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VISIBILITY OF CHARACTERIZED PERIPROSTATIC NERVE DISTRIBUTIONS FOR NERVE-SPARING RADICAL PROSTATECTOMY

Hypothesis / aims of study

Successful nerve-sparing radical prostatectomy is supposed to preserve continence and erectile functions, which require a high knowledge of anatomic and qualitative periprostatic nerve distribution. Our objective was to anatomically characterize the distributions of cholinergic, adrenergic, and sensory periprostatic nerves and verify those histological findings by diffusion tensor imaging (DTI).

Study design, materials and methods

For the microscopic study, radical prostatectomy specimens from 19 patients were examined. Additionally, in five volunteers nerve concordance was investigated by DTI as a new MRI based technique to investigate neural structure. Serial whole-mounted sections were stained with PGP9.5 to estimate total nerve content, neuronal nitric oxide synthase (nNOS) as a marker for cholinergic nerves, tyrosine hydroxylase (TH) as a marker for adrenergic fibers, and calcitonin gene related peptide (CGRP) as a marker for sensory nerves. Extracapsular stained nerves were counted by prostate surface sector and classified by diameter. Relative density was calculated and distribution patterns were evaluated for each stain. MRI imaging using DTI technique was conducted and analyzed on a 3 Tesla MRI system with DTI tracking software.

Results

In the histological investigation at the prostatic base, cholinergic nerves were distributed across anterolateral, posterolateral, and posterior sectors. Their course continued posterolaterally in the midsection and both posterolaterally and posteriorly toward the apex of the prostate. Adrenergic nerves were distributed across the anterolateral, posterolateral, and posterior sectors at the prostate base, with the course narrowing to the posterolateral and posterior sectors at the mid and apical levels. Sensory fibers were found posterolaterally and posteriorly at the base, continuing posterolaterally over the mid and apical levels. Although it was not possible to determine the different nerve qualities it was possible to verify with DTI the concordance of the nerves from the base to the apex, confirming the histological findings.

Interpretation of results

Hostolglcal findings were confirmed by DTI. This opens the option not only to use DTI to preoperatively correlate the nerve concourse and the tumor(s) but with the incrising possibilities to project the findings into the OR-field to visualize the nerve structures and protect or to sacrifice them where possible or needed to have the best possible outcome.

Concluding message

Cholinergic, adrenergic, and sensory periprostatic nerve fibers show differences in their distribution and concordance over the surface of the prostate. When linked to possible functional aspects of the different nerve types, this morphologic evidence may be of importance when using nerve-sparing techniques in a radical prostatectomy to improve postoperative functions. DTI confirmed the histological findings and showed that DTI might be a tool to correlate the nerves to the tumor for better pre-operative planning and performance of the treatment. The histological concordance of the different nerve qualities can be confirmed by DTI. To ensure a good nerve sparing prostatectomy outcome, the concordance of the nerves need to be simultaneously respected on different levels from base to apex taking into account that the sector (anterior to posterior) might be different.

Disclosures

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