: It was found that MRI has 100% sensitivity ,53% specificity ,68.2% positive predictive value ,100% negative predictive value and 76.7 % overall accuracy for malignant prostatic lesions diagnosis compared with histopathological findings. BUT TRUS has 40% sensitivity , 53.3 % specificity ,46.2% positive predictive value ,47.1% negative predictive value and 46.8 % overall accuracy for malignant prostatic lesions diagnosis compared with histopathological findings

Conclusion The currently used diagnostic tools are digital rectal examination; serum prostate-specific antigen (PSA), a nonspecific blood test; and Trans rectal ultrasound (TRUS)–guided biopsy, a standardized but untargeted method. Because of the limitations of these available diagnostic tools, advances in MRI techniques show potential for improving the diagnostic accuracy of MRI for prostatic lesions detection. A recently developed Multiparametric MRI approach that combines anatomic T2-weighted imaging with functional data appears to be one of the most promising techniques for prostatic lesions detection

Introduction:

Worldwide, diseases of Prostate gland are responsible for significant morbidity and mortality among adult males. Most frequently encountered diseases affecting prostate are Prostatitis, Benign prostatic hyperplasia and Prostatic cancer. (Hafiz Muhammad Aslam ,etal ,2013)

Prostate cancer is one of the most common malignancies in elderly men and it is one of the leading causes of cancer-related mortality.(Zidan S, et al,2015).

By 1990 ,trans rectal ultrasound (TRUS) has emerged as the best imaging modality of the prostate .Its use led to an improved understanding and demonstration of intra glandular anatomy. For long time ,TRUS is used screening, diagnosis and monitoring of benign disease , prostatic cancer and for guiding biopsy from the suspicious lesions. (Kammermeir, 1991).

The implementation of multi parametric MRI(mpMRI) into a screening program currently seems to be the most promising

technique to improve the early detection of clinically significant PC.(**Pieter J., et al,2016**).

Recently, great interest has been shown in mpMRI, which combines anatomic T2-weighted (T2W) imaging and T1Wwith MR spectroscopic imaging (MRSI), diffusion-weighted imaging (DWI) and/or dynamic contrast-enhanced MRI (DCE-MRI).(**Sciarra, et al, 2011**).

The combination of anatomic, biologic and functional dynamic information offered by mpMRI improve many aspects of PC management. There is a real need for clinicians to base therapeutic decisions not only on predictive methods and nomograms that include PSA, digital rectal examination (DRE) findings, and TRUS biopsy findings, but also on imaging.(**Sciarra, et al, 2011**).

Patients and Methods

Thirty adult male patients aged between 43-80 years with urinary symptoms related to and presented by any prostatic lesions were enrolled in our study after written informed consent and approval of ethical committee.This Study was conducted in Sohag University Hospitals from August 2016 to March 2017.

>>The patients who have the following criteria will be included in the study:

*Men at least 18 years or over at risk of prostate lesions

*Fit to undergo all protocol procedures

*Elevated PSA

>>The patients who have the following criteria will be excluded from the study:

*Previous history of prostate surgery

*General contraindications to MRI as metal implant, pacemaker implant, claustrophobia and renal impairment estimated GFR <50

*General contraindications to TRUS as piles and acute painful perianal disorders

The following data will be collected from each patient

****Demographic data:***

• Name, Age ,Residence and Occupation

****Medical history:***

Any urinary symptoms (urinary frequency, dysuria, weak stream, hesitancy, urgency, nocturia, incomplete emptying, terminal dribbling, overflow or urge incontinence , complete urinary retention, body aches and sometimes fever and problems during sexual intercourse)

Investigations:

• Abdominal sonography.

• TRUS color Doppler.

• Prostate - specific antigen (PSA).

• If available, histopathology of TRUS guided prostatic biopsy or trans perineal biopsy of some patients with suspected cancer prostate.

Methods:

• ***All patients will be subjected to TRUS as screening of different prostatic pathologies by APLIO 500 TOSHIB Device at Sohag University Hospital.***

• ***MRI prostate by ACHIVA PHILLIPS 1.5 T, device at Sohag University Hospital, using Pelvic phased array coil and/or endo rectal coil without prior bowel preparation.***

Statistical analysis

The collected data will be statistically analyzed using Statistical Package for the Social Science (SPSS) version 16 program and expressed in tables and charts regarding sensitivity, specificity and accuracy of mpMRI in comparison with those of TRUS Conclusions and recommendations will be suggested based on the results.

Results:

It was found that MRI has 100% sensitivity ,53% specificity ,68.2% positive predictive value ,100% negative predictive value and 76.7 % overall accuracy for malignant prostatic lesions diagnosis compared with histopathological findings. BUT TRUS has 40% sensitivity , 53.3 % specificity ,46.2% positive predictive value ,47.1% negative predictive value and 46.8 % overall accuracy for malignant prostatic lesions diagnosis compared with histopathological findings.

