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Should abdominal sequences be included in prostate cancer MR staging studies?

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ABSTRACT

Objectives: Prostate cancer staging MR examinations commonly include abdominal sequences to assess for non-regional (common iliac or para-aortic) nodal metastasis. In our experience the diagnostic yield of this is limited, but incidental findings are frequent, often necessitating further investigations. The aim of this study is to assess the diagnostic utility of abdominal sequences in routine prostate cancer MR staging studies.

Methods: Findings on abdominal sequences of consecutive MRI prostate studies performed for staging newly diagnosed prostate cancer between September 2011 and September 2013 were reviewed with respect to adenopathy and additional incidental findings. Results were correlated with Gleason grade and serum prostate-specific antigen (PSA) level in each case.

Results: 355 MRI prostate examinations were reviewed. 4 (1.1%) showed enlarged non-regional lymph nodes. Incidental findings were found in 82(23.1%) cases, neccessitating further investigation in 45 (12.7%) cases. Enlarged non-regional nodes were associated with higher PSA level and Gleason grade ($p = 0.007$, $p = 0.005$ respectively). With a combined threshold of PSA > 20 ng/mL and/or Gleason grade $\geq$8 the sensitivity, specificity, PPV and NPV were 100, 60, 3 and 100% respectively for predicting the presence of non-regional adenopathy.

Conclusions: Routine abdominal sequences are of very low yield in routine prostate cancer MR staging, frequently resulting in incidental findings requiring further work-up and should be reserved for high-risk cases. Our experience supports the use of an abdominal staging sequence in high-risk cases only.

1. Introduction

Prostate cancer is the most common cancer affecting the male population in the western world [1]. It is the sixth leading cause of cancer death in males. Death rates have decreased in much of the developed world including the UK and USA but the incidence and mortality of prostate cancer is rising in Asia [2].

MRI has several roles in prostate cancer imaging. It is most widely used in patients with a diagnosis of prostate cancer to evaluate tumour extent and local staging [3–5]. Prostate cancer is typically staged using the American Joint Committee on Cancer (AJCC) TNM staging system [6]. MRI is also increasingly used in the detection of biopsy-occult prostate cancer [7–9] and for assessment of local recurrence following treatment [10,11]. MRI prostate examinations performed for staging purposes typically include high resolution T2 weighted images through the prostate and also variably include an abdominal sequence to assess for non-regional [12] (e.g. common iliac, para-aortic) nodal metastasis. Nodal metastasis from prostate cancer is associated with poorer prognosis [13]. The presence of non-regional nodal metastasis results in upstaging of disease to M1a/Grade IV disease. In our experience the diagnostic yield of the abdominal sequence is minimal, but incidental findings are common, often necessitating further investigations. The European Society of Urogenital Radiology (ESUR) has developed clinical guidelines for prostate MRI [14]. Included in this is a recommendation that a limited abdominal sequence be reserved for high-risk cases only. They define high-risk as PSA levels greater than 20 ng/mL, Gleason score 8–10 or clinical stage >T2c. Supporting data for this is, however, lacking.

Abbreviations: MRI, magnetic resonance imaging; AJCC, American Joint Committee on Cancer; TNM, tumour-node-metastasis; ESUR, European Society of Urogenital Radiology; PSA, prostatic specific antigen.

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The purpose of this study is to assess the diagnostic yield of abdominal sequences in MR staging studies for prostate cancer for all patients and for the subgroup with high-risk disease. A secondary aim is to quantify the frequency of incidental findings necessitating further investigations.

2. Materials and methods

The study was approved by the local institutional ethics review board. All consecutive MRI prostate examinations performed for newly diagnosed prostate cancer between September 2011 and September 2013 were included in the study. Imaging was performed with a 1.5-T whole body magnet (Siemens Magnetom Avanto, Forcheim, Germany) or a 1.5 T whole body magnet (GE signa HDx, Waukesha, WI, USA). The local protocol routinely includes breathhold two dimensional axial T1-weighted (T1W) sequence of the abdomen. Parameters for this sequence include TR of 158 ms, TE of 4.72 ms, slice thickness of 7 mm, interslice gap of 1.4 mm, flip angle of 70° and a NEX of 2. The reported findings on abdominal T1W sequence of each study were reviewed. Gleason grade and serum prostate-specific antigen (PSA) level was recorded in each case. The prevalence of enlarged common iliac or para-aortic lymph nodes (defined as >1 cm in short axis diameter) was calculated for all cases and for the subgroup with high-risk disease. High-risk disease was defined as PSA >20 ng/mL or Gleason score ≥8. The sensitivity, specificity, negative and positive predictive value of PSA >20 ng/mL or Gleason score ≥8 for the finding of para-aortic adenopathy was calculated using PSA and Gleason grade thresholds separately and combining both parameters.

Statistical analysis was performed using Minitab statistical software (Minitab Inc., PA, USA). Categorical variables were assessed using Fishers exact test. Continuous variables were assessed using the Mann–Whitney *U* test for non parametric data. A *p* value of less than 0.05 was considered significant. The diagnostic performances were assessed on calculated values for sensitivity, specificity, positive and negative predictive values.

The number and types of incidental findings were documented in addition to recommendations for additional imaging.

