Impact of Active Leisure (Noncompetitive) Contact Sports Activities on the Space Available for the Cord of the Subaxial Cervical Spine of Asymptomatic Adults

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BACKGROUND: **Leisure sports activities are assumed to be safe. It is however possible that participation in contact sports as leisure activity may also affect the space available for the cervical cord (SAC). The objective of this study is to compare the SAC of asymptomatic young adults involved in active leisure contact sports with matched controls that do not participate in contact sports.**

METHODS: **This magnetic resonance imaging–based prospective, cross-sectional study involved 204 randomly selected asymptomatic adults, 21–50 years of age. The study included 2 groups: group A (participants in active leisure contact sports) and group B (participants who did not participate in any form of contact sport). The SAC was calculated by subtracting disk-level midsagittal spinal canal dimension from the corresponding level spinal cord dimension.**

RESULTS: **The SAC at C3-4 was 4.5 ± 1.1 mm (group A) and 4.9 ± 1.4 mm (group B) ($P = 0.025$), at C4-5 was 4.3 ± 1.1 mm (group A) and 4.5 ± 1.2 mm (group B), at C5-6 was 4.6 ± 1.1 mm (group A) and 4.5 ± 1.4 mm (group B), at C6-7 was 5.2 ± 1.3 mm (group A) and 4.9 ± 1.2 mm (group B), at C7-T1 was 5.6 ± 1.3 mm (group A) and 5.6 ± 1.5 mm (group B) ($P = 0.004$). In men, the SAC at C3-4 was 4.39 ± 0.28 mm (group A) and 4.90 ± 0.30 mm (group B) ($P = 0.036$) and at C4-5 was 4.16 ± 0.27 mm (group A) and 4.56 ± 0.35 mm (group B). Three-way multivariate analysis of variance revealed significant effect of contact sports ($P = 0.005$), sex ($P = 0.001$), and age ($P = 0.0001$) on the SAC. Combined effect of contact sports participation and age also have significant effects on the SAC ($P = 0.035$).**

CONCLUSIONS: **Participation in leisure contact sports has a small but overall negative effect on the SAC, especially at the upper subaxial cervical spine levels. This effect is most marked after the age of 40 years. Overall, there was no sex difference observed.**

INTRODUCTION

The space available for the cervical cord (SAC) is an established direct stenosis indicator in the cervical spine.[1-3] Participation in competitive contact sports activities has been demonstrated in previous studies to affect the SAC,[3-5] but the extent of the participation that predisposes to this effect on SAC has not been established.

Leisure sports activities are assumed to be less traumatic. It is however possible that participation in contact sports as a leisure activity may also affect the SAC, and this impact may be significant in environments where young adults participate significantly in noncompetitive contact sport activities for leisure.

The aim of this paper is to compare the SAC of asymptomatic young adults who are involved in active leisure contact sports activity with matched controls that do not participate in contact sports. This will help to clarify if there is a significant risk to the subaxial cervical spinal cord after long-term active leisure participation in contact sports among asymptomatic young adults.

METHODS

This is a magnetic resonance imaging (MRI)–based prospective, cross-sectional study of 204 randomly selected asymptomatic adult Nigerians between 21 and 50 years of age. The BASDA (BTI 035 MRI System, Shenzhen Basda Medical Apparatus Co., Ltd., China)

Key words
- Leisure contact sports
- Nigerians
- SAC

Abbreviations and Acronyms
MRI: Magnetic resonance imaging
SAC: Space available for the cervical cord

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open magnet 0.35-T machine in the radiology unit of Memfys Hospital for Neurosurgery Enugu was used, and data were collected from years 2012 to 2014. Individuals with cervical spine or spinal cord symptoms, congenital spine deformities, previous cervical spine surgeries, MRI scan finding of cervical spine disease, and contraindication to the use of MRI were excluded. This study used disk-level measurements instead of the traditional midvertebral body measurements because we think the clinical effect of degenerative and traumatic cord injury is more pronounced at the disk levels.[6] After ethical approval, a mini interview and screening questionnaire were administered. Individuals recruited into this study were stratified into 2 groups.

Group A consisted of people who participated in active leisure contact sports activities at least 3 d/wk over a minimum of 5 years. Contact sport was defined as sporting activities in which physical contact between players is allowed as part of play. These include football, handball, basketball, and volleyball. Leisure activity in this study was defined as participation in active nonprofessional contact sports over time. The control (group B) was made up of adults who do not participate in any form of contact sports activities.

