

Literatuur searches

Hoofdstuk 3: MRI

Key question

1a. Is (mp)MRI geïndiceerd bij de primaire diagnostiek van prostaatacarcinoom?

P: suspected prostate carcinoma (with or without negative biopsies)
I: MRI (and/or mpMRI) (excluding MRI-guided biopsy)
R: histology (prostatectomy, or (re)biopsy and/or follow-up in case of benign assessment by MRI)
T: prostate carcinoma

1b. Is (mp)MRI geïndiceerd bij de staging (lokaal en pelviene lymfeklieren) van bewezen prostaatacarcinoom?

P: patients with prostate carcinoma
I: MRI (and/or mpMRI) (excluding MRI-guided biopsy)
R: histology (prostatectomy and/or pelvic lymph node dissection)
T: localization, seminal vesicle invasion, extracapsular extension, pathological T staging (T2/T3 staging), pelvic lymph node metastases, undergrading, understaging

1c. Is MRI-geleide biopsie geïndiceerd bij de primaire diagnostiek van prostaatacarcinoom?

P: suspected prostate carcinoma
I: MRI-guided biopsy
R: histology (prostatectomy, of (re)biopsy and/or follow-up)
T: prostate carcinoma

Golden hits

Question 1a:

- Delongchamps et al., Multiparametric magnetic resonance imaging for the detection and localization of prostate cancer: combination of T2-weighted, dynamic contrast-enhanced and diffusion-weighted imaging. *BJU International*, 2010.
- Vilanova et al., Usefulness of prebiopsy multifunctional and morphologic MRI combined with free-to-total prostate-specific antigen ratio in the detection of prostate cancer. *American Journal of Roentgenology*, 2011.
- Tanimoto et al., Prostate cancer screening: the clinical value of diffusion-weighted imaging and dynamic MR imaging in combination with T2-weighted imaging, *Journal of Magnetic Resonance imaging*, 2006.

Question 1b:

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Question 1c:

- Aristotelis G. Anastasiadis et al., MRI-Guided Biopsy of the Prostate Increases Diagnostic Performance in Men with Elevated or Increasing PSA Levels after Previous Negative TRUS Biopsies. *European urology*, 2006.
- Dirk Beyersdorff et al., MR Imaging-guided Prostate Biopsy with a Closed MR Unit at 1.5 T: Initial Results. *Radiology*, 2005

- K. Engelhard et al., Prostate biopsy in the supine position in a standard 1.5-T scanner under real time MR-imaging control using a MR-compatible endorectal biopsy device. *European Radiology*, 2006.
- Tobias Franiel et al., Areas Suspicious for Prostate Cancer: MR-guided Biopsy in Patients with at Least One Transrectal US-guided Biopsy with a Negative Finding—Multiparametric MR Imaging for Detection and Biopsy Planning. *Radiology*, 2011.
- Thomas Hambroek et al., Prospective Assessment of Prostate Cancer Aggressiveness Using 3-T Diffusion-Weighted Magnetic Resonance Imaging-Guided Biopsies Versus a Systematic 10-Core Transrectal Ultrasound Prostate Biopsy Cohort. *European Urology*, 2011.
- Thomas Hambroek et al., Magnetic Resonance Imaging Guided Prostate Biopsy in Men With Repeat Negative Biopsies and Increased Prostate Specific Antigen. *The journal of urology*, 2010.
- Caroline M.A. Hoeks et al., Three-Tesla Magnetic Resonance-Guided Prostate Biopsy in Men With Increased Prostate-Specific Antigen and Repeated, Negative, Random, Systematic, Transrectal Ultrasound Biopsies: Detection of Clinically Significant Prostate Cancers. *European urology*, 2012.
- M. Roethke et al., MRI-guided prostate biopsy detects clinically significant cancer: analysis of a cohort of 100 patients after previous negative TRUS biopsy. *World J Urol*, 2012.

Search strategy

Searches were run on May 13th 2012 for all three questions combined. OVID Medline, OVID PreMedline, Embase and the CDSR were searched. The search limits were: 2002-2012; English and Dutch. Besides systematic reviews and RCTs, only diagnostic studies with at least 50 patients were considered.

Search results

The Medline and Pre-Medline search yielded 2021 and 130 hits respectively, while the Embase search yielded 2576 hits. The search in the CDSR yielded 16 Cochrane reviews.

Excluded studies Question 1a and 1b

After merging the search files into 1 file and removal of the duplicates, 3268 hits were screened on title and abstract. Of these, 3095 were excluded. The most important reasons for exclusion were:

1. Wrong cancer type
2. Wrong diagnostic test
3. < 50 patients
4. Wrong study design (e.g. case report, narrative review, etc.)

