

한국 성인에서 척수원추 위치의 다양성

- 자기 공명 영상 연구 -

주성필 · 김수한 · 이정길 · 김태선 · 정 신 · 김재휴 · 강삼석 · 이제혁

= Abstract =

The Variation of Position of the Conus Medullaris in Korean Adults

- A Magnetic Resonance Imaging Study -

Sung-Pil Joo, M.D., Soo-Han Kim, M.D., Jung-Kil Lee, MD.,
Tae-Sun Kim, M.D., Shin Jung, M.D., Jae-hyoo Kim, M.D.,
Sam-Suk Kang, M.D., Je-Hyuk Lee, M.D.

Department of Neurosurgery, Chonnam National University Medical School, Kwang-Ju, Korea

Objectives : There have been several studies documenting the changing level of the conus throughout infancy and childhood, but there is only a little detailed study that documents the range of conus positions in a living adult population, especially in Korean, without spinal deformity.

Methods : we made a sequential study of magnetic resonance images of the lumbar spine to determine the variation in position of the conus medullaris in 650 living korean adults population without spinal deformity who checked MRI to identify the cause of low back pain. The study population consisted of patients over the age of 16 years. A T1 - weighted, midline, sagittal image was reviewed for identifying the position of conus. This location was recorded in relation to the upper, middle, or lower third of the adjacent vertebral body or the adjacent intervertebral disc.

Results : The study group consisted of 305 men(47%) and 345 women(53%) with a mean age 45.9 years(range, 16 - 79 years). The conus existed commonly at the middle third of L1(131cases, 20.2%), at the L1 - 2 intervertebral space(129cases, 19.8%), and the lower third of L1(123cases, 18.9%). The mean position of conus was the lower third of L1(range, middle third of T12 to middle third of L3).

Conclusions : The mean position of conus was at the lower third of L1(range, middle third of T12 to middle third of L3). This results was same as that of foreign study. Our results of living korean adult population could allow for safe clinical procedures such as lumbar puncture, spinal anesthesia, and help to explain the differences among observed neurologic injuries from fracture - dislocation at the thoracolumbar junction.

KEY WORDS : Conus medullaris · Anatomical variation · Korean adults.

서 론

1 2 가 16)

2

1
7)8)10)14)

T1 - , ,

16)

2

11).

가

, Reimann

대상 및 방법

1997 1 1998 12
650

G - signa - 1.5T - advantage

5mm 1mm
16

T1 -

(sagittal)

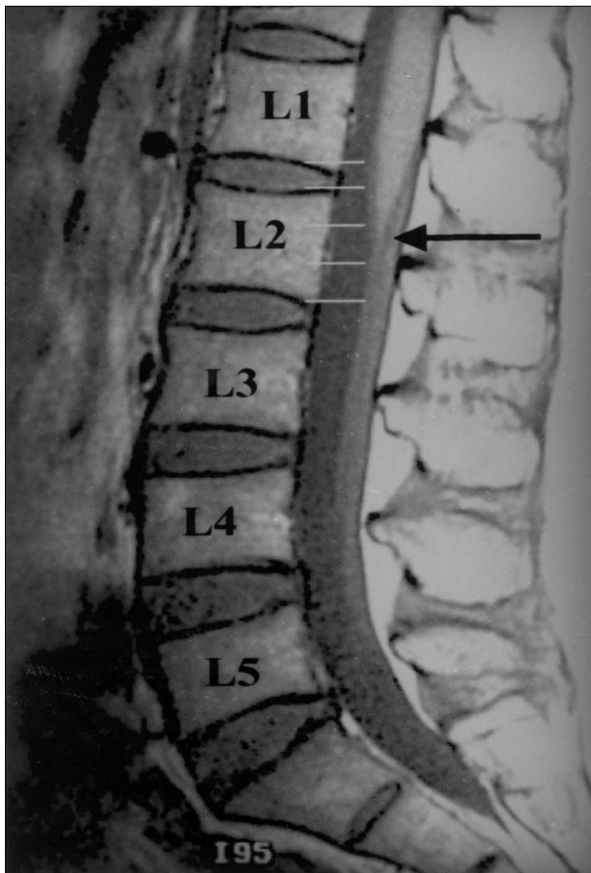


Fig. 1. A midline, sagittal, T1-weighted MRI of the lumbar spine, demonstrating the method for determining the position of the tip of the conus (in this example, upper third of L2).

Anson

1/3, 1/3, 1/3
(Fig. 1)¹⁰⁾.

