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Research Article

Morphometric Analysis based on length of Cervical enlargement of spinal cord with the gestational age in Indian Human foetuses

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Abstract

Introduction: Morphological studies were performed on vertebral canal and spinal cord from time to time during prenatal and postnatal periods. Foetal spinal cord has been the focus of interest by a lot of scientists but morphometric information regarding cervical enlargement received little attention, though important for clinical applications. Morphometric readings of length of cervical enlargement in foetal spinal cord will help in determining the age of foetuses, which may be very useful in many medicolegal cases.

Material and Methods: Foetuses without any congenital cranio-vertebral anomalies were selected for the study and divided into five groups on the basis of gestational age. Laminectomy was performed and the spinal cords from human foetuses were taken out and length of cervical enlargement was measured by Vernier calipers under standard conditions.

Result & Conclusion: Significant increment in the length of cervical enlargement in foetal spinal cord was observed in successive adjacent groups from group I onwards. Maximum increment in the length of cervical enlargement in spinal cord was observed between groups II and III human foetuses.

Keywords: morphometry, cervical enlargement, spinal cord, human foetus

1. Introduction

Morphological studies were performed on vertebral canal and spinal cord from time to time during prenatal and postnatal periods. Ghazi (1994) reported an allometric growth of spinal cord in relation to the vertebral column during prenatal and postnatal periods in thirty sheep[1]. The cervical enlargement is located from C4 to T1, where sensory input comes from and motor output goes to upper limbs.

Foetal spinal cord has been the focus of interest by a lot of scientists but morphometric information regarding cervical enlargement received little attention, though important for clinical applications. Very few references available were based on imaging techniques having possibilities of errors. Manual measurements in foetal specimens provide accurate readings. Morphometric readings of length of cervical enlargement in human foetal spinal cord will help in determining the age of foetuses, which may be very useful in many medicolegal cases.

2. Material and Methods

Human foetuses without any congenital cranio-vertebral anomalies were selected for this study. The parameters used for determination of gestational age was foetal foot length. Fair correlation between foot length and gestational age was documented[2]. For the purpose of analysis and evaluation, foetuses were divided into 5 groups as follows.

Table -1. Groups and parameters

Groups	Age (wks)	No. of Males	No. of Females	Total
I	< 17	3	3	6
II	17-20	3	3	6
III	21-25	3	3	6
IV	26-30	3	3	6
V	> 30	3	3	6

Laminectomy was performed to open vertebral canal from behind. The method was popularly used by surgeons to approach structures inside the canal[3].

i. Vertebral canal was exposed by laminectomy performed by putting the scissor in sacral hiatus on either side and continuing it upwards (Fig. 1).
ii. Spinal cord with its meningeal coverings were cleaned by removing soft tissue in viscinity.
iii. A vertical cut was made in dura mater along with arachnoid mater, starting in the lumbar region and continuing upto foramen magnum.
iv. Spinal cord was exposed by reflecting dura, arachnoid together laterally from aforementioned midline incision.
v. All the nerve roots were cut on both sides.
vi. The spinal cord was removed after making cross section in it at the level of the upper border of atlas vertebra.
vii. Length of cervical enlargement in various spinal cords was recorded by Vernier calipers under standard conditions (Fig. 2).
viii. For Statistical analysis findings were analysed by using Student's 't' test.

Figure –1. Dorsal aspect of human foetus showing total laminectomy (A) to expose spinal cord along with its meninges (B) in the vertebral canal

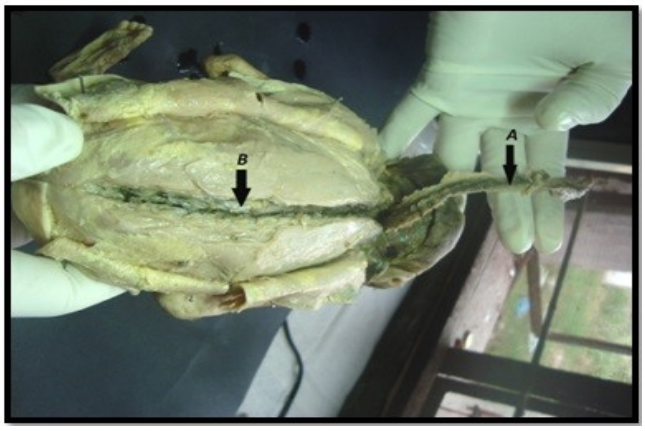
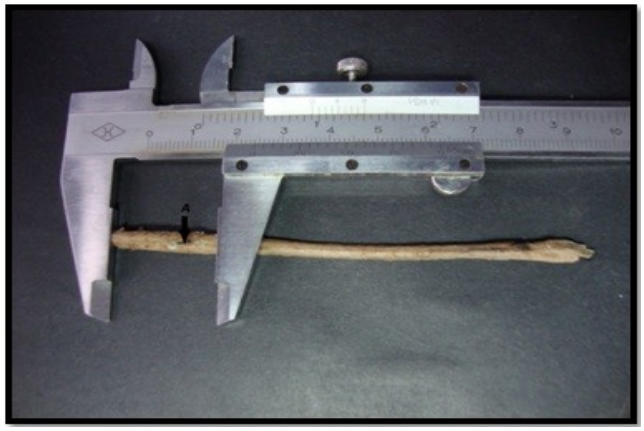