Of the remaining 177 studies, the full-text was retrieved. Based on the full-text, an additional 115 studies were excluded. Table 1 provides an overview of excluded studies, with the reasons for exclusion.

Table 1. Overview of excluded studies based on full-text evaluation

First author	Reference	Title	Reason(s) for exclusion
Afaq A	BJU Int 2011 108(11):1716-22	Clinical utility of diffusion-weighted magnetic resonance imaging in prostate cancer	Narrative review
Ahmed HU	BJU Int 2009 104(2):269-70; author reply 270	The role of magnetic resonance imaging in targeting prostate cancer in patients with previous negative biopsies and elevated prostate-specific antigen levels	Letter
Ahmed HU	J Urol 2007 177(6):2395; author reply 2395-6	Re: Dynamic contrast enhanced, pelvic phased array magnetic resonance imaging of localized prostate cancer for predicting tumor volume: correlation with radical prostatectomy findings. A. Villers, P. Puech, D. Mouton, X. Leroy, C. Ballereau and L. Lemaitre, J Urol 2006; 176: 2432-2437	Letter
Barentsz J	Eur Urol 2011 60(1):e5-6	Re: Axel Heidenreich. Consensus criteria for the use of magnetic resonance imaging in the diagnosis and staging of prostate cancer: not ready for routine use. Eur Urol 2011;59:495-7	Editorial
Bianco FJ, Jr.	Urology 2007 69(2):343-6	Prostate volume measured preoperatively predicts for organ-confined disease in men with clinically localized prostate cancer	No diagnostic accuracy study
Blaszczyk P	Onkol. Radioter. 2011 16(2):44-51	Dynamic contrast-enhanced magnetic resonance in the evaluation of stage prostate cancer	Not available
Borley NC	Scand. J. Urol. Nephrol. 2003 37(5):382-386	Laparoscopic Pelvic Lymph Node Dissection Allows Significantly More Accurate Staging in "High-risk" Prostate Cancer Compared to MRI or CT	< 50 pts with MRI
Borre M	Acta Oncologica 2005 44(6):589-92	Phased array magnetic resonance imaging for staging clinically localised prostate cancer	< 50 pts
Bourne R	ANZ J Surg 2003 73(8):666-8	Detection of prostate cancer by magnetic resonance imaging and spectroscopy in vivo	Case report
Brajtbord JS	BJU Int 2011 107(9):1419-24	Endorectal magnetic resonance imaging has limited clinical ability to preoperatively predict pT3 prostate cancer	Index test insufficiently clear
Caldas MED	Rev 2010 37(6):447-9	Magnetic resonance imaging in staging of locoregional prostate cancer: comparison of results with analysis post-surgical histopathology	< 50 pts
Carlani M	Radiol Med (Torino) 2008 113(5):670-88	Combined morphological, [1H]-MR spectroscopic and contrast-enhanced imaging of human prostate cancer with a 3-Tesla scanner: preliminary experience	< 50 patients
Chandra RV	ANZ J Surg 2007 77(10):860-5	Endorectal magnetic resonance imaging staging of prostate cancer	< 50 pts
Cheng GC	Int J Radiat Oncol Biol Phys 2003 55(1):64-70	Clinical utility of endorectal MRI in determining PSA outcome for patients with biopsy Gleason score 7, PSA <or=10, and clinically localized prostate cancer	No diagnostic accuracy study
Choi S	J Urol 2011 186(4):1181-2	The role of magnetic resonance imaging in the detection of prostate cancer	Editorial
Cirillo S	Tumori 2008 94(1):65-9	Comparison of endorectal magnetic resonance imaging, clinical prognostic factors and nomograms in the local staging of prostate cancer patients treated with radiotherapy	No diagnostic accuracy study
Coakley FV	J Urol 2003 170(6 Pt 2):S69-75; discussion S75-6	Magnetic resonance imaging and spectroscopic imaging of prostate cancer	Narrative review
Crehange G	Int J Radiat Oncol Biol	Tumor volume and metabolism of	No diagnostic accuracy study