Table1: MRI Diagnosis

shows that with MRI about 18 of cases are diagnosed with prostate cancer with percentage of 60% (13 proved to be cancer and other 5 cases were 3 atrophic prostatitis and 2 granulomatous prostatitis) , 4 case are diagnosed as cystic lesion with percentage of 13.3%, 4 case are diagnosed as BPH with percentage of 13.3% and last 4 are suspicious with 13.3% (2 of them proved to be cancer and 2 infarction)

Pathology	MRI Diagnosis	No	Percent
Benign	Cystic lesion	4	26.7%
	BPH	4	26.7%
	Prostate cancer	5	33.3%
	Suspicious	2	13.3%
	Total	15	100.0%
Malignant	Prostate cancer	13	86.7%
	Suspicious	2	13.3%
	Total	15	100.0%

Table 2: MRI Diagnostic accuracy for malignant prostatic lesions

shows the sensitivity of MRI diagnosis with 15 cases are true positive with percentage of 50%, 8 cases are true negative with percentage of 26.7% and 7 cases are false positive with percentage of 23.3%. This was reflected in 100% sensitivity, but low specificity (53%) and an overall accuracy of 76.7%.

Pathology		No	Percent
Benign	True negative	8	53.3%
	True positive	—	—
	False negative	—	—
	False positive	7	46.7%
	Total	15	100.0%
Malignant	True positive	15	100.0%
Sensitivity		100%	
Specificity		53.3%	
Positive predictive value		68.2%	
Negative predictive value		100%	
Accuracy		76.7%	

Table 3: TRUS Diagnosis

Shows that with TRUS about 4 of cases are diagnosed as malignancy with percentage of 13.3%, 4 case are diagnosed as cystic lesion with percentage of 13.3%, 11 case are diagnosed as BPH with percentage of 36.7% and last 11 are suspicious & for biopsy with percentage of 36.7%.

Pathology		No	Percent
Benign	Cystic lesion	4	26.7%
	Suspicious & for biopsy	7	46.7%
	BPH	4	26.7%
	Total	15	100.0%
Malignant	Suspicious & for biopsy	4	26.7%
	BPH	7	46.7%
	Malignancy	4	26.7%
	Total	15	100.0%

Table 4: TRUS Diagnostic accuracy for malignant prostatic lesions

shows the sensitivity of TRUS diagnosis with 6 cases are true positive with percentage of 20%, 8 cases are true negative with percentage of 26.7%, 9 cases are false positive with percentage of 30% and 7 cases are false negative with percentage of 23.3%. This was reflected in weak sensitivity (40%), low specificity (53%) and an overall accuracy of 46.8%

Pathology		No	Percent
Benign	True negative	8	53.3%
	False positive	7	46.7%
	False negative	—	—
	True positive	—	—
	Total	15	100.0%
Malignant	True positive	6	40.0%
	False positive	2	13.3%
	False negative	7	46.7%
	Total	15	100.0%
Sensitivity		40%	
Specificity		53.3%	
Positive predictive value		46.2%	
Negative predictive value		17.1%	
Accuracy		46.8%	

Discussion:

In our study, by using conventional MRI almost half the cases 17 (56.7%) had enlarged transitional zone with abnormal peripheral zone, by MR diffusion there was restriction in 17 (56.7%) cases, however **MRI spectroscopy** showed 21 (70%) cases were abnormal, 17 cases were showing

results suggesting cancer with percentage of 56.7%, 3 cases were abnormal with percentage of 10% and only 8 cases were normal with percentage of 26.7%.

The sensitivity of MRI diagnosis in this study with 15 cases are true positive with percentage of 50%, 8 cases are true negative with percentage of 26.7% and 7

cases are false positive with percentage of 23.3%. Our results support the findings of systematic reviews that assess the diagnostic accuracy of MP-MRI (*Futterer et al. 2015, Thompson et al. 2014*). The reviews declared sensitivities of 58–96%, negative predictive value of 63–98% and specificity of 23–87%. The ranges were broad because of the single centre nature of the studies, each of which invoked different target conditions on different reference standards

The meta-analysis of the 10 included studies showed a higher diagnostic accuracy for T2-weighted imaging combined with DWI (sensitivity and specificity of 0.72 and 0.81, respectively) than for T2-weighted imaging alone (0.62 and 0.77). The major strength of this diagnostic meta-analysis is that this study is the first meta-analysis to investigate the accuracy of the combination of anatomic T2-weighted imaging and two functional techniques, DWI and MRS or DCE-MRI, as recommended by the ESUR guidelines (*Barentsz et al. 2012*).

By using TRUS in our study, we found that about 13 cases have enlargement with nodule with percentage of 43.3%, 13 cases have enlargement without nodule with percentage of 43.3% and 4 cases have cystic lesion with percentage of 13.3%. 18 of cases were diagnosed as malignancy with percentage of 13.3%, 4 case were diagnosed as cystic lesion with percentage of 13.3%, 11 case were diagnosed as BPH with percentage of 36.7% and last 11 were suspicious & for biopsy with percentage of 36.7%.

