Pudendal neuralgia is a debilitating condition and an important cause of chronic pelvic and perineal pain. It causes a significant impact on quality of life, psychosocial distress, sexual dysfunction, and problems with partner-relationships. It is also noted to have an increased association with depression, anxiety, and fatigue.[1]

Currently, the diagnosis of pudendal neuralgia is based on the Nantes Diagnostic Criteria, which relies on clinical findings and is not specific, leading to an average time to diagnosis of 4.5 years from the onset of symptoms to definitive treatment.[1]

Patients who present with pain – such as tingling, numbness, muscle weakness, genital pain and/or urinary symptoms – are commonly misdiagnosed, leading to misdirected and ineffective treatments. Often, patients with intrapelvic nerve entrapments undergo 1.2 ineffective surgical procedures, aimed at the wrong cause of pain.[1]

Once accurately diagnosed, treatment via laparoscopy has shown to be successful in resolving symptoms and relieving pain.[1]

Therefore, diagnosis is the main factor standing between patients and effective treatment. Tractography is a 3D modeling technique used to visually represent neural tracts using data collected by diffusion-weighted images (DWI) and has already been used to map the lumbar sacral plexus.[3]

We have piloted the use of this technique in patients undergoing pelvic MRI and MR Neurography for the investigation of intrapelvic neuropathy. The objective of this study is to analyze the tractography reconstruction and compare it with neurography and intraoperative findings.

## METHODS

This is a retrospective tractographic reconstruction of DWI sequences collected from patients who underwent laparoscopic detraction of the sacral plexus, as previously described.[1] As per since the last quarter of 2015 our standard preoperative workup protocol was established with pelvic MRI with MR Neurography (MRN) and DWI sequences, which are used for anatomical analysis and preoperative planning.

Axial DWI sequence is performed with diffusion-weighted single shot echo planar imaging (EPI) with following parameters: echo time=85 ms, repetition time=9900 ms, time of acquisition=7.55, sensitie factor=3, field of view=255 mm, matrix size=128 x 160, number of slices=50, isotropic size=1.6 x 1.6 x 4.0, b values=0, 50, 500, 700, gradient directions=6. Two information generated from the DTI sequence will aid in the study of the lumbar sacral plexus: fiber tractography and fractional anisotropy (FA).

These images are used solely for anatomical visualization and preoperative planning, but not for diagnostic purposes. All diagnosis is based on clinical Preoperative Neuropelveological Assessment (PNA) and Urodynamics, as previously described.[1]

In March 2018, all the stored DWI sequences were reprocessed for tractography analysis. All patients had signed a consent authorizing the use of MR and surgical images and clinical data for research, educational and quality improvement purposes.

Data was tabulated and correlated with MRN and PNA tracts. Both MRN and PNA tracts were compared to MR tractography (MRT) results and to intraoperative findings. Primary outcome was the correlation between MRT and intraoperative findings. Secondary outcomes were the correlation between MRT and MRN results, and correlation between intraoperative findings and MRT results with correlation with clinical outcomes.

## RESULTS

A total of 14 patients (11 women, 3 men) were included in this analysis. Tabulated results are displayed on the table. Twelve out of 14 MRT reconstructions were considered satisfactory. Two had limited results secondary to artifacts generated by orthopedic hardware.

On all cases whose MRT reconstruction was considered technically reliable, diffusion rate and tractographic analyses were capable of identifying the site of entrapment found intraoperatively. Of these, 10 had satisfactory clinical outcomes (>50% symptom reduction on VAS).

## CONCLUSIONS

The perfect correlation between MRT and intraoperative findings are extremely encouraging.

This study, however, has several important limitations: it is a retrospective analysis with MRT interpretation performed in light of intraoperative findings; there is no control group to allow for estimation of positive and negative predictive values.

A pilot prospective blinded case-control study has already been designed to set the basis for a larger trial that will allow for the establishment of sensitivity and specificity of the technique to pudendal neuralgia, as well as other intrapelvic nerve entrapments. If the results of these larger trials are as good as expected, we might finally have an objective and reliable diagnostic tool, that could potentially reduce the gap between the onset of symptoms and final diagnosis.

## REFERENCES

1. Lemos N¹, Fernandes G², Melo H³, Morgado-Ribeiro A⁴, Szejnfeld J⁴, Cancelliere L⁵, Li A⁵, Sermer C⁵, Lemos N¹, Melo H³, Morgado-Ribeiro A⁴, Szejnfeld J⁴, Cancelliere L⁵, Li A⁵, Sermer C⁵.