First author	Reference	Title	Reason(s) for exclusion
	Phys 2011 80(4):1087-94	prostate cancer determined by proton magnetic resonance spectroscopic imaging at 3T without endorectal coil reveal potential clinical implications in the context of radiation oncology	
Cruz M	Eur Radiol 2002 12(2):357-65	Characterization of low-intensity lesions in the peripheral zone of prostate on pre-biopsy endorectal coil MR imaging	No diagnostic accuracy study
Dae CJ	J. Magn. Reson. Imaging 2008 28(1):144-150	Preoperative MR imaging in the evaluation of seminal vesicle invasion in prostate cancer: Pattern analysis of seminal vesicle lesions	same as Jung DC!
Delongchamps NB	Prostate Cancer Prostatic Dis 2011 14(3):232-7	Multiparametric MRI is helpful to predict tumor focality, stage, and size in patients diagnosed with unilateral low-risk prostate cancer	All patients had proven prostate cancer; for the detection of cancer in second lobe: no 2x2 tables possible
Doo KW	Eur. Radiol. 2012 1-8	Detectability of low and intermediate or high risk prostate cancer with combined T2-weighted and diffusion-weighted MRI	All patients had proven prostate cancer
Franiel T	AJR Am J Roentgenol 2010 American Journal of Roentgenology. 194(3):675-81	Differentiation of prostate cancer from normal prostate tissue: role of hotspots in pharmacokinetic MRI and histologic evaluation	All patients had proven prostate cancer
Franiel T	Radiology 2011 259(1):162-172	Multiparametric MR imaging for detection and biopsy planning	Double
Franiel T	Radiology 2011 259(1):162-72	Areas suspicious for prostate cancer: MR-guided biopsy in patients with at least one transrectal US-guided biopsy with a negative finding--multiparametric MR imaging for detection and biopsy planning	No reproducible method for image assessment
Frauscher F	N Engl J Med 2003 349(12):1185-6; author reply 1185-6	Use of MRI to detect lymph-node metastases in prostate cancer	Letter
Gbenou MCG	Urologia Internationalis 2012 88(1):12-7	Localising prostate cancer: comparison of endorectal magnetic resonance (MR) imaging and 3D-MR spectroscopic imaging with transrectal ultrasound-guided biopsy	Double
Guzzo TJ	UROL 2012 30(3):301-5	Endorectal T2-weighted MRI does not differentiate between favorable and adverse pathologic features in men with prostate cancer who would qualify for active surveillance	No diagnostic accuracy study
Hambrock T	Eur Urol 2012 61(1):177-84	Prospective assessment of prostate cancer aggressiveness using 3-T diffusion-weighted magnetic resonance imaging-guided biopsies versus a systematic 10-core transrectal ultrasound prostate biopsy cohort	Evaluation of MRI-guided biopsy
Hambrock T	J Urol 2010 183(2):520-7	Magnetic resonance imaging guided prostate biopsy in men with repeat negative biopsies and increased prostate specific antigen	No diagnostic accuracy study
Hara N	Prostate 2005 62(2):140-7	Dynamic contrast-enhanced magnetic resonance imaging (DCE-MRI) is a useful modality for the precise detection and staging of early prostate cancer	No 2x2 tables
Heesakkers RAM	Radiology 2009 251(2):408-14	Prostate cancer: detection of lymph node metastases outside the routine surgical area with ferumoxtran-10-enhanced MR imaging	No 2x2 tables
Hentschel B	Strahlenther Onkol 2011 187(3):183-90	Definition of the CTV prostate in CT and MRI by using CT-MRI image fusion in IMRT planning for prostate cancer	No diagnostic accuracy study
Hoeks CMA	Eur. Urol. 2012	Three-Tesla Magnetic Resonance-Guided Prostate Biopsy in Men With Increased Prostate-Specific Antigen and Repeated, Negative, Random,	On MRGB