Figure –2. Measuring the length of cervical enlargement in spinal cord



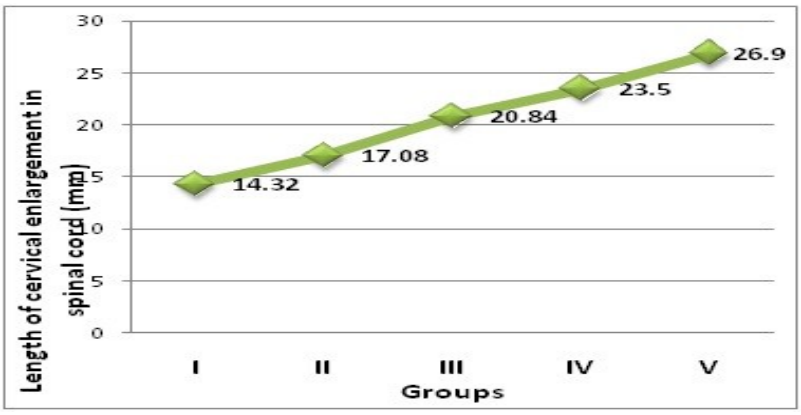
3. Results

Table 2: Length of cervical enlargement in spinal cord (mm)

Groups	No. of Foetuses	Mean ± S.D.	Per cent change	T value	P value
I	6	14.32 ± 0.72	–	–	–
II	6	17.08 ± 0.24	+19	4.76	Significant*
III	6	20.84 ± 1.01	+22	4.87	Significant*
IV	6	23.50 ± .03	+13	7.50	Significant*
V	6	26.90 ± 1.00	+14	9.02	Significant*

*P value < 0.001

Figure – 3. Graph showing the pattern of length of cervical enlargement in spinal cord with gestational age.



4. Discussion

A study on three-dimensional sonographic evaluation, correlated the length of lumbar spine with spinal length and concluded that there was significant increase in all volumetric measurements between sixteen and fourty one weeks of gestations[4]. An assessment of prenatal changes in the human spinal cord was made by Raoof (2001) using room-temperature plastination technique. The results showed that crown rump length and spinal cord length were not correlated with changes in relation to gender and ethnicity[5]. No one has earlier reported information regarding length of cervical enlargement in spinal cord.

Length of cervical enlargement in spinal cord got increased from 14.32 mm in group I to 26.90 mm in group V (Figure-3). There was significant change between all adjacent groups ie between groups I and group II, groups II and III, groups III and IV, groups IV and V. We found maximum increment in length of cervical enlargement (Table- 2) of spinal cord between the group II and group III foetuses.

5. Conclusion

This analysis reflected that maximum increment in cervical enlargement of foetal spinal cord in Indian human foetuses occurs from 17 to 25 weeks of gestation.

References

1. Ghazi SR, Gholami S. Allometric growth of the spinal cord in relation to the vertebral column during prenatal and postnatal life in the sheep. *J Anat* 1994 ; 185 : 427-431.
2. Streeter G. L. (1920): "Weight, sitting height, head size,foot length, and menstrual age for the human embryo",Contrib Embryol. 11:143
3. Fu YS, Zeng BF, et al. Long-term Outcomes of Two Different Decompressive Techniques for Lumbar Spinal Stenosis. *Spine* 2007; 33 (5): 514–518.
4. Wallny T, Schild RL, et al. Three-dimensional sonographic evaluation of the foetal lumbar spinal canal. *J Anat* 2002; 200(5): 439-443.
5. Raoof A. Using a room temperature plastination technique in assessing prenatal changes in the human spinal cord. *Journal of the InternationaL society for plastination* 2001 ; 16 : 5-8.