🏆 Best Basic Science Abstract

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Wöllner J[1], Zweers P[2], Krebs J[3], Berger M[2], Pannek J[1]

1. *Swiss Paraplegic Center, Neuro-Urology,* ***2.*** *Swiss Paraplegic Center, Radiology,* ***3.*** *Swiss Paraplegic Center, Clinical Trial Unit*

IN-VIVO IMAGING OF THE NEURONAL NETWORK OF THE LOWER URINARY TRACT USING DTI-FIBRE TRACKING – A PILOT STUDY

Hypothesis / aims of study

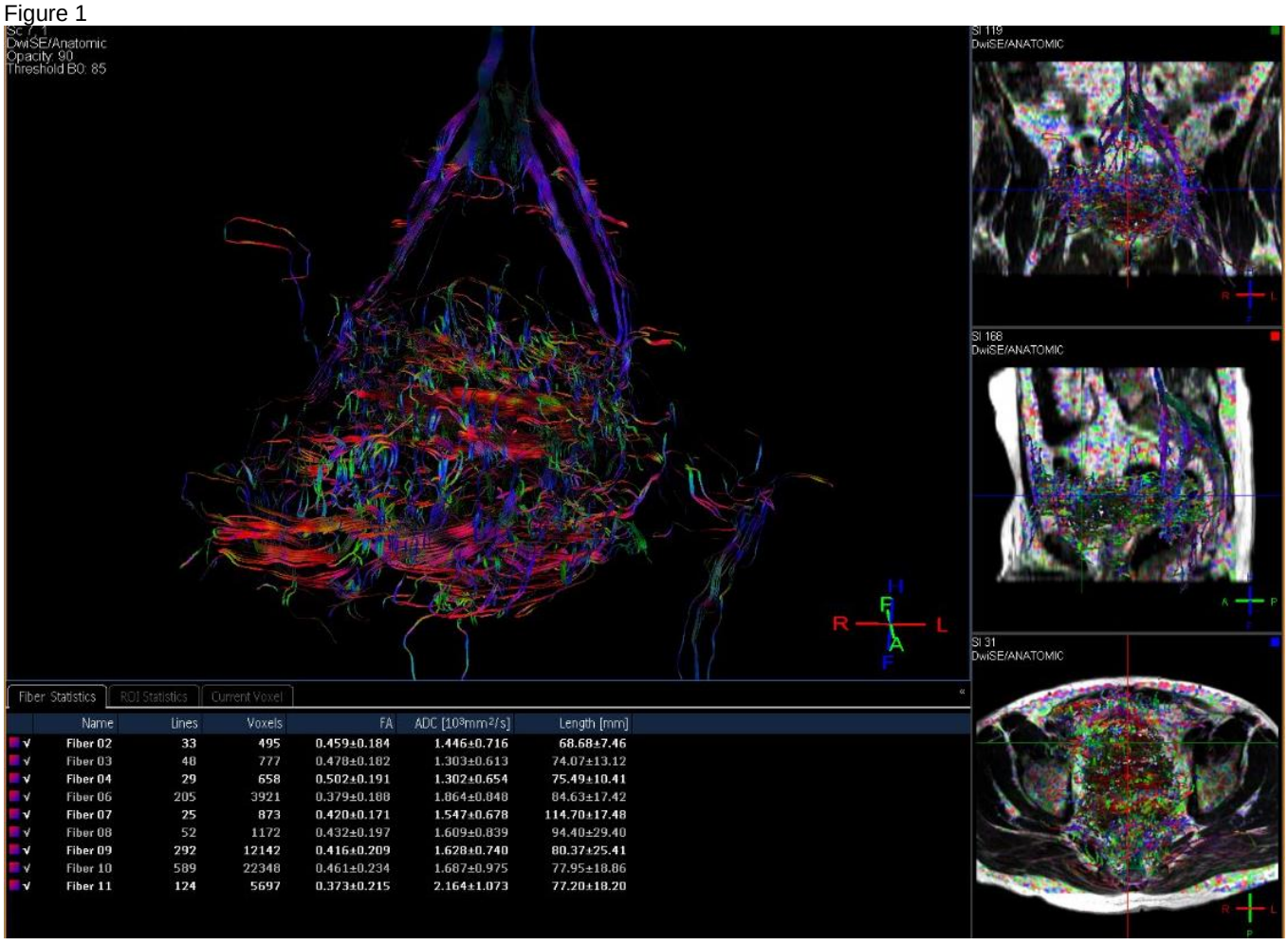
The neuronal innervation of the lower urinary tract (LUT) is important for the unaffected function of the LUT [1]. Neurogenic disease can affect the integrity of this network and can lead to neurogenic LUT dysfunction (NLUTD). DTI technology is used in central nervous disease to identify changes in the neuronal network [2]. Aim of this study was to demonstrate the feasibility and reproducibly to image the nerve-fibres innervating the LUT in vivo, and to design an DTI algorithm to image the LUT network using DTI technology.