Individuals that consented for the study had sagittal T1-weighted imaging of the cervical spine using standard protocol and sagittal T2-weighted imaging to help in identification of consenting individuals that may have subtle spinal cord pathologies. Disk-level midsagittal spinal canal dimension (A) and the corresponding level spinal cord dimension (B) were obtained from C3-4 to C7-T1. The SAC was calculated as A − B (Figure 1). All measurements were in millimeters and taken by the researcher. Each measurement was performed 3 times, and the average was recorded. Data were analyzed using both descriptive and inferential statistics with Student t test, 3-way multivariate analysis of variance (Wilks λ), and Bonferroni multiple comparison correction. Data analysis was aided by SPSS version 17 (Chicago, Illinois, USA).

RESULTS

The SAC at the C3-4 level was 4.9 ± 1.4 mm in the noncontact sports group and 4.5 ± 1.1 mm in the leisure contact sports group ($P = 0.025$). Also, at the C4-5 level, the SAC was 4.5 ± 1.2 mm in the noncontact sports group compared with the 4.3 ± 1.1 mm in the contact sports group ($P = 0.278$). At C5-6, the SAC was 4.5 mm in the noncontact sports group and 4.6 mm in the contact sports group ($P = 0.572$), whereas at the C6-7 level, the SAC in the noncontact sports group was 4.9 mm and 5.2 mm in the contact sports group ($P = 0.105$). At the C7-T1 level, the SAC was 5.6 mm in the noncontact sports group and 5.6 mm in the contact sports group ($P = 0.648$). Overall, there was a significant difference between the values of the SAC obtained in the contact and noncontact sports groups ($P = 0.004$, $F = 3.593$) (Table 1).

Among the leisure contact sports group, multiple comparison analysis of C3-4 against the other individual SAC levels revealed P values of >0.999 (C4-5 and C5-6) and 0.0001 (C6-7 and C7-T1). Analysis of C4-5 against other individual SAC levels revealed P values of 0.556 (C5-6) and 0.0001 (C6-7 and C7-T1). Analysis of C5-6 against other individual SAC levels revealed P values of 0.002 (C6-7) and 0.0001 (C7-T1), whereas the P value of C6-7 against C7-T1 was 0.066 (Table 2).

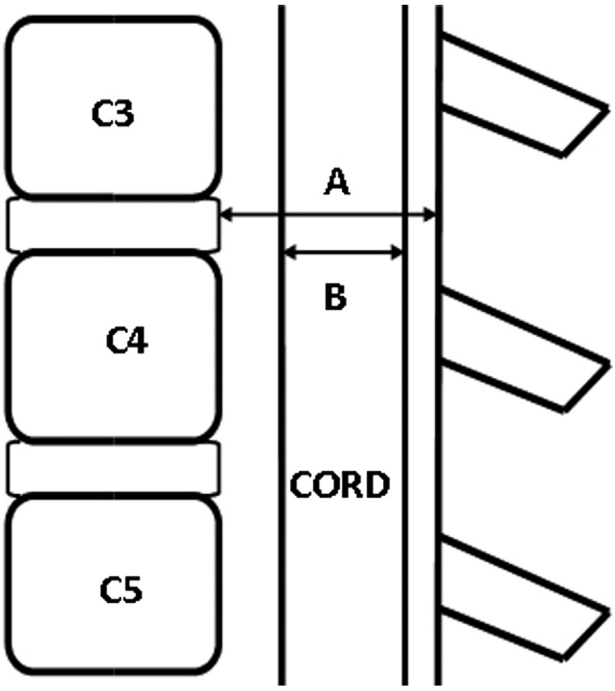

Figure 1. Sketch description of how the measurements of disc-level midsagittal spinal canal dimension (**A**) and the corresponding level spinal cord dimension (**B**) were done.

Among the noncontact sports group, multiple comparison analysis of C3-4 against other individual SAC levels revealed P values of 0.346 (C4-5), 0.532 (C5-6), >0.999 (C6-7), and 0.003 (C7-T1). Analysis of C4-5 against other individual SAC levels revealed P values of >0.999 (C5-6), 0.180 (C6-7), and 0.0001 (C7-T1). Analysis of C5-6 against other individual SAC levels revealed

Table 1. Space Available for the Cervical Cord Values Between the Noncontact Group and the Leisure Contact Sports Group

SAC Level	Contact Status	Mean	*t* Value	*P* Value
C3-4	Noncontact	4.9220	5.088	0.025
	Leisure contact	4.5356		
C4-5	Noncontact	4.5230	1.184	0.278
	Leisure contact	4.3442		
C5-6	Noncontact	4.5570	0.321	0.572
	Leisure contact	4.6548		
C6-7	Noncontact	4.9700	2.659	0.105
	Leisure contact	5.2529		
C7-T1	Noncontact	5.6060	0.210	0.648
	Leisure contact	5.6942		

SAC, space available for the cervical cord.