가

(: 12 1/3=1, 3 1/3=
13). students t test, Anova test of normal
distribution P - value 0.05

결 과

1. 성별 및 연령별 분포

650 가 305(47%) , 가 345(53%)
45.9 (: 16~79)

2. 척수원주의 위치 분포 (Table 1, Fig. 2)

1 1/3(131 ,20.2%),
1 - 2 (129 ,19.8%), 1
1/3(123 ,18.9%) (58.9%)
12 1/3 3 1/3

3. 척수원주의 평균 위치 및 표준편차

5.94 1
2.0 /

Table 1. Position of the tip of the conus medullaris as referred to the adjacent third of the vertebral body or disc space

	Spinal level	Count	Percentage	Cumulative(%)
1	T12 : M3	5	0.77	100
2	T12 : L3	14	2.15	99.23
3	T12/L1	45	6.92	97.08
4	L1 : U3	85	13.08	90.16
5	L1 : M3	131	20.15	77.08
6	L1 : L3	123	18.92	56.93
7	L1/L2	129	19.85	38.01
8	L2 : U3	50	7.69	18.16
9	L2 : M3	38	5.85	10.47
10	L2 : L3	19	2.92	4.62
11	L2/L3	8	1.23	1.70
12	L3 : U3	2	0.31	0.47
13	L3 : M3	1	0.15	0.16

Mean conus level no.=5.94(just above the lower third of the body of L1) Standard deviation of conus level no.= 2.0(half of spinal level).

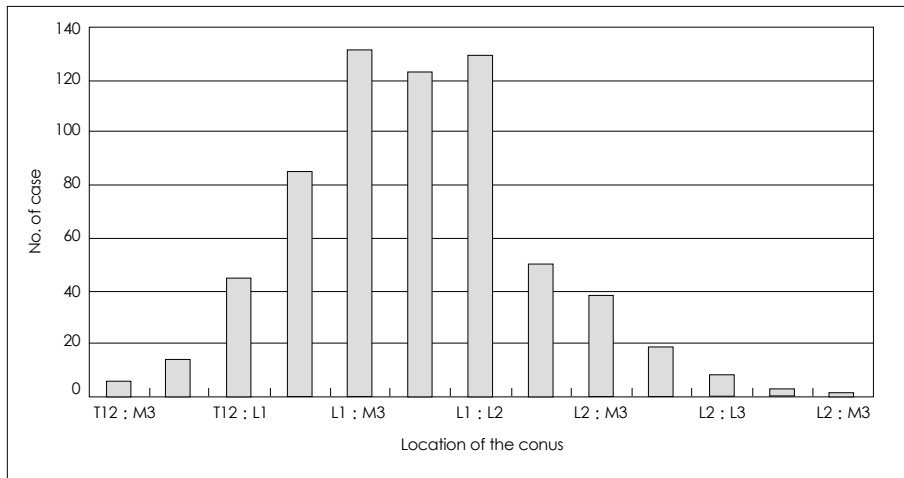


Fig. 2. Histogram presenting the frequency distribution for conus position.

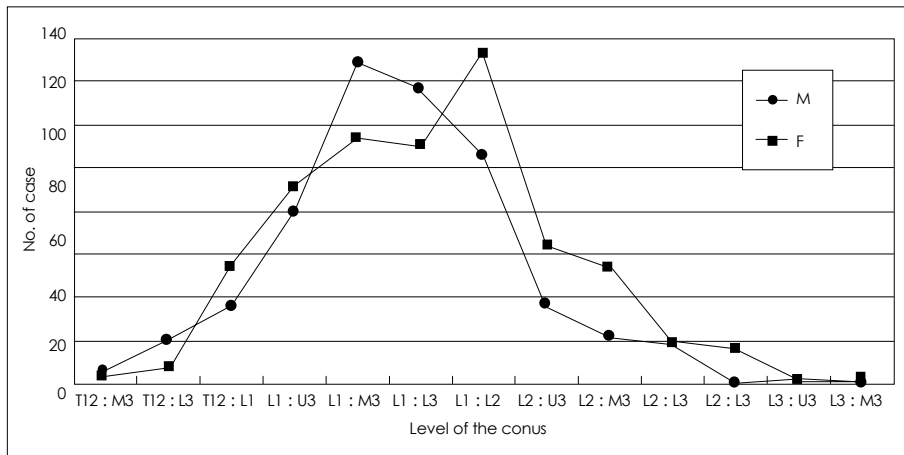


Fig. 3. Comparison of frequency distribution for conus position between male and female significant statistical difference in conus position between male and female (t value, - 1.832 ; p=0.01).

4. 성별 및 연령별에 따른 척수원주 분포 및 평균 위치의 차이 (Fig. 3)

1 1/3, 1 1/3 (Anova test of normal distribution, p=0.01) (10) (analysis of variance F value, 1.40 ; p=0.23).

