

Estimation of Torg's Ratio in adult female population of Rajasthan

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Abstract

To estimate the midsagittal diameter of the cervical spinal canal in normal healthy adult female population of Rajasthan, to set the normal range of the Torg's ratio (canal/body ratio) for the cervical spinal canal in adult female population of Rajasthan, to Correlate sex and age with mid sagittal diameter of cervical spinal canal and to Correlate sex and age with Torg's ratio (canal/ body) ratio. 50 healthy adult females, whose age ranging from 20-40 years formed the subject for the current study. Plain X-rays of cervical spine (Lateral view) were studied with the help of view box and the diameters measured through C3 to C7 vertebrae using vernier callipers. Finally Torg's ratio was calculated. The mean values of Torg's ratio at C3 were 0.98, C4 was 1.00, C5 was 0.98, C6 was 0.97 and C7 was 0.97. : The above mentioned values are normal values of Torg's ratio related to the cervical vertebrae of adult female population of Rajasthan. In case of any deviation from the average values, we can detect the narrowing or widening of the cervical spinal canal. It may prove as useful information to evaluate and assess the problems of cervical pain and stenosis of Rajasthan female population

Key Words: cervical spinal canal, Torg's ratio, cervical canal stenosis, cervical vertebra

INTRODUCTION

The dimensions of cervical spinal canal, especially its midsagittal diameter is of significant clinical importance in sports related spinal cord injuries.^[1,2] There is a strong correlation between stenosed spinal canal and injuries of cervical segment of spinal cord so also in diseases involving cervical spinal canal and cervical spinal cord like Cervical spondylotic myelopathy, cervical neurapraxia.^[3-6]

Among different imaging modalities plain X-rays of cervical spine (Lateral view) is known to give accurate and critical information in the diagnosis of cervical spinal stenosis due to cervical lordosis.^[7]

Scientific data related to dimensions of spinal canal at different levels have shown lot of inconsistencies among scientist. This may be due to variable enlargement factors, mainly the object film distance which depends upon individual shoulder width.^[8] To counteract this difficulty Torg et al and Pavlov et al,^[5,9] devised a ratio method to determine cervical spinal stenosis. This ratio is determined by dividing the sagittal diameter of the spinal canal by the corresponding diameter of the vertebral body. Torg et al used this ratio to assess the presence of stenosis of the canal as predisposing factor for cervical neuropraxia. They found that at ratio less than 0.80 indicate significant spinal stenosis and an increased risk for neurologic injury.

MATERIALS AND METHODS

50 healthy adult females, whose age ranging from 20-40 years formed the subject for the current study. Torg's ratio was calculated as devised by Torg et al.^[5] This ratio compares the sagittal diameter of the spinal canal with the antero-posterior width of the vertebral body.

Plain X-rays of cervical spine (Lateral view) were

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studied with the help of view box and the diameters measured through C3 to C7 vertebrae. The atlas and axis were excluded as they have different shape as compared with other cervical spinal stenosis occur at the levels between C4 and C6.

In lateral radiographs of cervical spine the following measurements were taken using vernier callipers at different cervical levels from C3 to C7 in individuals.

1. The antero-posterior diameter of cervical canal, measured as the distance from the posterior surface of the vertebral body to the nearest point on the corresponding spinal lamina line.
2. The antero-posterior width of vertebral body from the centre of body.

The ratio of the antero-posterior diameter of cervical canal to the antero-posterior width of the vertebral body, called Torg's ratio, were calculated from the above measurements at spine levels C3 to C7. In the present study, the subjects were divided into 4 groups according to ages of subjects and Torg's ratio calculated by dividing the sagittal diameter of the spinal canal by the antero-posterior diameter of vertebral body. Range, mean, standard deviation of all the parameters were calculated for C3 –C7 cervical vertebrae.

RESULTS

All the findings have been arranged according to age group and presented in tabulated form to establish relationship between the observations (Table 1 to 4). The antero-posterior diameter of vertebral body according to age group shows that in age group 20-25 years (table no. 1) for females at C3 was 16.09±1.84 mm, at C4 was 15.24±1.05mm, at C5 was 15.45±0.95 mm, C6 was 16.78±1.37mm and at C7 was 16.91±0.87mm.

For the age group 26 to 30 years the antero-posterior diameter of vertebral body at C3 was 18.32±0.60mm, at C4 was 18.31±0.38mm, at C5 was 18.38±0.31mm, at C6 was 18.50±0.35mm and at C7 was 18.58± 0.34mm.