In this study, the sensitivity of TRUS diagnosis with 6 cases are true positive with percentage of 20%, 8 cases are true negative with percentage of 26.7%, 9 cases are false positive with percentage

of 30% and 7 cases are false negative with percentage of 23.3%, *Futterer et al. (2015)* said that MP-MRI was more accurate than TRUS-biopsy in terms of both sensitivity (93% vs 48%) and negative predictive value (89% vs 74%). TRUS-biopsy showed better specificity in their study (41% vs 96%) and positive predictive value (51% vs 90%).

In conclusion, in this study prostate cancer represents about 13.3 % of cases, as 22.2 % of cases are diagnosed by TRUS while MRI diagnosed 100% of cases with significant difference between the two groups. It shows that cystic lesion represents about 13.3 % of cases, as 100 % of cases are diagnosed by MRI and also TRUS diagnosed 100% of cases with insignificant difference between the two groups. It also shows that BPH represents about 13.3 % of cases, as 100 % of cases are diagnosed by MRI and while TRUS diagnosed 36.4 % of cases with significant difference between the two groups. We found also that malignancy represents about 13.3 % of cases, as 26.7 % of cases are diagnosed by TRUS while MRI diagnosed 100% of cases with significant difference between the two groups. It shows that benign lesion represents about 26.7% % of cases, as 100 % of cases are diagnosed by MRI and also TRUS diagnosed 53.3% of cases with significant difference between the two groups. It also shows that suspicious represents about 16.7 % of cases, as 71.4 % of cases are diagnosed by MRI and while TRUS diagnosed 45.5 % of cases with significant difference between the two groups. True positive represents about 20 % of cases, as 40 % of cases are diagnosed by TRUS while MRI diagnosed 100% of cases with significant difference between the two groups. It shows that true negative

represents about 26.7% % of cases, as 100 % of cases are diagnosed by MRI and also TRUS diagnosed 100% of cases with insignificant difference between the two groups. It also shows that false positive represents about 23.3 % of cases, as 100 % of cases are diagnosed by MRI and while TRUS diagnosed 77.8 % of cases with significant difference between the two groups.

Conclusion:

The combination of anatomic, biologic and functional dynamic information offered by multi-parametric MRI promises to make it successful imaging tool for improving many aspects of prostatic lesions detection and characterization. There is a real need for clinicians to base therapeutic decisions not only on predictive methods and nomograms that include PSA, digital rectal examination (DRE) findings, and trans-rectal ultrasound (TRUS) biopsy findings, but also on imaging. Multi-parametric MRI, T2W and T1W with MR spectroscopic imaging (MRSI), diffusion-weighted imaging (DWI) and/or dynamic contrast-enhanced MRI (DCE-MRI) provides noninvasive diagnostic tool for detection and characterization of prostatic lesions

References:

1. Barentsz JO, Richenberg J, Clements R, et al.; European Society of Urogenital Radiology. ESUR prostate MR guidelines 2012. *EurRadiol* 2012; 22:746–757
2. Futterer JJ, Briganti A, De Visschere P, et al. Can clinically significant prostate cancer be detected with multiparametric magnetic resonance imaging? A systematic review

of the literature. *EurUrol* 2015; 68: 1045–53.

3. Hafiz Muhammad Aslam, NazishShahid, Naseem Ahmad Shaikh, HibaArshadShaikh, ShafaqSaleem, AnumMughal *Int Arch Med.* 2013; 6: 36.
4. Pieter J., Briganti A., Jurgen J., et al. Role of multiparametric magnetic resonance imaging in early detection of prostate cancer. *Insights Imaging* (2016) 7:205–214
5. Sciarra A, Barentsz J, Bjartell A, Eastham J, Hricak, Hricak H, Panebianco V et al (2011) *Advances in Magnetic Resonance Imaging: How They are Changing the Management of Prostate Cancer.* *Eur. Urol* 95; 962-977
6. Thompson JE, van Leeuwen PJ, Moses D, et al. The Diagnostic Performance of Multiparametric Magnetic Resonance Imaging to Detect Significant Prostate Cancer. *J Urol* 2014; 195: 1428–35.
7. Zidan S, Tantawy HI, Prostate carcinoma: Accuracy of diagnosis and differentiation with Dynamic Contrast-Enhanced MRI and diffusion Weighted Imaging, *Egypt J RadiolNucl Med* (2015)
8. Thompson JE, van Leeuwen PJ, Moses D, et al. The Diagnostic Performance of Multiparametric Magnetic Resonance Imaging to Detect Significant Prostate Cancer. *J Urol* 2014; 195: 1428–35.
9. Zidan S, Tantawy HI, Prostate carcinoma: Accuracy of diagnosis and differentiation with Dynamic Contrast-Enhanced MRI and diffusion Weighted Imaging, *Egypt J RadiolNucl Med* (2015)