Detection of Clinically Significant Prostate Cancer Using Magnetic Resonance Imaging–Ultrasound Fusion Targeted Biopsy: A Systematic Review

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Abstract

Context: The current standard for diagnosing prostate cancer in men at risk relies on a transrectal ultrasound-guided biopsy test that is blind to the location of the cancer. To increase the accuracy of this diagnostic pathway, a software-based magnetic resonance imaging-ultrasound (MRI-US) fusion targeted biopsy approach has been proposed.

Objective: Our main objective was to compare the detection rate of clinically significant prostate cancer with software-based MRI-US fusion targeted biopsy against standard biopsy. The two strategies were also compared in terms of detection of all cancers, sampling utility and efficiency, and rate of serious adverse events. The outcomes of different targeted approaches were also compared.

Evidence acquisition: We performed a systematic review of PubMed/Medline, Embase (via Ovid), and Cochrane Review databases in December 2013 following the Preferred Reported Items for Systematic reviews and Meta-analysis statement. The risk of bias was evaluated using the Quality Assessment of Diagnostic Accuracy Studies-2 tool.

Evidence synthesis: Fourteen papers reporting the outcomes of 15 studies (n=2293; range: 13-582) were included. We found that MRI-US fusion targeted biopsies detect more clinically significant cancers (median: 33.3% vs 23.6%; range: 13.2-50% vs 4.8-52%) using fewer cores (median: 9.2 vs 37.1) compared with standard biopsy techniques, respectively. Some studies showed a lower detection rate of all cancer (median: 50.5% vs 43.4%; range: 23.7-82.1% vs 14.3-59%). MRI-US fusion targeted biopsy was able to

detect some clinically significant cancers that would have been missed by using only standard biopsy (median: 9.1%; range: 5-16.2%). It was not possible to determine which of the two biopsy approaches led most to serious adverse events because standard and targeted biopsies were performed in the same session. Software-based MRI-US fusion targeted biopsy detected more clinically significant disease than visual targeted biopsy in the only study reporting on this outcome (20.3% vs 15.1%).

Conclusions: Software-based MRI-US fusion targeted biopsy seems to detect more clinically significant cancers deploying fewer cores than standard biopsy. Because there was significant study heterogeneity in patient inclusion, definition of significant cancer, and the protocol used to conduct the standard biopsy, these findings need to be confirmed by further large multicentre validating studies.

Patient summary: We compared the ability of standard biopsy to diagnose prostate cancer against a novel approach using software to overlay the images from magnetic resonance imaging and ultrasound to guide biopsies towards the suspicious areas of the prostate. We found consistent findings showing the superiority of this novel targeted approach, although further high-quality evidence is needed to change current practice.

Keywords: Image processing; Image-guided biopsy; Magnetic resonance imaging; Prostate neoplasms; Software; Targeted biopsy; computer assisted.

Comment on

- Is Magnetic Resonance Imaging-Transrectal Ultrasound Fusion Biopsy Ready for "Prime Time"?
  Loeb S.Eur Urol. 2015 Jul;68(1):20-1. doi: 10.1016/j.eururo.2014.11.027. Epub 2014 Nov 29.PMID: 25465339 **Free PMC article.** No abstract available.