First author	Reference	Title	Reason(s) for exclusion
		Systematic, Transrectal Ultrasound Biopsies: Detection of Clinically Significant Prostate Cancers	
Hoshii T	Int J Urol 2007 14(4):305-10	Evaluation of magnetic resonance imaging-based prostate-specific antigen density of the prostate in the diagnosis of prostate cancer	No diagnostic accuracy study
Hricak H	Cancer 2004 100(12):2655-63	The role of preoperative endorectal magnetic resonance imaging in the decision regarding whether to preserve or resect neurovascular bundles during radical retropubic prostatectomy	No 2x2 tables
Ilic D	Cochrane Database of Systematic Reviews 2006 3):	Screening for prostate cancer	Not on MRI
Isebaert S	Eur J Radiol 2012 81(3):e217-22	Evaluation of semi-quantitative dynamic contrast-enhanced MRI parameters for prostate cancer in correlation to whole-mount histopathology	All patients had proven prostate cancer
Itou Y	J Magn Reson Imaging 2011 33(1):167-72	Clinical utility of apparent diffusion coefficient (ADC) values in patients with prostate cancer: can ADC values contribute to assess the aggressiveness of prostate cancer?	No diagnostic accuracy study
Jackson ASN	Clin Oncol (R Coll Radiol) 2005 17(3):167-71	Tumour staging using magnetic resonance imaging in clinically localised prostate cancer: relationship to biochemical outcome after neo-adjuvant androgen deprivation and radical radiotherapy	No diagnostic accuracy study
Janane A	Eur. J. Radiol. 2011	Endorectal MRI accuracy in auguring tumour location, tumour extent, capsular perforation and seminal vesicle invasion of prostate cancer in north-African men	Not available
Janane A	Int. Urol. Nephrol. 2010 1-6	Endorectal MRI accuracy and its staging evaluation contribution in prostate cancer: a North African ethnic group	Retracted
Joseph T	Int J Radiat Oncol Biol Phys 2009 73(3):665-71	Pretreatment endorectal magnetic resonance imaging and magnetic resonance spectroscopic imaging features of prostate cancer as predictors of response to external beam radiotherapy	No diagnostic accuracy study
Kirkham APS	Eur Urol 2006 50(6):1163-74; discussion 1175	How good is MRI at detecting and characterising cancer within the prostate?	Narrative review
Klijn S	Eur J Radiol 2012 81(3):411-6	Comparison of qualitative and quantitative approach to prostate MR spectroscopy in peripheral zone cancer detection	Known prostate cancer in 72/185 pts at moment of MRI
Kumar R	Urology 2008 72(4):859-63	Potential of magnetic resonance spectroscopic imaging in predicting absence of prostate cancer in men with serum prostate-specific antigen between 4 and 10 ng/ml: a follow-up study	No 2x2 tables
Kumar V	Int. J. Urol. 2012	Prebiopsy magnetic resonance spectroscopy and imaging in the diagnosis of prostate cancer	Narrative review
Kurth J	UROLOGY 2011 29(5):562-71	Magnetic resonance spectroscopy: a promising tool for the diagnostics of human prostate cancer?	Narrative review
Kwek JW	Ann Acad Med Singapore 2003 32(4):500-6	MR imaging and MR spectroscopy of adenocarcinoma of the prostate	Narrative review
Labanaris AP	Urology 2011 78(1):116-20	Inapparent tumor on endorectal multimodality magnetic resonance imaging of prostate: should we perform a biopsy?	No 2x2 tables
Labanaris AP	Magn Reson Imaging 2010 28(7):943-6	Guided e-MRI prostate biopsy can solve the discordance between Gleason score	No diagnostic accuracy study

First author	Reference	Title	Reason(s) for exclusion
		biopsy and radical prostatectomy pathology	
Labanaris AP	Scand J Urol Nephrol 2009 43(1):25-31	The role of conventional and functional endorectal magnetic resonance imaging in the decision of whether to preserve or resect the neurovascular bundles during radical retropubic prostatectomy	No 2x2 tables
Latchamsetty KC	Can J Urol 2007 14(1):3429-34	Experience improves staging accuracy of endorectal magnetic resonance imaging in prostate cancer: what is the learning curve?	No 2x2 tables
Lawrentschuk N	BJU Int 2009 103(6):730-3	The role of magnetic resonance imaging in targeting prostate cancer in patients with previous negative biopsies and elevated prostate-specific antigen levels	SR of insufficient quality
Lee HW	Yonsei Med J 2010 51(5):700-7	Can we predict real T3 stage prostate cancer in patients with clinical T3 (cT3) disease before radical prostatectomy?	No diagnostic accuracy study
Lee JS	Urologia Internationalis 2007 78(4):323-7	Transrectal ultrasound versus magnetic resonance imaging in the estimation of prostate volume as compared with radical prostatectomy specimens	No diagnostic accuracy study
Lee SE	Urology 2007 69(3):510-4	Significance of neurovascular bundle formation observed on preoperative magnetic resonance imaging regarding postoperative erectile function after nerve-sparing radical retropubic prostatectomy	No diagnostic accuracy study
Lee SH	World J Urol 2010 28(6):667-72	Is endorectal coil necessary for the staging of clinically localized prostate cancer? Comparison of non-endorectal versus endorectal MR imaging	< 50 pts per test
Manikandan R	J Endourol 2007 21(10):1171-4	Routine use of magnetic resonance imaging in the management of T(1c) carcinoma of the prostate: is it necessary?	No 2x2 tables
Mason BM	Urology 2010 76(5):1130-5	The role of preoperative endo-rectal coil magnetic resonance imaging in predicting surgical difficulty for robotic prostatectomy	No diagnostic accuracy study
Masterson TA	Magma 2008 21(6):371-7	The role of endorectal coil MRI in preoperative staging and decision-making for the treatment of clinically localized prostate cancer	Narrative review
Mazaheri Y	Radiology 2008 246(2):480-8	Prostate cancer: identification with combined diffusion-weighted MR imaging and 3D 1H MR spectroscopic imaging--correlation with pathologic findings	< 50 patients
McKenna DA	Radiology 2008 247(1):141-6	Prostate cancer: role of pretreatment MR in predicting outcome after external-beam radiation therapy--initial experience	No diagnostic accuracy study
Muglia VF	AJR Am J Roentgenol 2011 American Journal of Roentgenology. 197(6):1369-74	Endorectal MRI of prostate cancer: incremental prognostic importance of gross locally advanced disease	No diagnostic accuracy study
Mullerad M	Radiology 2004 232(1):140-6	Prostate cancer: detection of extracapsular extension by genitourinary and general body radiologists at MR imaging	No diagnostic accuracy study
Nishida K	Acta Radiol 2011 52(1):120-6	Incremental value of T2-weighted and diffusion-weighted MRI for prediction of biochemical recurrence after radical prostatectomy in clinically localized prostate cancer	No diagnostic accuracy study
Nishida S	Int J Urol 2011 18(9):653-8	Prostate cancer detection by prebiopsy 3.0-Tesla magnetic resonance imaging	No diagnostic accuracy study
Nogueira L	Urology 2010 75(2):472-7	Focal treatment or observation of	No 2x2 tables

