JSSN 2015; 18 (1)

Original Article

Torg's ratio in normal adult nepalese population

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Abstract

Introduction: Acute cervical trauma occasionally leads to cervical canal stenosis in some individuals in spite of minor trauma. The spinal canal-to-vertebral body ratio (Torg-Pavlov ratio) has been proposed for assessing developmental spinal canal stenosis. It is not affected by magnification, and is measured on lateral plain films of cervical vertebrae. The result of this study may help in better understanding of the Torg's ratio, which is more reliable than direct measuring of the mid-sagittal diameter of the cervical spinal canal in the diagnosis of cervical spinal stenosis or predicting the prognosis of cervical spinal cord injury. If Torg's ratio is below normal there is risk of cervical cord injury whereas relatively safe in large Torg's ratio. Torg's ratio can be accessed even in rural areas where x-rays are easily available and more economical than MRI and CT scan. It can assess the risk of cord injury during sports and outdoor activities and help individuals' choose safe carrier in sports or others activities.

Methods: In order to ascertain the normal values of the Torg's ratio in adults Nepalese, hundred sets of cervical vertebral columns of hundred adult Nepalese population of age group 20-40 years were examined. Consecutive patients presenting with history of neck pain with normal x-ray findings or history of trauma without cervical spine injury from Orthopaedic OPD (out patients department) and emergency department of Tribhuvan University Teaching Hospital, Maharajgunj, Kathmandu from March 2011 to August 2012 were included in the study.

Results: There were 48 males and 52 females with age ranging from 20 yrs to 40 yrs with the mean of 30.34±5.36 years. The normal average canal/body ratio of the cervical spine is 0.99 +/- 0.09 in male and 1.01 +/- 0.07 in female. It was observed that the ratio of the antero-posterior diameters of cervical spinal canal and vertebral bodies showed sexual dimorphism.

Conclusion: The Torg's ratio is the same irrespective of gender and height. The result of this study will help in better understanding of the Torg's ratio, which is more reliable than direct measuring of the mid-sagittal diameter of the cervical spinal canal in the diagnosis of cervical spinal stenosis or predicting the prognosis of cervical spinal cord injury.

Key words: Cervical canal diameter; Torg's ratio

Introduction

Cervical canal stenosis is a disorder that may cause neurological deficits commonly resulting from cervical trauma in hyperextension or hyperflexion as well as in axial loading. The sign and symptoms of neurological deficits may be in the form of sensory or motor impairment which if not detected promptly will cause more severe neurological deficits.[1-3]

A number of investigators have conducted various studies to detect the presence of cervical stenosis by simple measurement of the cervical canal diameter using cervical lateral plain film.[4] However, the existence of these various reports giving different cervical canal diameters resulted in several different normal ranges.[4,5]

The spinal canal to vertebral body ratio introduced by Torgis not affected by magnification, and is measured on lateral plain films of cervical vertebrae.[6] A ratio of > 1.0 signifies absence of stenosis of the spinal canal, but a ratio of <0.8 indicates the presence of cervical spinal canal stenosis.[7] The Torg's ratio for diagnosis of stenosis of the cervical canal has been used by many researchers. [3,8]

Till date no study has been conducted on the Torg's ratio in normal Nepalese population. So this study determines the normal range of Torg's ratio in Nepalese population as a reference value. X-ray, being relatively inexpensive and readily available in most parts of our country as compared to CT and MRI, is a more relevant investigation in our context and will be used for measurements in our study.

Methods

Hundred consecutive adult Nepalese population of age group 20-40 years presenting with neck pain and a normal x-ray findings or history of trauma without cervical spine injury from Orthopaedics OPD (out patients department) and emergency department of Tribhuvan University Teaching Hospital, Maharajgunj, Kathmandu from March 2011 to August 2012 were included in the study.

The measurements were made by using scale calibrated to 0.5 mm. The dimensions of C3 to C7 cervical vertebrae were studied. The Torg's ratio was determined on a lateral cervical radiographs as the sagittal diameter of the spinal canal divided by the anteroposterior vertebral body diameter of the corresponding vertebral body. (Figure 1)

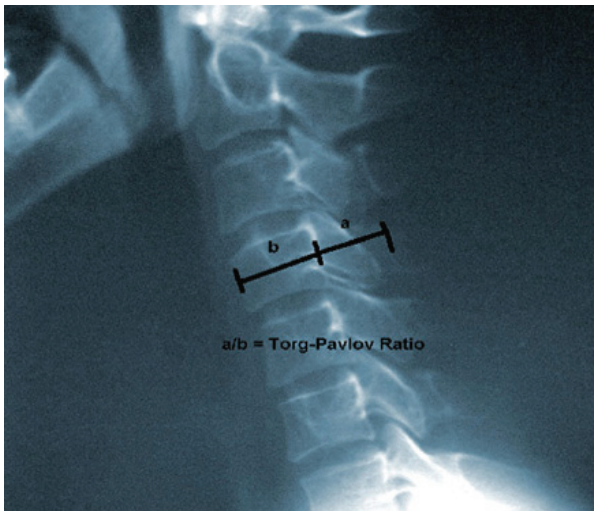

Figure 1: The Torg's ratio (a/b) is a comparison between the sagittal diameter of the spinal canal (a) and the sagittal diameter of the vertebral body (b).