In the age group 31-35 years antero-posterior diameter

Table -1 Shows relation of age with Torg's Ratio (canal/body ratio) in adult female Rajasthan population age group (20 to 25 years)

S. N	Vertebral level	Midsagittal diameter of cervical canal (in mm)	Anteroposterior diameter of vertebral body (in mm)	Torg's Ratio
1	C3	18.07	16.09	1.12
2	C4	17.77	15.24	1.17
3	C5	17.11	15.45	1.11
4	C6	18.38	16.78	1.10
5	C7	18.02	16.91	1.07

Table -2 Shows relation of age with Torg's Ratio (canal/body ratio) in adult female Rajasthan population age group (26 to 30 years)

S.N	Vertebral level	Midsagittal diameter of cervical canal (in mm)	Anteroposterior diameter of vertebral body (in mm)	Torg's Ratio
1	C3	18.28	18.32	0.99
2	C4	17.79	18.31	0.97
3	C5	18.36	18.38	0.99
4	C6	18.24	18.50	0.98
5	C7	18.93	18.58	1.02

Table -3 Shows relation of age with Torg's Ratio (canal/body ratio) in adult female Rajasthan population age group (31 to 35 years)

S.N	Vertebral level	Midsagittal diameter of cervical canal (in mm)	Anteroposterior diameter of vertebral body (in mm)	Torg's Ratio
1	C3	17.11	18.42	0.93
2	C4	16.63	17.12	0.97
3	C5	16.66	17.10	0.97
4	C6	17.11	18.76	0.91
5	C7	17.55	20.70	0.85

Table-4 Shows relation of age with Torg's Ratio (canal/body ratio) in adult female Rajasthan population age group (36 to 40 years)

S. N	Vertebral level	Midsagittal diameter of cervical canal (in mm)	Anteroposterior diameter of vertebral body (in mm)	Torg's Ratio
1	C3	16.44	15.10	0.91
2	C4	15.80	17.49	0.90
3	C5	15.54	17.62	0.88
4	C6	16.11	17.77	0.91
5	C7	16.81	17.90	0.94

of vertebral bodies at C3 was 18.42 ± 0.74 mm, at C4 was 17.12 ± 0.98 mm, at C5 was 17.10 ± 0.80 mm, at C6 was 18.76 ± 1.91 mm and at C7 was 20.70 ± 1.37 mm.

For the age group 36-40 years the antero-posterior diameter of vertebral body at C3 was 15.10 ± 1.39 mm, at C4 was 17.49 ± 1.19 mm, at C5 was 17.62 ± 1.17 mm, At C6 was 17.77 ± 1.07 mm, and at C7 17.90 ± 1.10 mm. Age wise analysis of the observations shows that in the age group 20-25 years midsagittal diameter of cervical canal at C3 was 18.07 ± 1.04 mm, at C4 was 17.77 ± 1.86 mm, at C5 was 17.11 ± 1.09 mm, at C6 was 18.38 ± 1.00 mm and at C7 was 18.02 ± 1.04 mm.

In second age group 26-30 years midsagittal diameter of cervical spinal canal at C3 was 18.28 ± 0.84 mm, at C4 was 17.79 ± 0.64 mm, at C5 was 18.36 ± 0.41 mm and at C6 was 18.24 ± 0.66 mm and C7 was 18.93 ± 0.45 mm.

For age group 31-35 years midsagittal diameter of cervical spinal canal at C3 was 17.11 ± 1.61 mm, at C4 was 16.34 ± 1.55 mm, at C5 was 16.66 ± 1.66 mm, at C6 was 17.11 ± 2.06 mm and at C7 was 17.55 ± 1.39 mm.

In fourth age group 36-40 years midsagittal diameter of cervical spinal canal at C3 was 16.44 ± 2.81 mm, at C4 was 15.80 ± 2.33 mm, at C5 was 15.54 ± 2.17 mm, at C6 was 16.11 ± 1.85 mm and at C7 was 16.81 ± 2.43 mm.

The relationship between the antero-posterior diameter of vertebral body and the midsagittal diameter of cervical spinal canal by findings the canal body ratio (Torg's Ratio) in all the subjects the mean values of Torg's ratio at C3 was 0.98, C4 was 0.96, C5 was 1.00, C6 was 0.97 and C7 was 0.97. These findings when arranged according to the age groups shows that for the age group 20-25 years at C3 was 1.12, at C4 was 1.17, at C5 was 1.11, at C6 was 1.10 and at C7 was 1.07.

In the second age group 26-30 years the canal body ratio at C3 was 0.99, at C4 was 0.97, at C5 was 0.99, at C6 was 0.98 and at C7 was 1.02.

In the third age group 31-35 years the Torg's ratio at C3 was 0.93, at C4 was 0.97, at C5 was 0.97, at C6 was 0.91 and at C7 was 0.85.