First author	Reference	Title	Reason(s) for exclusion
		prostate cancer: pretreatment accuracy of transrectal ultrasound biopsy and T2-weighted MRI	
Ocak I	AJR Am J Roentgenol 2007 American Journal of Roentgenology. 189(4):849	Dynamic contrast-enhanced MRI of prostate cancer at 3 T: a study of pharmacokinetic parameters	All patients had proven prostate cancer
Oto A	AJR Am J Roentgenol 2011 American Journal of Roentgenology. 197(6):1382-90	Diffusion-weighted and dynamic contrast-enhanced MRI of prostate cancer: correlation of quantitative MR parameters with Gleason score and tumor angiogenesis	No diagnostic accuracy study
Ouzzane A	Urology 2011 78(6):1356-62	Combined multiparametric MRI and targeted biopsies improve anterior prostate cancer detection, staging, and grading	< 50 pts
Oyen RH	Eur Radiol 2003 13(5):921-4	Dynamic contrast-enhanced MRI of the prostate: is this the way to proceed for characterization of prostatic carcinoma?	Editorial
Park KK	BJU Int 2010 106(8):1148-51	The effects of the period between biopsy and diffusion-weighted magnetic resonance imaging on cancer staging in localized prostate cancer	No 2x2 tables
Perdona S	Urol. Oncol. Semin. Orig. Invest. 2011	Combined magnetic resonance spectroscopy and dynamic contrast-enhanced imaging for prostate cancer detection	Impossible to reconstruct the 2x2 tables
Pinto PA	J Urol 2011 186(4):1281-5	Magnetic resonance imaging/ultrasound fusion guided prostate biopsy improves cancer detection following transrectal ultrasound biopsy and correlates with multiparametric magnetic resonance imaging	No diagnostic accuracy study
Ploussard G	BJU Int 2011 108(4):513-7	Magnetic resonance imaging does not improve the prediction of misclassification of prostate cancer patients eligible for active surveillance when the most stringent selection criteria are based on the saturation biopsy scheme	No diagnostic accuracy study
Pondman KM	Eur Urol 2008 54(3):517-27	MR-guided biopsy of the prostate: an overview of techniques and a systematic review	Narrative review
Puech P	Urology 2009 74(5):1094-9	Dynamic contrast-enhanced-magnetic resonance imaging evaluation of intraprostatic prostate cancer: correlation with radical prostatectomy specimens	All pts had prostate cancer
Ren J	J Magn Reson Imaging 2009 30(2):351-6	Combined T2-weighted and diffusion-weighted MRI for diagnosis of urinary bladder invasion in patients with prostate carcinoma	Outcome not part of PICO
Riches SF	NMR Biomed 2009 22(3):318-25	Diffusion-weighted imaging of the prostate and rectal wall: comparison of biexponential and monoexponential modelled diffusion and associated perfusion coefficients	No diagnostic accuracy study
Roethke MC	Eur J Radiol 2011 79(2):189-95	Tumorsize dependent detection rate of endorectal MRI of prostate cancer--a histopathologic correlation with whole-mount sections in 70 patients with prostate cancer	All patients had proven prostate cancer
Roethke MC	Eur. J. Radiol. 2011 79(2):189-195	A histopathologic correlation with whole-mount sections in 70 patients with prostate cancer	Double
Sala E	Radiology 2006 238(3):929-37	Endorectal MR imaging in the evaluation of seminal vesicle invasion: diagnostic accuracy and multivariate feature analysis	Case-control design
Scheenen TWJ	Invest Radiol 2011	Discriminating cancer from noncancer	Case-control design