The data were entered into Statistical Software package for Social Science version 16.0 (SPSS v 16.0). The data were expressed as mean±SD for continuous variables. The comparison of mean were performed by using Student's t test and analysis of variance (ANNOVA). The Test were considered significant when the p value was <0.05.

Results

Total 100 patients for the study consisted of 48 males and 52 females. Age ranged from 20yrs to 40 yrs with the mean of 30.34±5.36 years. Among the 100 patients, the highest number of patients (40%) was from age group 25-30 yrs and lowest number of patients (16%) from the age group of 20-24.

The mean Torg's ratios of C3, C4, C5, C6, C7 vertebra were 1.01±0.10, 0.99±0.10, 1.01±0.11, 0.99±0.10, 0.98±0.08 respectively. The lowest mean Torg's ratio was at C7 and the highest Torg's ratio was at C3 and C5 vertebral level.

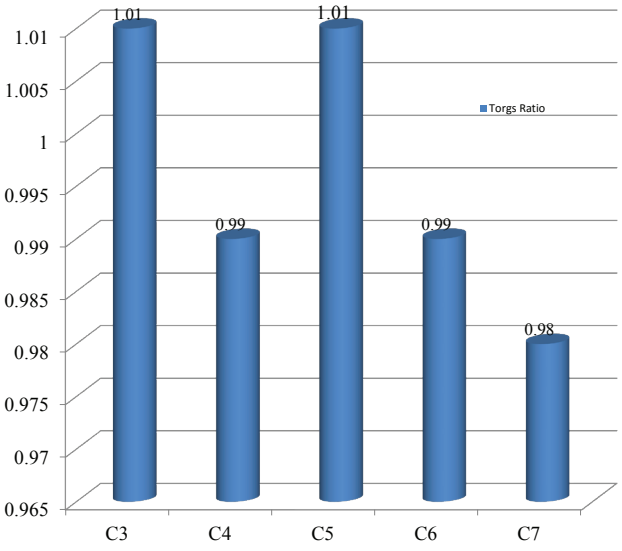

Figure 2: The mean Torg's ratio of different vertebral level

The mean Torg's ratio were equal in male and female at vertebral level C3, C4, C5 and C6 except for C7 where the Torg's ratio in female was higher than male (p-value 0.049)

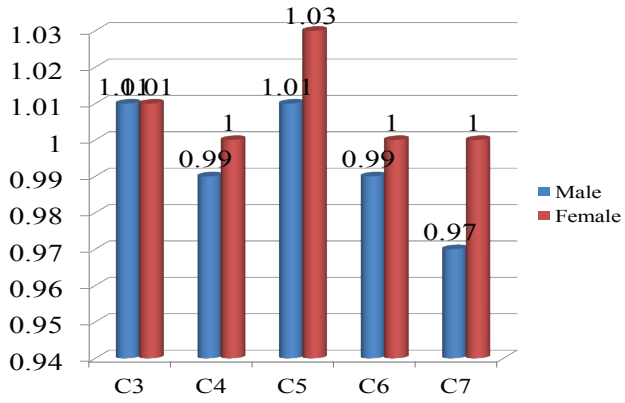

Figure 3: The mean Torg's ratio in male and females

Table 2: Sex wise comparison of the mean Torg's ratio

Vertebral	Sex		p-value
	Male(n=48)	Female(n=52)	
Canal	18,19±2.09	17.41±1.47	0.03
Body	18.38±2.20	17.34±1.63	0.008
Torg's ratio	0.99±0.09	1.01±0.07	0.34

The vertebral canal and body diameter in male were higher than female and were significantly different (P<0.05). However, the mean Torg's ratio of male was 0.99±0.09 and female was 1.01±0.07 which was statistically insignificant (P>0.05).

Discussion

This study was used to determine the Torg's ratio in normal adult Nepalese population. With this information, the study would assist physicians and surgeons to make informed decisions about diagnosis and treatment of the cervical canal stenosis.

The various methods used for assessing the Torg's ratio are lateral plain film, CT scan and MRI in living subjects as well as cadavers and direct measurement on dried bony specimens.[4,9,10] To date no studies had been conducted on the Torg's ratio in Nepalese population.