고 찰

1894 Thompson 14) 198

27% 5mm 2 3 43%가 12

McCotter 7) 1916 234

terminale) 4 (lower root) 77%

가 1, 2 Needles 8) 240 (107 , 133) 49% 1

1/3 2 1/3 , 3 1/3

Reimann Anson 10)

129 4

(filum

가

가 1-2 12 1/3 3 .
 1/3 .
 , 가 4-5 3-4
 가 3 가 2-3
 801 가 . 2-3
 1 1/3 가 11/650 (1.7%)
 (lumbosacral
 transitional vertebrae) 2
 가
 가
 . Saifuddin ¹¹⁾ 1998
 가 1 1/3
 12 1/3 3 1/3 Wilson ¹⁶⁾ 3 가
 T1 , 가 12 1/3 2 95%
 1/3 가 3 1/3
 가 1.7% ,
 8~15% . Saifuddin ¹¹⁾ tethered cord
 가 , 73 Warder Oakes ¹⁵⁾
 tethered cord syndrome
 13
 가 1-2
 가 1-2
 1 1/3 12 1/3 3 가
 1/3 , 가 1-2
 가 가 59%
 , tethered cord syndrome
 tethering (,)
 Saufuddin ¹¹⁾ ,
 7)8)10)14)
 . Needles ⁸⁾ -
 가
 가 3)5)13)
 가 . Thompson Needles
 8)14) 가 1
 Saufuddin ¹¹⁾ 80% , 가
 12 1/3
 가 2 1/2
 가
 가 가

Barson 가
가
가

1)
12 1/3 3
1/3 1
1/3 가
가

- : 2000 5 8
- : 2000 8 14
- : 501 - 757 1 8

: 062) 220 - 6606, : 062) 224 - 9865
E - mail : nsjsp@netian.com

References

- 1) Barson AJ : *The vertebral level of termination of the spinal cord during normal and abnormal development. J Anat* 106 : 489-497, 1970
- 2) Boden SD : *Current concepts review : The use of radiographic imaging studies in the evaluation of patients who have degenerative disorders of the lumbar spine. J Bone Joint Surg (Am)* 78 : 114-124, 1996
- 3) Dall BE, Stauffer ES : *Neurologic injury and recovery patterns in burst fractures at the T12 or L1 motion segment. Clin Orthop* 233 : 171-176, 1988
- 4) Ford LT, Goodman FG : *X-ray studies of the lumbosacral spine. South Med J* 59 : 1123-1128, 1966
- 5) Gertzbein SD, Court-Brown CM : *The neurological outcome following surgery for spinal fractures. Spine* 13 : 641-644, 1988
- 6) Lee JA, Atkinson RS, Watt MJ : *Lumbar Puncture and Spinal Algesia : Intradural and Extradural. 5th ed. London : Churchill Livingstone, 1988, pp162-3*
- 7) McCotter RE : *Regarding the length and extent of the human medulla spinalis. Anat Rec* 26 : 559-564, 1916
- 8) Needles J : *The caudal level of termination of the spinal cord in American whites and American negroes. Anat Rec* 63 : 417-424, 1935
- 9) O'Driscoll CM, Irwin A : *Variations in morphology of the lumbosacral junction on sagittal MRI. Skeletal Radiol* 25 : 225-230, 1996
- 10) Reimann AF, Anson BJ : *Vertebral level of termination of the spinal cord with report of a case of a sacral cord. Anat Rec* 88 : 127-138, 1944
- 11) Saifuddin A, Burnett SJ, White J : *The variation of position of the conus medullaris in an adult population. Spine* 23 : 1452-1456, 1998
- 12) Shapiro SS, Wilk MB : *An analysis of variance test for normality. Biometrika* 52 : 591-611, 1965
- 13) Shuman WR, Rogers JV : *Thoracolumbar burst fractures. AJNR Am J Neuroradiol* 6 : 337-341, 1985
- 14) Thompson A : *Fifth annual report of the committee of collective investigation of the Anatomical Society of Great Britain and Ireland for the year 1893-94. J Anat Physiol* 29 : 35-60, 1894
- 15) Warder DE, Oakes WJ : *Tethered cord syndrome : The lowlying and normally positioned conus. Neurosurgery* 34 : 597-600, 1994
- 16) Wilson DA, Prince JR : *MR imaging determination of the location of the normal conus medullaris throughout childhood. AMJR* 152 : 1029-1032, 1989
- 17) Wright JG, Feinstein AR : *Improving the reliability of orthopaedic measurements. J Bone Joint Surg (Br)* 74 : 287-291, 1992