First author	Reference	Title	Reason(s) for exclusion
	46(1):25-33	tissue in the prostate by 3-dimensional proton magnetic resonance spectroscopic imaging: a prospective multicenter validation study	
Scheidler J	ROFO Fortschr Geb Rontgenstr Nuklearmed 2009 181(6):531-5	Combined MRI and MRS in prostate cancer: improvement of spectral quality by susceptibility matching	No diagnostic accuracy study
Scheidler J	ROFO Fortschr Geb Rontgenstr Nuklearmed 2012 184(2):130-5	Diagnosis of prostate cancer in patients with persistently elevated PSA and tumor-negative biopsy in ambulatory care: performance of MR imaging in a multi-reader environment	Inadequate reference test
Sciarra A	UROL 2011 29(6):634-40	Value of magnetic resonance spectroscopy (MSR) and dynamic contrast-enhanced magnetic resonance (DCEMR) imaging for the characterization of high-grade prostatic intraepithelial neoplasia (HGPIN) foci	< 50 pts
Sciarra A	Eur Urol 2011 59(6):962-77	Advances in magnetic resonance imaging: how they are changing the management of prostate cancer	SR, no QA
Seitz M	Eur Urol 2009 55(3):591	Editorial comment on: Combined magnetic resonance imaging and magnetic resonance spectroscopy imaging in the diagnosis of prostate cancer: a systematic review and meta-analysis	Editorial
Seitz M	Eur Urol 2009 55(4):801-14	Functional magnetic resonance imaging in prostate cancer	SR, no QA
Shah N	J Am Osteopath Assoc 2006 106(1):23-7	Magnetic resonance spectroscopy as an imaging tool for cancer: a review of the literature	Narrative review
Shimizu T	Acta Radiol 2009 50(9):1080-8	Prostate cancer detection: the value of performing an MRI before a biopsy	No 2x2 tables
Shukla-Dave A	Radiology 2007 245(2):499-506	Detection of prostate cancer with MR spectroscopic imaging: an expanded paradigm incorporating polyamines	All patients had proven prostate cancer
Shukla-Dave A	BJU Int 2007 99(4):786-93	The utility of magnetic resonance imaging and spectroscopy for predicting insignificant prostate cancer: an initial analysis	No diagnostic accuracy study
Turkbey B	Radiology 2010 255(1):89-99	Prostate cancer: value of multiparametric MR imaging at 3 T for detection--histopathologic correlation	All patients had proven prostate cancer
Vargas HA	Radiology 2011 259(3):775-84	Diffusion-weighted endorectal MR imaging at 3 T for prostate cancer: tumor detection and assessment of aggressiveness	All patients had proven prostate cancer
Vargas HA	Radiology 2012 262(3):894-902	Normal central zone of the prostate and central zone involvement by prostate cancer: clinical and MR imaging implications	All pts had prostate cancer
Verma S	AJR Am J Roentgenol 2011 American Journal of Roentgenology. 196(2):374-81	Assessment of aggressiveness of prostate cancer: correlation of apparent diffusion coefficient with histologic grade after radical prostatectomy	No diagnostic accuracy study
Vilanova JC	Radiology 2009 253(1):135-43	Peripheral zone prostate cancer in patients with elevated PSA levels and low free-to-total PSA ratio: detection with MR imaging and MR spectroscopy	No diagnostic accuracy study
Villeirs GM	Eur J Radiol 2011 77(2):340-5	Combined magnetic resonance imaging and spectroscopy in the assessment of high grade prostate carcinoma in patients with elevated PSA: a single-institution experience of 356 patients	Known prostate cancer in 131/356 pts at moment of MRI
Villeirs GM	Eur J Radiol 2010 73(2):352-6	A qualitative approach to combined magnetic resonance imaging and spectroscopy in the diagnosis of prostate cancer	Known prostate cancer in 131/356 pts at moment of MRI

