

3T MR neurography in Lumbosacral Nerves: an anatomical study

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Objective

1. To study the anatomy of lumbosacral spinal nerves and branches by dissecting healthy corpse. 2. 30 healthy volunteers were performed with MRN of lumbosacral spinal nerves by T2-Weighted FRFSE-XL sequence with fat saturation in 3 Tesla high fields MR scanner. 3D images of normal lumbosacral spinal nerves were reconstructed and compared with the corpse images to explore the value of MRN in displaying lumbosacral spinal nerves.

Methods

1. Corpse: The anatomical photos of two male corpses fixed with formaldehyde were taken as the standard of MRN. The specimen of lumbosacral spinal nerves and vessels was fixed on a plastic slab, and scanned with a 16 multi-slice spiral CT scanner (GE Company, Lightspeed 16 CT System). 2. Healthy Volunteers: A total of 30 healthy volunteers (17 men and 13 women; mean age 25.7 years, range 25-35years) were examined with 3 Tesla MR Scanner (GE Company, 3T Signa EXCITE HD System). Original MRN images was performed by FRFSE-XL sequence with fat saturation to suppress fat signal (TR/TE/NEX:4000ms/85ms/2, Thick/gap, 1.0mm/0.0mm, totally 42 ~ 44 images, acquisition Time : 4min17s) (totally 63 ~ 88 images and 6min26s ~ 8min35s were needed when examined in sacral spinal nerve) .3. AW4.3 workstation was used for image post-processing, with MPR, MIP and VR Reconstruction. 4. All the Statistical analysis was made using SPSS 13.0 software package.

Results

The normal lumbosacral spinal nerve demonstrated high signal intensity in MRN original images with vertebral body, muscles, and fat low signal intensity. MRN images clearly showed the appearances of spinal nerve root, ganglion and most of the anterior ramus. MPR , MIP and VR images can display the outline of spinal nerve in multi directions. Most of the big branches of T12~L5 spinal nerve could be seen well. The display ratios of femoral nerve (100.00%), obturator nerve (91.67%) were higher than that of lumbosacral trunk ($P<0.05$) . No statistical significance ($P>0.05$) existed in displaying ratios between femoral nerve and obturator nerve.

Conclusion

1. Using 3T FRFSE-XL sequence as MRN method, we can get 2-D MRN original images with high space resolution and high SNR. The 3D appearance of spinal nerves was clearly demonstrated by multiple reconstructive methods. 2. Among all the reconstructive methods, it's easier to different the spinal nerve structure from surrounding tissues with MPR method. VR image is much better than MPR and MIP in demonstrating the difference among spinal nerve, spinal cord, fat, muscles and blood vessels by using multi-threshold color technique. Spinal nerve VR image can display the three-dimensional structure of spinal nerve more directly. 3. The display ratios of T12-L5 nerve root sheath, ganglion and proximate anterior rami reached 85%-100%. The displaying ratios of L2~L5 lumbosacral plexus branch is high too(41.6%,100%,100%,100%), The displaying ratios of femoral nerve, obturator nerve, and lumbosacral trunk is 100.00% , 91.67% , 61.67% respectively.

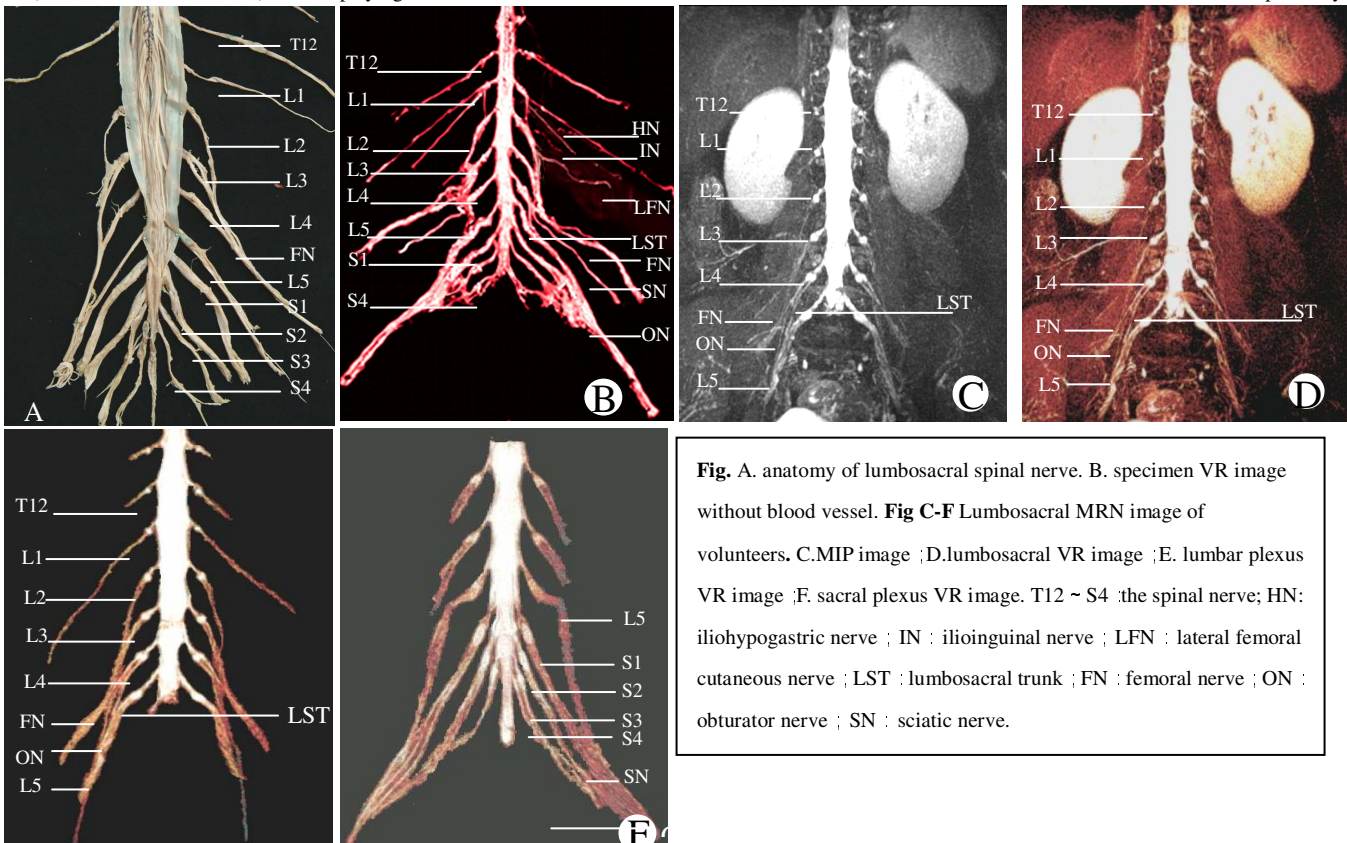


Fig. A. anatomy of lumbosacral spinal nerve. **B.** specimen VR image without blood vessel. **Fig C-F** Lumbosacral MRN image of volunteers. **C.**MIP image ;**D.**lumbosacral VR image ;**E.** lumbar plexus VR image ;**F.** sacral plexus VR image. T12 ~ S4 :the spinal nerve; HN: iliohypogastric nerve ; IN : ilioinguinal nerve ; LFN : lateral femoral cutaneous nerve ; LST : lumbosacral trunk ; FN : femoral nerve ; ON : obturator nerve ; SN : sciatic nerve.