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ORIGINAL ARTICLE

3 Tesla MRI surface coil: Is it sensitive for prostatic imaging??

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KEYWORDS

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Abstract *Objective:* This study aimed to check the sensitivity of phased array surface coli of 3T MRI, in pre-sampling diagnosis of prostate cancer, in an attempt to use it instead of endorectal coil.
Patients and methods: This was a prospective comparative study, included 20 male patients, presented with suspected prostate cancer due to unexplained high PSA. The study protocol was approved by the ethics committee in Al-Mana General Hospital.
Results: Prostate cancer was correctly diagnosed by T2w sequence within 9 patients, 10 by DW&T2w, 13 by T2w – DW-DCE and 14 by of T2w-DW-DCE-MRS sequences.
Conclusion: 3T MRI imaging using phased array surface coil is a useful diagnostic tool for detecting prostate cancer, trustworthy when compared to endorectal approach.

1. Introduction

Newly published international statistics had stated that prostate cancer is gaining remarkable increased records. Worldwide surveys reported that among six men, one will be diagnosed as prostate cancer, during his lifetime. It is well known that such neoplasm occurs mainly in older men; about two thirds are diagnosed after the age of 65, it is uncommon before age 40. Age of 67 is considered average age at the time of diagnosis. It is considered the second leading cause of cancer death in American men, following bronchial carcinoma; about 1 man in 36 will die of prostate cancer.[1]

1.1. Risk factors for prostate cancer

Some factors might be associated with increased risk of prostate cancer, although such link is not yet clearly explained.

Abbreviations: ADC, apparent diffusion coefficient; BPH, benign prostatic hyperplasia; DCE-MRI, dynamic contrast enhanced MRI; DWI, diffusion-weighted MRI; 3dFES, 3d fastfield echo sequence; EPI, echoplanar imaging; ERC, endorectal coil; MRS, MR spectroscopy; NPV, negative predictive value; PACS, Picture archiving and communication system

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1.1.1. Age

Prostate cancer is very rare in men younger than 40, but the chance of having prostate cancer rises rapidly after age 50. Almost 2 out of 3 prostate cancers are found in men over the age of 65.

1.1.2. Race/ethnicity

Prostate cancer occurs more often in African-American men than in men of other races. African–American men are also more likely to be diagnosed at an advanced stage, and are more than twice as likely to die of prostate cancer as white men. Prostate cancer occurs less often in Asian–American and Hispanic/Latino men than in non-Hispanic.

1.1.3. Family history

Prostate cancer seems to be of high incidence in some families, which suggests that there may be an inherited or genetic factor. Having a first degree relative with prostate cancer doubles the risk of developing such disease. Also, the risk is much higher for men with several affected relatives.

1.1.4. Genes

Some inherited genes had been found to raise the risk for more than some type of cancer. For example, inherited mutations of the BRCA1 or BRCA2 genes are the reason that breast and ovarian cancers are much more common in some families. Mutations in these genes may also increase prostate cancer risk in some men, but they account for a very small percentage of prostate cancer cases.[1–3]

1.2. Clinical picture

The majority of prostate cancers are incidentally diagnosed in patients who are asymptomatic in the screening programs of prostate-specific antigen (PSA) level or findings on digital rectal examination. Some patients with prostate cancer may present with urinary complaints or retention, back pain, hematuria, frequency, urinary urgency, and decreased urine stream. However, these symptoms often result from benign prostatic hyperplasia (BPH).[4,5]

Manifestations of advanced disease result from combination of lymphatic, hematogenous, or contiguous local spread. Skeletal manifestations are especially common, because metastasis of prostate cancer has a strong osseous predilection. These advanced signs include weight loss and loss of appetite, anemia, bone aches, with or without pathologic fracture, and neurologic deficits from spinal cord compression. Also, lower extremity pain and edema due to obstruction of venous and lymphatic tributaries by nodal metastasis may be encountered. Uremic symptoms can occur from ureteral obstruction caused by local prostate growth or retroperitoneal adenopathy secondary to nodal metastasis.[4,5]

1.3. Pathophysiology

Adenocarcinoma is the most common type (95%). Approximately 4% of cases is transitional cell, which is thought to arise from the prostatic urethra epithelium. Squamous cell carcinomas constitute less than 1% of all prostate carcinomas. In many cases, prostate carcinomas with squamous differentiation arise after radiation or hormone treatment. The few cases that have neuroendocrine morphology are believed to arise from the neuroendocrine stem cells normally present in the prostate. Of prostate cancer cases, 70% arise in the peripheral zone, 15–20% arise in the central zone, and 10–15% arise in the transitional zone. Most prostate cancers are multifocal, with synchronous involvement of multiple zones of the prostate.[3,5]

1.4. Diagnostic tools

1.4.1. Transrectal US (TRUS)

TRUS is usually the first applied imaging modality for diagnosis of prostate cancer. It can show the focal prostatic lesion and guide transrectal biopsy. Also, it can evaluate the layers of the rectal wall to determine the depth of tumor penetration and demonstrate the regional lymphadenopathy, if present. So, it can help in staging of prostate cancer, however as with all ultrasound examinations, it is operator dependent. There are many advantages that make TRUS the first and commonest applying imaging modality e.g. it is less expensive than magnetic resonance imaging (MRI); it is portable and not time consuming. Also, TRUS is well-tolerated by patients, and involves no radiation exposure.[6,7]

1.4.2. CT scan

CT scan has almost no role in the initial diagnosis of prostate cancer, due to poor tissue contrast between the prostate and the surrounding levator ani. Also, the prostatic spatial resolution is of limited value, so its internal anatomy is not well demonstrated. The major role of CT is in the nodal staging of prostate cancer, so that CT should be performed only in patients with a PSA level greater than 20, when it is possible to have advanced malignancy with nodal deposits. CT sensitivity for diagnosis of nodal deposits ranges around 36%, because of the missed microscopic ones. One of the benefits of CT scan is its high sensitivity, as guiding imaging modality in nodal biopsy. Also, CT scan is sensitive for early detection of osseous deposits, long before X-ray can do.[8,9]

1.4.3. Radionuclide bone scanning

Scintigraphy still remains the examination of choice for diagnosis of prostatic osseous deposits, which are frequently encountered complication even in symptom free patients. Bone scan is not strictly indicated for patients with PSA below 10 ng/mL., this is because chances of a positive bone scan are less than 1%. The incidence of osseous deposits increases in conjunction with PSA level, becoming more than 50% if PSA level is above 50 ng/mL. Prostatic bony deposits are commonly osteoplastic showing avid tracer uptake; however the less commonly reported osteopenic type may reflect extensive damage to bone with little osteoblastic activity.[9]

1.4.4. MRI

MRI had been proven to be an important imaging tool in the diagnosis of prostate cancer. MRI shows clear a delineation of the prostate as well as its high spatial resolution quality as regards demonstration of the internal zonal anatomy. Thus, it can show clear anatomical differentiation between the peripheral and transitional zone. In addition, MRI also allows