For the fourth age group 36-40 years the Torg's ratio at C3 was 0.91, at C4 was 0.90, at C5 was 0.88, at C6 was 0.91 and at C7 was 0.94.

DISCUSSION

Torg et al [5] calculated the canal body ratio in 49 normal subjects and in 22 patients. They found that the canal body ratio range in normal subjects was 0.69 – 1.27 at C3 and its mean was 1.00. At C4 range was 0.76 – 1.19 and its mean was 0.97. At C5 range was 0.80- 1.17 and its mean was 0.97 and these data matches with present study also. In 24 cases that have cervical stenosis or disc disease or congenital anomalies the canal body ratio range was 0.33- 1.18 at C3 and its mean was 0.73. At C4 range was 0.32 -0.86 and mean was 0.70. At C5 range was 0.31-0.90 and mean was 0.68, At C6 range was 0.36 -0.81 and its mean was 0.66. These findings show that the Torg's ratio is less than 0.80 in cervical stenosis.

Gupta et al [10] observed sagittal diameter of the cervical canal in normal Indian adults. The mean sagittal diameter ranged from 21.43 mm at C1 to 16.42 at C7 in males and from 20.13 mm at C1 to 15.54 mm at C7 in females. They found that this diameter decreased from C1 down to C4 or C5 where there was a gradual but marginal increase to C6. In present study the canal diameter

decreased from C4 to C5 and then increased up to C7.

Hwan-MO Lee et al [11] measured the midsagittal diameter of cervical spinal canal in Koreans. The midsagittal diameter of cervical spinal canal in males at C3 was 13.8mm, C4 was 12.8 mm, C5 was 13.0mm, C6 was 13.2mm and C7 was 13.4mm. They found that mean diameter were narrowest at the C4 level. The Canal body ratio in males at C3 was 0.92 , at C4 was 0.90 ,at C5 was 0.94 ,at C6 was 0.95 and at C7 was 0.96 .

Sasaki et al [7] radiologically measured the midsagittal diameter of cervical canal in adult Japanese. The mid sagittal diameter of cervical spinal canal at C1 was 21.00 ± 2.2 mm, at C2 was 18.00 ± 1.7 mm, at C3 was 15.8 ± 1.5 mm, at C4 was 15.20 ± 1.5 mm, at C5 was 15.3 ± 1.5 mm, at C6 was 15.71 ± 1.5 mm and at C7 was 15.9 ± 1.4 mm. They found that younger subjects had greater diameters than older subjects and these matches with present study also. Yue et al [12] calculated Torg's ratio in patients with cervical spondylotic myelopathy and in non-spondylotic, non-myelopathic population. They found that the average Torg's ratio in myelopathic patients was 0.72 ± 0.08 and in normal subjects was 0.95 ± 0.14 .

Tierney RT et al [13,14] calculated Torg's ratio in normal male subjects using MRI. The range of Torg's ratio at C3 was 0.57-1.08 and its mean was 0.80. At C4 range was 0.56-1.18 and its mean was 0.79. At C5 range was 0.59-0.92 and its mean was 0.79. At C6 range was 0.52-0.90 and its mean was 0.72. At C7 range was 0.58 -0.93 and its mean was 0.71. The same Pattern from C3 to C7 level is also found in present study.

Zhang et al [15] found in their study that the mean sagittal diameter of cervical spinal canal at C (1) to C (7) ranged from 15.33 mm to 20.46 mm, the mean transverse diameter at the same levels ranged from 24.45 mm to 27.00 mm and the mean value of Torg ratio was 0.96. Lim et al [16] found that the average Torg's ratio in men was 0.87.

Athar Maqbool et al [17] calculated Torg's ratio in 100 dried human spinal columns of Pakistani origin. The canal body ratio in males at C3 was 0.96, at C4 was 0.95, at C5 was 0.94, at C6 was 0.93 and C7 was 0.94. These data are in striking resemblance with our data obtained from our previous study [18] done on adult male population of Rajasthan where in the mean values of Torg's ratio at C3 were 0.97, C4 were 0.96, C5 were 0.95, C6 was 0.94 and C7 was 0.9. In the current study where we measured and estimated the Torg's ratio in adult female population of Rajasthan, the mean values of Torg's ratio at C3 were 0.98, C4 was 1.00, C5 was 0.98, C6 was 0.97 and C7 was 0.97

CONCLUSION

The above values are the normal values for the various parameters related to the cervical vertebrae of adult female residents of Rajasthan. In case of any deviation from the average values of the above parameters, we can detect the narrowing or widening of the cervical spinal canal. It may prove as useful information to evaluate and assess the problems of cervical pain and stenosis of Rajasthan female population

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