Study design, materials and methods

Prospective, investigator-initiated pilot study.

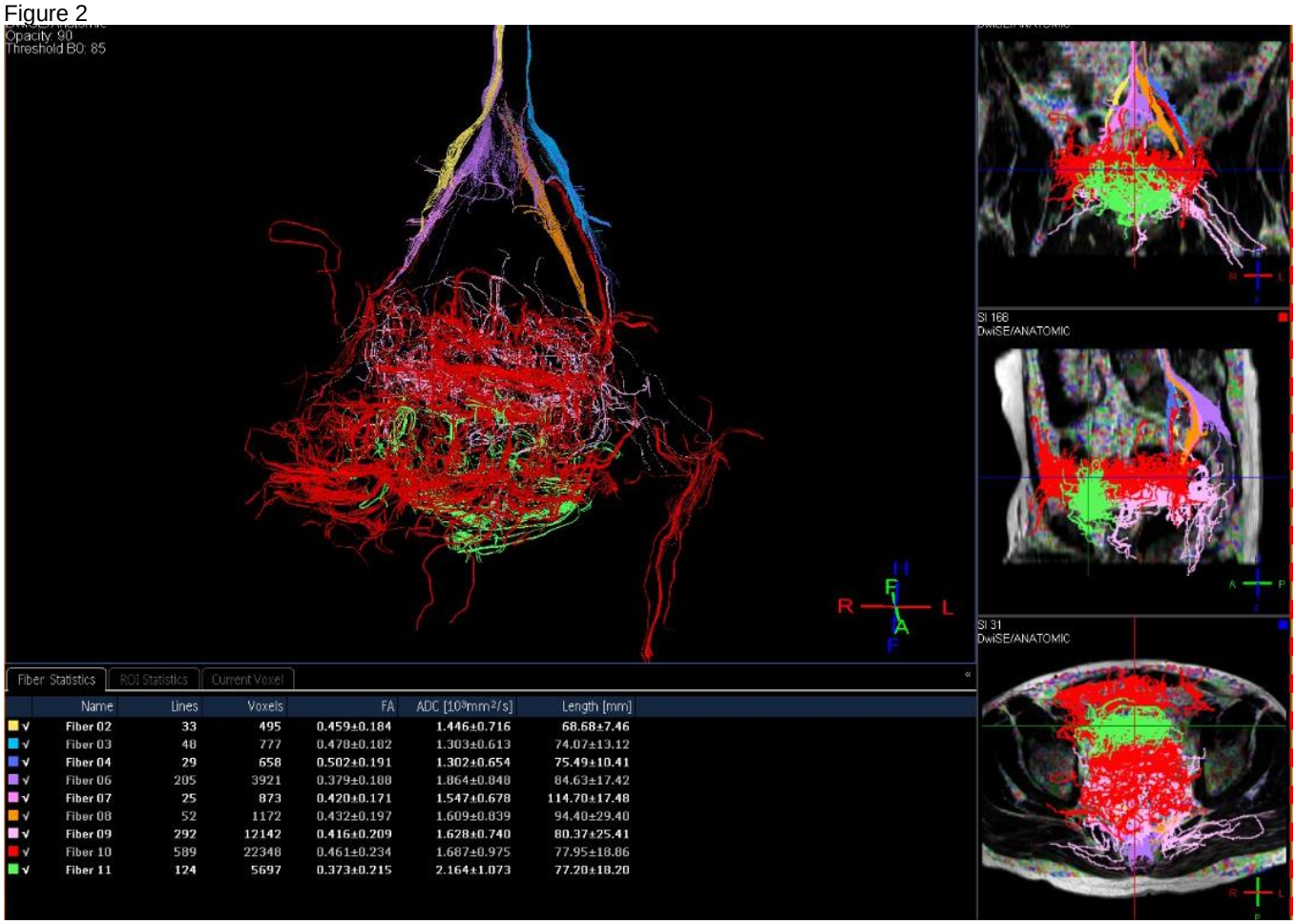
We investigated the feasibility of DTI fibre tracking in ten healthy volunteers and two patients with NLUTD. we used the algorithm by van der Jagt [3] , which we adapted and modified. All subjects were examined with a 3.0 Tesla MR, T2, which was performed from L5 to the pelvic floor. Voxel size was 3x3.1x3 mm, 70 slides, 2400 images/subjects, total scanning time 11.50 min.