First author	Reference	Title	Reason(s) for exclusion
Wang L	Radiology 2007 242(1):182-8	Prediction of seminal vesicle invasion in prostate cancer: incremental value of adding endorectal MR imaging to the Kattan nomogram	No diagnostic accuracy study
Wang L	Radiology 2006 238(2):597-603	Prediction of organ-confined prostate cancer: incremental value of MR imaging and MR spectroscopic imaging to staging nomograms	No diagnostic accuracy study
Wang L	Radiology 2008 246(1):168-76	Assessment of biologic aggressiveness of prostate cancer: correlation of MR signal intensity with Gleason grade after radical prostatectomy	No diagnostic accuracy study
Weinreb JC	Radiology 2009 251(1):122-33	Prostate cancer: sextant localization at MR imaging and MR spectroscopic imaging before prostatectomy--results of ACRIN prospective multi-institutional clinicopathologic study	No 2x2 tables
Wetter A	AJR Am J Roentgenol 2006 American Journal of Roentgenology. 187(3):724-30	Combined MRI and MR spectroscopy of the prostate before radical prostatectomy	Results only provided for 38 pts
Whang SY	Radiology 2012 262(3):903-11	Preoperative detection and localization of accessory pudendal artery with contrast-enhanced MR angiography	Outcome not part of PICO
Woodfield CA	AJR Am J Roentgenol 2010 American Journal of Roentgenology. 194(4):W316-22	Diffusion-weighted MRI of peripheral zone prostate cancer: comparison of tumor apparent diffusion coefficient with Gleason score and percentage of tumor on core biopsy	No 2x2 tables
Yaes RJ	N Engl J Med 2003 349(12):1185-6; author reply 1185-6	Use of MRI to detect lymph-node metastases in prostate cancer	Letter
Yamamura J	J Comput Assist Tomogr 2011 35(2):223-8	Magnetic resonance imaging of prostate cancer: diffusion-weighted imaging in comparison with sextant biopsy	No 2x2 tables
Yamamura J	Radiology Research & Practice Print 2011 616852	MR Imaging of Prostate Cancer: Diffusion Weighted Imaging and (3D) Hydrogen 1 (H) MR Spectroscopy in Comparison with Histology	No 2x2 tables
Zakian KL	Radiology 2005 234(3):804-14	Correlation of proton MR spectroscopic imaging with gleason score based on step-section pathologic analysis after radical prostatectomy	All patients had proven prostate cancer
Zakian KL	J Urol 2010 184(6):2320-7	An exploratory study of endorectal magnetic resonance imaging and spectroscopy of the prostate as preoperative predictive biomarkers of biochemical relapse after radical prostatectomy	No diagnostic accuracy study
Zelhof B	BJU Int 2009 104(5):621-7	Description of magnetic resonance imaging-derived enhancement variables in pathologically confirmed prostate cancer and normal peripheral zone regions	No diagnostic accuracy study
Zhang JQ	Urology 2007 69(6):1134-7	Role of endorectal coil magnetic resonance imaging in treatment of patients with prostate cancer and in determining radical prostatectomy surgical margin status: report of a single surgeon's practice	Impossible to reconstruct 2x2 tables

Excluded studies Question 1c

3268 hits were screened on title and abstract. Of these, 3244 were excluded. The most important reasons for exclusion were:

1. Wrong cancer type
2. Wrong diagnostic test
3. < 50 patients
4. Wrong study design (e.g. case report, narrative review, etc.)
5. No reference standard after negative biopsy

Of the remaining 24 studies, the full-text was retrieved. Based on the full-text, an additional 22 studies were excluded. Table 2 provides an overview of excluded studies, with the reasons for exclusion.

