The clinical value of MR elastography in diagnosis of prostate cancer at 3.0T

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Purpose: To investigate the clinical value of MR elastography in diagnosis of prostate cancer at 3.0T, and to assess the elasticity and viscosity of prostate cancer and benign prostatic disease.

Introduction

MR elastography is a new imaging tool capable of noninvasively assessing the viscoelastic properties of tissue. The clinical application of MR elastography in diagnosis of prostate cancer remain to be elucidated.

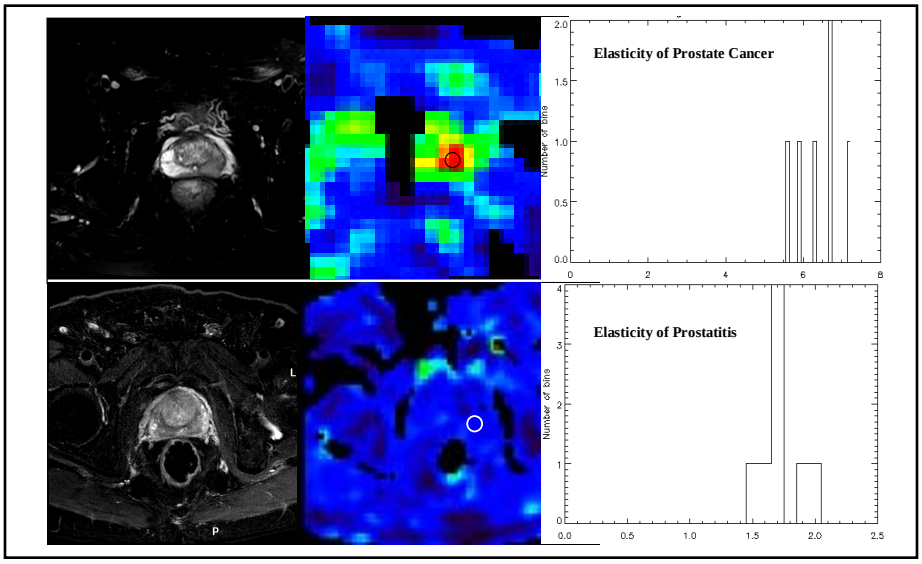
Methods

Eight patients (63 ± 7.25 years old) with 12 foci of prostate cancer and 10 patients (59 ± 3.25 years old) with 14 foci of prostatitis in the peripheral zone were evaluated by MR elastography. The results were confirmed by prostate histopathological findings. Clinical data of the patients such as Gleason scores were also retrospectively analyzed. All examinations were performed on a 3.0T Philips Achieva scanner (Philips medical systems, The Netherland). MR elastography were implemented by transmitting low-frequency longitudinal mechanical waves of 65Hz into prostate with a transducer paced above the pubic bones. A modified spin echo sequence with sinusoidal motion sensitive gradient was used. The waves can be visualized within the phase imaging by the motion-sensitive sequence. The experiment was repeated with MSG in three orthogonal directions and eight dynamics were acquired for each direction by adjusting the phase offset between the mechanical excitation and the oscillating gradient. The phase images were reconstructed to acquire viscoelastic mapping. The mean elasticity and viscosity of prostate cancer and prostatitis were estimated and statistical analysis was done by SPSS.

Results and discussion

We found the viscosity and elasticity were significant higher in the lesions with prostate cancer (6.56±0.99Pa.s, 6.55±0.47 kPa, respectively) than in the lesions with prostatis (2.13±0.21 Pa.s, 1.99±0.16 kPa, respectively), and the difference was statistically significantly(p=0.001, p=0.003). In addition, we observed that the elasticity of the prostate cancer increased with increasing of the Gleason scores.The shear elasticity maps for prostate cancer and prostatitis were observed in Fig 1.

Fig.1



MR elastography is a imaging tool capable of noninvasively assessing the viscoelastic properties of tissue. Several studies have addressed the feasibility of MRE to assess breast tumors, liver fibrosis and muscles(1-2). The evaluation of prostate by MRE is still in the early stage (3). Our preliminary study shows that the elasticity and viscosity of prostate cancer provided by MR elastography were significantly different from that of prostatitis, which may be helpful for the differential diagnosis and detection of prostate cancer. This result was concordance with the reports in the literature (4), the lesions with stiffer tissue in the prostate suggestive of prostate cancer. Clinically, transrectal ultrasound and Digital Rectal Exam (DRE) are expected to check the stiffness of lesions of the prostate gland, however, both of the two techniques have their own limitations. Our results demonstrated that MRE might reliably detect the compressional waves which penetrate deep and well shielded organ in human body, like prostate. In addition, we found that the quantitative elasticity of the prostate cancer provided by MRE was related with the classification of the tumors, which indicated that prostate tumor with higher Gleason scores was stiffer. The findings might attribute to the facts of that the more active proliferation and higher density of tissue composition could exist in the malignant tumor with higher Gleason scores.

Conclusion

MR elastography can be used to visualized the difference in viscoelastic properties between prostate cancer and benign prostatic disease, it is a new imaging method with great potential in diagnosis of prostate cancer.

References

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