In our study the mean Torg's ratio of C3-C7 level was higher in female except C3 level where it was same in both sexes. The highest mean Torg's ratio was in C3, C5 and C5 level in male and female respectively. In North Indian population the mean Torg's ratio of C3-C7 level was higher in female than in male and the highest mean Torg's ratio was in C3 level in both sexes.[13] (Table 3) In another study, the mean Torg's ratio of C3 –C7 level was higher in female than male and the highest mean Torg's ratio was in C6, C7 and C5, C6 in male and female respectively.[11] Both studies are comparable to this study.

Table 3: Comparison of canal-body ratio

Authors	Canal body ratio (Torg's ratio)											
	Male						Female					
	C3	C4	C5	C6	C7	Avg	C3	C4	C5	C6	C7	Avg
Madhur Gupta 1998 (North India)	1.01	0.97	0.95	0.94	0.86	0.95	1.05	1.01	1.04	1.0	0.97	1.01
M A. Kathole 2012 (Western Maharastra India)	0.95	0.95	0.95	0.96	0.96	0.95	1.06	1.07	1.08	1.08	1.07	1.07
Our Study (Nepal)	1.01	0.99	1.01	0.99	.97	0.99	101	1.0	1.03	1.0	1.0	1.01

In this study, the average canal body ratio for males and females were found to be 0.99 and 1.01 respectively. Findings of canal body ratio in both sexes in this study, more or less correlate well with those reported from North India in 1998 where the Torg's ratio of male and female was 0.95 and 1.01 respectively.[13] Another study reported from a population in India, Western Maharashtra found that the Torg's ratio of males and females were 0.95 and 1.07 respectively.[11]

Table 4: Comparison of Torg's ratio to other population

Country	Torg's ratio (male)	Torg's ratio (female)
Indonesia(Tishiadi D)	0.99	1.06
Korea(Suk)	0.93	1.02
Pakistan(yue)	0.95	1.08
Singapore(lim)	0.90	0.99
South Africa(G.Tossel)	0.81	0.89
Our study (Kathmandu, Nepal)	0.99	1.01

In our study, the results indicate the existence of differing values, the Torg's ratio in Nepalese males being larger than that of Pakistani males (0.95), whereas Nepalese females had a lower Torg's ratio compared with that in Pakistani females (1.08) and that of Koreans males and females (0.93 and 1.02 respectively).[4, 14]

The mean Torg's ratio of Nepalese was larger compared with that of Singaporean males and females (0.90 and 0.99) respectively.[15] The mean Torg's ratio in Nepalese male was same as that of Indonesian males (0.99) but female had a lower Torg's ratio compared with that in Indonesian females (1.06).[16]

In South African Negroid population the Torg's ratio was measured by G.Tossel, M.C.Bossman in age between 30-75 yrs in 179 people. The study was done in University of Pretoria, Pretoria, in South Africa from 2005 – 2007. The Torg's ratio of C3, C4, C5, C6, C7 vertebral levels were 0.89, 0.89, 0.89, 0.88, 0.87 respectively and average Torg's ratio was 0.88 in age group 30-45 yrs. The mean Torg's ratio of male and female was 0.81 and 0.89 respectively (30-75 yrs group). The mean Torg's ratio of male and female was smaller than Nepalese people (0.99 and 1.01 in male and female respectively). There was higher Torg's ratio in female than male as our study.[17]

In a study of normal forty nine male athletes (15-25 yrs) from New York City and Pennsylvania, USA in 1984 the cervical canal and body diameter of C3-C6 vertebral level was measured in lateral plain x-ray. Torg's ratio of C3, C4, C5 and C6, Vertebral level was 1.01, 0.97, 0.98 and 0.98 respectively which is similar to our study.[7]

In a review of 87 patients aged 20-40 years in Wrightington General Hospital, Wrightington, United Kingdom (UK) in 2002, the Torg's ratio in C4- C7 level was 1.0, 1.0, 0.9 and 0.9 respectively which is comparable to our study.[18]

It was observed that, in all studies including this study, females showed a larger canal to body ratio than the males.

A study in Caucasians reported that, there was no correlation found between the Torg's ratio and age.[19] Age related osseous changes had only minor impact on the size and shape of the cervical vertebral canal. Much of cervical stenosis was due to degenerative changes in the soft tissue.

Conclusion

The vertebral canal and body diameter in males is higher than females and are significantly different however the average mean Torg's ratio of male and female are similar. The result of this study will help in better understanding of the Torg's ratio, which is more reliable than direct measuring of the mid-sagittal diameter of the cervical spinal canal in the diagnosis of cervical spinal stenosis or predicting the prognosis of cervical spinal cord injury.

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