

**The Furcal nerve. Ronald L L Collins,MB,BS(UWI),FRCS(Edin.),FICS (Fort Lee Surgical Center, Fort Lee,NJ)**

The furcal nerve is regarded as an anomalous nerve root, and has been found with significant frequency in disc material, especially in disc material from percutaneous endoscopic discectomies. These nerve roots are commonly found at the L3 and L4 levels. They may also be found intra- as well as extraforaminally. Selective spinal nerve blocks have revealed regions of sensory impairment in the lower extremities because of these anomalous nerves. Neurologic symptoms suggestive of two roots being involved, are frequently due to furcal nerve compression.

Key Words: L4 root anomalous epidural impairment sensory

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With the increased popularity of minimally invasive spinal surgery[7], the occasional discovery of peripheral nerve fibers in disc material has prompted the focus on a nerve that is sometimes found crossing the triangular area where most endoscopic spinal surgery, (the posterolateral approach) is done [8,9,10] Fig.1..

In contrast to traditional spine surgery that (a) May create spinal instability (b) Devitalize the paraspinal muscles (c) Cause scarring and adhesions around exiting spinal nerves, the morbidity associated with the posterolateral approach to the disc is generally seen as minimal.[8,9].EMG data after standard approaches to the spine that emphasize maximum exposure , are severely compromised.

Spinal structures that are accessible with the posterolateral approach (Fig.2) include the facet joints, the pedicles of the superior and inferior vertebrae, the traversing and exiting nerve roots, as well as the disc annulus. The neural foramen also may contain aberrant nerves (Fig.1 ), that branch off the exiting nerve root and may connect with the traversing nerve [8,9,10]. The nerves are described as furcal nerves in the literature and are not generally seen in the traditional posterior approaches. The prevalence of anomalous nerve roots has been based on anatomic dissection or preoperative neuroradiologic imaging techniques [1]. Studies have involved the use of MRI in the diagnosis of lumbosacral nerve root anomalies (Fig.4) and (Fig.5). An incidence of approximately 17.3% of nerve root anomalies was found by Haijiao Wet al, of which one case was cranial in origin, five cases of caudal origin, two cases of conjoined nerve root and 57 cases of furcal nerve roots (15.1% ) out of a series of 376 patients who complained of low back pain and or radicular pain who then underwent MRI imaging of the lumbar spine. Furcal nerve roots were most commonly found at the L3 and L4 levels and are classified according to their division i.e. (1) intra- and (2) extraforaminal. MRI has been found to provide accurate information of lumbosacral nerve root anomalies [1]. Yeung AT gives an anecdotal account of visualizing a furcal nerve at the L5/S1 disc level in a 3301b football player with back pain and sciatica. Probing and using electro-thermal cautery next to this 2.5 mm anomalous nerve reproduced pain in the second, third ,and fourth toes of the player's foot [8,9,1 0]. Selective lumbar spinal nerve block [7] has also been used to determine where regions of sensory impairment were to be found in 71 patients with 86 lumbar

spinal nerve blocks (Fig.6) , (L4 119 cases, L5 141 cases, and 81/26 cases ), using what is called the writing brush method. In addition to this study, selective nerve blocks were done and matched the respective dermatomes L4 (88%), L5 (82%), and 81 (83%) of the time. There was no 100% match and this was interpreted as the displacement of one spinal segment by a furcal nerve [3]. An offshoot of this is that diagnostic selective nerve root blocks have been useful tools in the diagnosis of radicular pain in atypical presentations such as in the presence of conjoint nerve roots or furcal nerves [10].

More importantly, attention must be paid to the furcal nerve when analyzing lumbo-sacral radicular symptoms, especially when the neurologic findings are atypical and the responsible level cannot be determined [4]. An anatomic and clinical study of the furcal nerve by Kikuchi S et al showed the following: (1) The furcal nerve was found in all dissections, and it was found to arise at the L4 root level in most dissections (93%) ! The furcal nerve was found to have its own anterior and posterior root fibers and its own dorsal nerve root ganglion! This proves that the furcal nerve is an independent nerve root. Neurological symptoms suggestive of two root involvement are frequently due to furcal nerve compression [4].