3. Results

A total of 355 MRI prostate examinations were performed for staging of prostate cancer during the study period from September 2011 to September 2013 at our institution. The mean PSA level was 11.7 ng/mL in the study population, with a wide range from 0.8 to 135 ng/mL. Median Gleason grade was 7, ranging from 6 to 10.

Only 4 of 355 examinations (1.1%) showed enlarged non-regional nodes. Enlarged non-regional nodes were associated with higher PSA level and Gleason grade ($p = 0.007$, $p = 0.005$ respectively). Using a threshold of PSA > 20 ng/mL yielded a sensitivity of 75%, specificity of 90%, positive predictive value of 8% and a negative predictive value of 99% for predicting the presence of non-regional nodes. Using a Gleason grade threshold of ≥8 yielded a sensitivity of 100%, specificity of 64%, positive predictive value of 3% and negative predictive value of 100% for predicting the presence of non-regional nodes. Using a combined threshold of PSA > 20 ng/mL and/or Gleason grade ≥8 (high-risk patients) yielded a sensitivity of 100%, specificity of 60%, positive predictive value of 3% and negative predictive value of 100% for predicting the presence of non-regional nodes.

Incidental findings were identified on 82 examinations (23.1%) (Figs. 1–4). Further imaging was advised in 12.7% of cases ($n = 45$). Simple renal cysts were seen in 48 cases, with ultrasound performed to confirm the diagnosis in 17 cases. Simple liver cysts were seen in 7 cases, confirmed on ultrasound in 3 cases. Additional

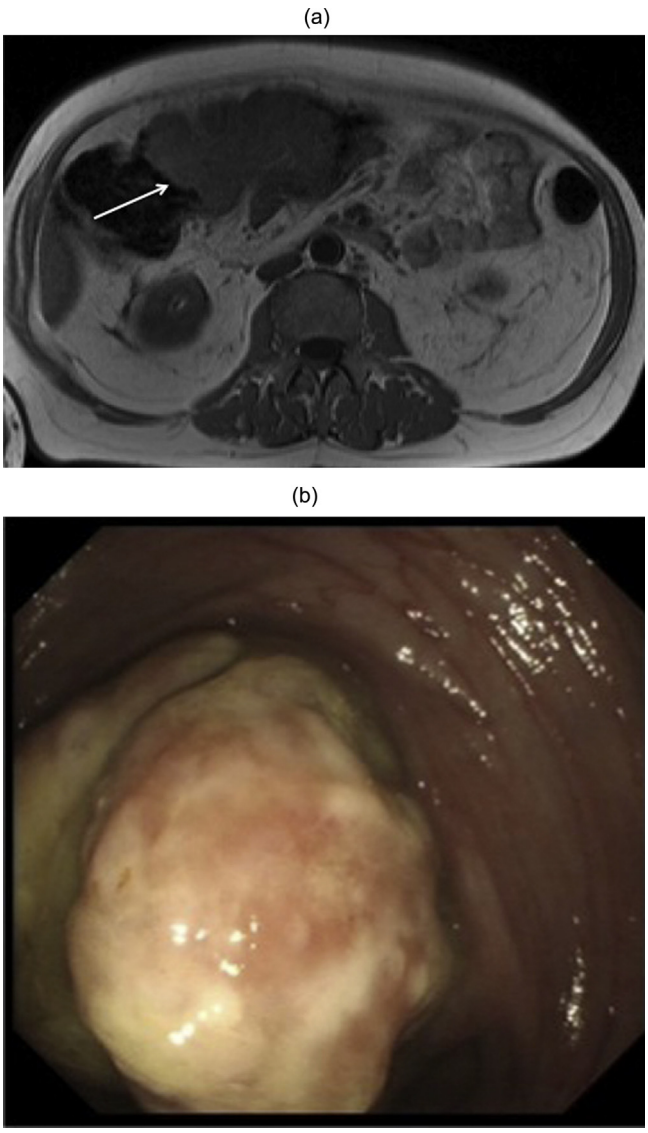

Fig. 1. 62 year old man with newly diagnosed prostate cancer, PSA of 5.7 ng/mL and Gleason grade of 7. T1-weighted MRI shows a large mass obliterating the lumen of the proximal transverse colon (a). Endoscopy shows the tumour which was confirmed histologically to be an adenocarcinoma (b).

incidental findings include abdominal aortic aneurysm, hepatic haemangioma, adrenal adenoma, renal cell carcinoma, serous cystadenoma of the pancreas, pancreatic tail neuroendocrine tumour, colorectal cancer and pleural thickening. In two cases perceived abnormalities on MRI were found to be artefactual on follow up CT examinations. In 16 cases with incidental findings (non specific renal, liver, and adrenal lesions), further imaging was advised but was not performed. Four of the 82 cases (5%) of incidental findings necessitated additional treatment i.e. colorectal cancer, two renal cell carcinomas and pancreatic neuroendocrine tumour.

4. Discussion

This study confirms a low yield for the diagnosis of non-regional lymphadenopathy in abdominal sequences when performed in the staging of prostate cancer. The high negative predictive value of combined thresholds of PSA > 20 and/or Gleason Grade ≥8, (100%) indicates that the addition of abdominal sequences can be safely reserved for high risk cases as defined by these criteria. The omission of an abdominal staging sequence in lower risk groups can