

Role of MRI in planning radical prostatectomy. What is the added value?

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Introduction

The goal of radical prostatectomy is eradicating oncological disease while achieving the best possible functional outcomes. In this sense, nerve-sparing offer a greater chance of potency recovery after surgery. Accurately locating prostate cancer foci is instrumental to identify good candidates for this approach whilst keeping a safe rate of oncological margins.

Furthermore, prediction of extra-capsular extension or seminal vesicles involvement during pre-surgical planning can help to adjust excisional margins.

Method

A literature search of the MEDLINE/PubMed and Scopus database was performed. A peer review of the Journals took place to select relevant articles

Results

Mp-MRI has proof to be accurate to detect and locate prostate cancer. Sensibility to detect extra-capsular extension, seminal vesicle involvement or T3 in general is moderate, alas with a great specificity when detected. Measurement of membranous urethral length has shown to be useful in predicting probability of achieving continence after surgery. Furthermore, image guided surgery has been tested to be accurate to direct surgical planes in order to safely preserve neurovascular bundles

Conclusion

The use of Mp-MRI for pre-surgical planning allows tailoring surgery in order to achieve optimal functional outcomes whilst not compromising positive surgical margins rate.

Introduction

Radical prostatectomy (RP) is considered the standard surgical approach to localised prostate cancer. Traditionally pre-operative prostate cancer assessment was performed based on nomograms¹. MRI has shown to increase accuracy of clinical nomograms to predict final pathological staging.

The goal of RP is achieve cure, whilst keeping the lowest possible rate of side effects. In this sense there is a balance between wide excision, which will theoretically achieve the lowest rate of positive surgical margins, and a narrower excision trying to preserve structures that will implement functional structures. For this strategy, a trustable way to determine the likelihood of disease in the boundaries of the prostate is mandatory. To address this dilemma mp-MRI has shown to be effective in detecting and locating prostate cancer to a great degree of certainty¹⁰.

Another essential goal in radical prostatectomy is maintaining urinary continence. Greater Maximal urethral length (MUL) prior to RP is associated with higher degrees of continence. Thus, preoperative measurement is recommended.

Staging of localised prostate cancer

Local staging of prostate cancer is paramount to offer an adequate treatment. Previously, this was done on the grounds on nomograms integrating PSA, Gleason score, number of positive scores and clinical stage based on digital rectal examination. This information is blind to size and location of tumour as well as relation with surrounding organs. Moreover, digital rectal examination is subjective and operator dependant⁸ and often underestimates tumour extension. The value of Mp-MRI in local staging is unclear. In a recent systematic review, high specificity but inconstant and generally low sensitivity was found for Mp-MRI to detect extra-capsular extension, seminal vesicle invasion and T₃ stage¹¹. Moreover, Mp-MRI allows to detect bulky extra-capsular extension, albeit not micro-capsular breach, and therefore is a more reliable method for local staging prior to RP⁴(ref-MRI more reliable staging).

A reliable prediction of final pathological stage is of seminal importance given the recent trend towards selecting more high risk prostate cancer for radical prostatectomy⁹, where involvement of bladder neck, peri-prostatic fat or surrounding organs is not rare.

Pre-surgical nodal evaluation

The most reliable way to assess lymph node involvement is a pelvic lymph node dissection (PLND); this is of course not free of morbidity or invasiveness. Therefore, identification of patients that will benefit from pelvic lymph node dissection and the extent of such is another preoperative planning where imaging might change the current decision-making tools.

On a recent meta-analysis, the pooled sensitivity within different studies for both CT scan and MRI scan was low at 0.42 and 0.39 respectively. Specificity was 0.82 for both tests. There was no statistical difference between the two tests, hence both have a similar poor capacity to detect nodal involvement. This is basically because both scans evaluate only anatomical information, lacking metabolic data.

Adding clinical parameters to the MRI findings seem to increase the ability to predict LNI (AUC 0.956). Furthermore, tumour volume, tumour ADC value and tumour T stage were the most accurate independent predictors of LNI. Finally, the prevalence of nodal metastasis in patients with localised (T2 on MRI) tumours with tumour size <1cm was very low; suggesting that MRI could be used to triage which patients might avoid PLND.

Nevertheless, consi

Role of MRI to guide nerve sparing radical prostatectomy

Preservation of neurovascular bundles (NVB) has shown to improve functional outcomes after radical prostatectomy. Despite anatomical variations that make the degree of preservation hard to predict^(ref. anatomical variations,5), in a general fashion NVB are considered to run posterolateral to the prostate from the base to the apex. As discussed above, the gain in side effects reduction must be weighted against the risk of compromising surgical margins, thus increasing the risk of prostate cancer recurrence and the morbidity of adjuvant treatments. Therefore in order to plan a narrower excision plane, it is desirable to ensure the absence of disease close to the posterolateral margins of the prostate. The role of Mp-MRI to decide the level of nerve spare and select patients for this approached was evaluated by Riccardo et al(Ref). They performed an MRI scan on 137 men deemed to undergo radical prostatectomy. The previous nerve sparing strategy based on clinical data was revised with the MRI findings, approximately in half the cases the nerve sparing strategy was changed either at patient or side level. Appropriateness of resection was considered taking into account presence of extra-capsular extension or positive surgical margins on the side were the NS strategy was changed. Overall appropriateness of change was referred to be 70%. Moreover, they demonstrated lower positive margin rates on this cohort of patients when compared to a synchronous dataset of RARP⁷.

Further, Panebianco et al. selected 125 patients who were deemed to have bilateral nerve sparing radical prostatectomy (NS RP) based on clinical parameters and also performed an MRI scan. Patients were subsequently divided according to MRI findings into those eligible for bilateral NS or those where the strategy should change to either unilateral or no NS bilateral, in roughly 30% of men the initial bilateral NS RP plan was changed. The authors claim that the use of pre-operative Mp-MRI allowed choosing an appropriate level of excision in 95.9% and 87.5% of men in the bilateral and the uni or non NS RP respectively. Moreover, the rate of positive margins in the posterolateral region was low at 3.8%³.

Measurement of membranous urethral length

Despite surgical advancements, incidence of urinary incontinence after radical prostatectomy is high, particularly in the early postoperative period. Recovery of continence, is unpredictable and quite variable amongst different series(REF). Time to continence recovery is also variable with improvements reported up to two years after surgery.

Various patient-related risk factors that affect continence have been reported. Amongst them, membranous urethra length (MUL) has been hypothesized to be positively correlated with better recovery of urinary continence. In one recent meta-analysis, greater MUL, measured on T2 weighted images on preoperative

MRI, correlated with better continence results at 3, 6 and 12 months. Furthermore, after statistical analysis every extra centimetre of MUL improved likelihood of continence recovery by more than 200%⁶.

Therefore, preoperative measurement of MUL should be a standard preoperative evaluation which will add valuable information for patient counselling.

Conclusion

Radical prostatectomy is the mainstay treatment for localised prostate cancer. Despite technological improvements, functional outcomes after radical prostatectomy are still variable and in some cases unpredictable. The introduction of preoperative imaging can shift the trend towards a more tailored radical prostatectomy incorporating patient and tumour information on the pre-surgical planning. This can reduce functional impact of the procedure without compromising oncological safety for a better-counselled patient.

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to include

1. **Nerve-sparing approach during radical prostatectomy is strongly associated with the rate of postoperative urinary continence recovery**

2. **Preoperative Membranous Urethral Length Measurement and Continence Recovery Following Radical Prostatectomy: A Systematic Review and Meta-analysis**
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