First author	Reference	Title	Reason(s) for exclusion
Anastasiadis AG	Eur Urol 2006 50(4): 738-748	MRI-guided biopsy of the prostate increases diagnostic performance in men with elevated or increasing PSA levels after previous negative TRUS biopsies	No reference standard
Beyersdorff D	Radiology 2005 234(2): 576-581	MR imaging-guided prostate biopsy with a closed MR unit at 1.5 T: initial results	No reference standard; No patient based analysis
Engelhard K	Eur Radiol 2006 16(6): 1237-43	Prostate biopsy in the supine position in a standard 1.5-T scanner under real time MR-imaging control using a MR-compatible endorectal biopsy device	No reference standard
Franiel T	Radiology 2011 259(1): 162-72	Areas suspicious for prostate cancer: MR-guided biopsy in patients with at least one transrectal US-guided biopsy with a negative finding on multiparametric MR imaging for detection and biopsy planning	MRI guided biopsy is reference standard instead of intervention
Futterer JJ	Imaging Med 2010 2(5):583-92	MRI of the prostate: potential role of robots	Narrative review
Futterer JJ	Abdom Imaging 2011	High-risk prostate cancer: value of multi-modality 3T MRI-guided biopsies after previous negative biopsies	Narrative review
Haffner J	BJU Int 2011 108: E171-8	Role of magnetic resonance imaging before initial biopsy: comparison of magnetic resonance imaging-targeted and systematic biopsy for significant prostate cancer detection	MRI targeted biopsy instead of MRI guided biopsy
Hambrock T	Invest Radiol 2008 43(10): 686-94	Thirty-two-channel coil 3T magnetic resonance-guided biopsies of prostate tumor suspicious regions identified on multimodality 3T magnetic resonance imaging: technique and feasibility	MRI guided biopsy is reference standard instead of intervention
Hambrock T	Eur Urol 2012 61(1): 177-84	Prospective assessment of prostate cancer aggressiveness using 3-T diffusion-weighted magnetic resonance imaging-guided biopsies versus a systematic 10-core transrectal ultrasound prostate biopsy cohort	Different outcome: prostate carcinoma aggressiveness Different patient population: patients with prostate cancer diagnosis
Hambrock T	J Urol 2010 183(2): 520-7	Magnetic resonance imaging guided prostate biopsy in men with repeat negative biopsies and increased prostate specific antigen	No reference standard in patients with negative biopsy results: partial verification
Kim CK	Nat Rev Urol 2011 8(12): 652-4	Prostate cancer: Predicting tumor aggressiveness using DWI-guided biopsy	Narrative review about prediction of gleason grade
Lichy MP	Urology 2007 69 (6): 1208.e5-8	Morphologic, functional, and metabolic magnetic resonance imaging-guided prostate biopsy in a patient with prior negative transrectal ultrasound-guided biopsies and persistently elevated prostate-specific antigen levels	Case report
Pondman KM	Eur Urol 2008 54(3): 517-27	MR-guided biopsy of the prostate: an overview of techniques and a systematic review	Narrative review

First author	Reference	Title	Reason(s) for exclusion
Ponholzer A	Eur Urol 2012 61(5): e52	Re: Thomas Hambrock, Caroline Hoeks, Christina Hulsbergen-van de Kaa, et al. Prospective assessment of prostate cancer aggressiveness using 3-T diffusion-weighted magnetic resonance imaging-guided biopsies versus a systematic 10-core transrectal ultrasound prostate biopsy cohort. Eur Urol 2012;61:177-84	Letter to the editor
Roethke M	World J Urol 2012 30(2): 213-8	MRI-guided prostate biopsy detects clinically significant cancer: analysis of a cohort of 100 patients after previous negative TRUS biopsy	No reference standard in patients with negative biopsy results: partial verification
Sciarra A	Eur Urol 2008 54(3): 526-7	Editorial comment on: MR-guided biopsy of the prostate: an overview of techniques and a systematic review	Editorial Comment
Sciarra A	Eur Urol 2011 59(6): 962-77	Advances in magnetic resonance imaging: how they are changing the management of prostate cancer	Narrative review
Singh AK	BJU Int 2008 101(2): 181-5	Patient selection determines the prostate cancer yield of dynamic contrast-enhanced magnetic resonance imaging-guided transrectal biopsies in a closed 3-Tesla scanner	No reference standard
Yakar D	Top Magn Reson Imaging 2008 19(6): 291-5	Magnetic resonance-guided biopsy of the prostate: feasibility, technique, and clinical applications	Describing technique of MR-guided biopsy; No patient data
Yakar D	Radiology 2011 260(1): 241-7	Feasibility of a pneumatically actuated MR-compatible robot for transrectal prostate biopsy guidance	No reference standard
Zangos S	Radiology 2011 259(3): 903-10	MR-compatible assistance system for biopsy in a high-field-strength system: initial results in patients with suspicious prostate lesions	No reference standard
Zangos S	Eur Radiol 2005 15(1): 174-82	MR-guided transgluteal biopsies with an open low-field system in patients with clinically suspected prostate cancer: technique and preliminary results	< 50 patients

Included studies Question 1a and 1b

Sixty-two studies were included for quality appraisal and data extraction:

- Question 1a: 2 systematic reviews and 23 diagnostic accuracy studies
- Question 1b:
 - T-stage: 1 systematic review and 30 diagnostic accuracy studies
 - N-stage: 1 systematic review and 5 diagnostic accuracy studies (of which 2 articles were on the same study, and another study was included in the systematic review)

Included studies Question 1c

Two studies were included for quality appraisal and data extraction:

- Engehausen DG et al., Magnetic resonance image-guided biopsies with a high detection rate of prostate cancer. The scientific world journal, 2012.
- Hoeks CMA et al., Three-Tesla Magnetic Resonance-Guided Prostate Biopsy in Men With Increased Prostate-Specific Antigen and Repeated, Negative, Random, Systematic, Transrectal Ultrasound Biopsies: Detection of Clinically Significant Prostate Cancers. European Urology, 2012.