Figure 1



	Name	Lines	Voxels	FA	ADC [10³mm²/s]	Length [mm]
√	Fiber 02	33	495	0.459±0.184	1.446±0.716	68.68±7.46
√	Fiber 03	48	777	0.478±0.182	1.303±0.613	74.07±13.12
√	Fiber 04	29	658	0.502±0.191	1.302±0.654	75.49±10.41
√	Fiber 06	205	3921	0.379±0.188	1.864±0.848	84.63±17.42
√	Fiber 07	25	873	0.420±0.171	1.547±0.678	114.70±17.48
√	Fiber 08	52	1172	0.432±0.197	1.609±0.839	94.40±29.40
√	Fiber 09	292	12142	0.416±0.209	1.628±0.740	80.37±25.41
√	Fiber 10	589	22348	0.461±0.234	1.687±0.975	77.95±18.86
√	Fiber 11	124	5697	0.373±0.215	2.164±1.073	77.20±18.20

Figure 2



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Results

In all subjects the DTI fibre tracking was feasible without artefacts. In all ten healthy volunteers (5 women, 5 men, mean age 43.3y) and two patients (male, mean age 46.5y) we were able to image the sacral roots S1 to S4, and the neuronal network of the LUT. All subjects demonstrated a high density of nerve fibres around the bladder (figure1,2). Results were reproducible in volunteers. The patient with chronic SCI (sub Th3, AIS A, since 1981) and bladder management with reflex-micturition did not reveal relevant differences compared to the healthy volunteers. The patient with NLUTD due to meningomyelocele who underwent bladder augmentation, showed a thinner network around the bladder and no direct connectivity to the spinal cord.

Interpretation of results

In vivo-imaging of the LUT neuronal network using DTI fibre tracking is feasible und reproducible. The network is very close, depicting a high innervation density. Potentially SCI causes a loss of connectivity between the brain and the target organs, but does not induce degeneration of the nerves fibres below, whereas the congenital lesion may prevent the formation of a compact network.

Concluding message

To the best of our knowledge, this is the first study investigating the feasibility of DTI fibre tracking in the LUT. We were able to reproducibly image the neuronal network of the LUT. Our preliminary results indicate that this technique is promising to further assess the development of the neural system after spinal cord injury. Further studies in patients with NLUTD are required.

References

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Disclosures

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