Further anatomic studies by Kikuchi S et al using cadavers showed that three factors are responsible for radicular symptoms :

- (1 )Congenital or acquired abnormalities of nerve and nerve roots i.e.
  - (a) the intradural segmental arrangement of rootlets
  - (b) congenital anomalies of the nerve roots
  - (c)and the furcal nerve.
- (2) Changes in bone and soft tissue around the nerves and the nerve roots

(together with the extremely transverse courses of the nerve roots) (3).

Spatial relationship of the nervous tissue to osseous and non-osseous elements of the spinal canal as well as the intervertebral foramen [5].

Finally , the nerve root is surrounded by a rather thick membranous structure (the epiradicular sheath) , which is responsible for a tubular shape obtained when the nerve root is infiltrated, outlining this sleeve. Anatomic abnormalities can be observed in contrast studies, but the defects revealed do not necessarily correspond with a patient's neurological symptoms. In such cases , nerve root infiltration is very useful for making a functional diagnosis. The analysis of radicular symptoms with nerve root infiltration[7] showed that radicular pain and/or claudication are caused by single nerve root involvement, irrespective of the findings obtained by contrast studies. Furthermore, the therapeutic effect of nerve root infiltration can be applied as a final trial of conservative treatment [5].

## Summary

Furcal nerve compression may be responsible for clinical neurological symptoms suggestive of two lumbar roots being involved. In this dissertations about the various anatomic presentations of this anomalous nerve root, examples of the neurologic symptoms have been discussed, and the use of selective spinal nerve root blocks[7] as well as MRI to demonstrate the-presence of these anomalous nerve roots has been presented.

## REFERENCES

1. Haijiao W, Koti M, Smith FW, Wardlaw D. Diagnosis of lumbosacral nerve root anomalies by magnetic resonance imaging. *Journal of Spinal Disorders* .2001 Apr.,14(2): 143-9.
2. Hermantin FU, Peters T, Quartararo L, Kambin P. A prospective randomised study comparing the results of open discectomy with those of video-assisted arthroscopic microdiscectomy. *J Bone Joint Surgery*.1999 ; 81A : 958-965.
3. Huston CW, Slipman CW. Diagnostic selective nerve root blocks: indications and usefulness. *Phys Med Rehabil Clin N Am* 2002 Aug ; 13 (3) : 545-65.
4. Kikuchi S, Hasue M, Nishiyama K, Ito T. Anatomic and clinical studies of radicular symptoms. *Spine* 1984 Jan- Feb ; 9(1) : 23-30.
5. Kikuchi S, Hasue M, Nishiyama K, Ito T. Anatomic features of the furcal nerve and its clinical significance. *Spine* 1986 Dec ; 11(10) :1002-7.
6. Kirkaldy-Willis W, The pathology and pathogenesis of low back pain. In Kirkaldy-Willis W, ed. *Managing low back pain*. New York: Churchill Livingstone ; 1983 :23- 24.
7. Nitta H, Tajima T, Sugiyama H, Morijama A. Study on dermatomes by means of selective lumbar spinal nerve block. *Spine* 1993 .Oct. 1; 18(13) : 1782-6.
8. Yeung AT. Minimally invasive disc surgery with the Yeung Endoscopic Spine System (YESS). *SURGICAL TECHNOLOGY INTERNATIONAL VIII* June 1999.
9. Yeung AT. The evolution of percutaneous spinal endoscopy and discectomy : State of the art. *Mount Sinai J Med*. 2000; 67: 327-332.
10. Yeung A T. Endoscopic spinal surgery : What future role ? *The Journal of Musculoskeletal Medicine*. Nov. 2001 ; 18 :518-528.