



Introduction

C2 laminar screw fixation is becoming a popular alternative for posterior upper cervical spine fixation. We radiologically assessed several parameters of the dorsal arch of C2 as it relates to C2 laminar screw placement. To our knowledge, no previous study has focussed on an afrocentric population.

Methods

Computed tomography (CT) scans of adult cervical spines performed at the University Hospital of the West Indies, Jamaica from January 2017 to July 2017 were evaluated. A Brightspeed (16-slice) GE scanner was used to obtain 1.25mm thick slices from the base of skull to at least T1. Several morphometric parameters were assessed. The widths were measured at the thinnest part of the lamina on axial view; the external diameter (ED) from the outer borders of the cortex of the lamina (Figure 1A), and the internal diameter (ID) from the inner borders of the cortex (Figure 1B). The spinolaminar angle was formed between the spinous process and a line parallel to the longitudinal axis of the lamina (Figure 1C). The length of lamina was taken from the entry point at the contralateral spinolaminar junction to the medial aspect of the inferior articular facet (Figure 1D).

Each scan was independently reviewed by two consultant radiologists. Statistical analysis was done using SPSS (version 19).

Fig. 1. Measurement methods for C2 lamina screw fixation. A: External diameter B: Internal diameter C: Spinolaminar angle D: Length

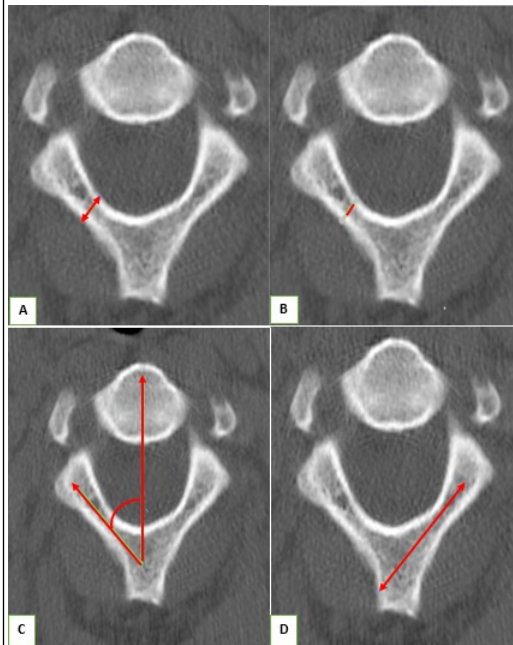


Table 1. Mean measurements and measurements between right and left laminae

MEASUREMENT	MEAN (N = 140)	RIGHT LAMINA (n = 70)	LEFT LAMINA (n = 70)
EXTERNAL DIAMETER (mm)	5.9	5.8	5.9
INTERNAL DIAMETER (mm)	3.2	3.1	3.2
LENGTH (mm)	26.3	26.2	26.4
SPINOLAMINAR ANGLE (°)	49	48.9	49.1

Results

The CT scans of 70 adult patients (55.7% male) were reviewed. The analysis was performed for a 3.5 mm diameter screw. Table 1 shows the mean radiographic measurements and measurements between right and left laminae. Table 2 compares the C2 measurements between male and female.

The ID and length of the laminae were significantly larger in males ($p < 0.05$). Laminae ≥ 4.5 mm will allow adequate fixation without breakthrough. Twenty one percent (15) of patients had at least one lamina unsuitable for screw fixation. Of this, 60% (9) had inadequate laminae bilaterally.

In this population, screw length can vary from 24 to 30 mm, and the lateral angulation for screw trajectory, signified by the spinolaminar angle was 49° bilaterally.

Table 2. Comparison of C2 measurements between male and female

MEASUREMENT	MALE	FEMALE	P VALUE
EXTERNAL DIAMETER (mm)			
Right lamina	5.9	5.7	0.54
Left lamina	6.0	5.7	0.19
INTERNAL DIAMETER (mm)			
Right lamina	3.4	2.8	<0.05
Left lamina	3.6	2.9	<0.05
LENGTH (mm)			
Right lamina	32.6	30.9	<0.05
Left lamina	27.3	25.2	<0.05
SPINOLAMINAR ANGLE (°)			
Right lamina	48.6	49.2	0.36
Left lamina	48.5	49.9	0.74

Conclusions

The suitability of using a 3.5mm diameter screw for translaminar fixation was assessed. Using external lamina diameters, 21% of patients had at least 1 lamina deemed unsuitable for fixation.

The mean ED of the lamina (5.9mm) was comparable with international studies (5.5 - 6.95mm), however the ID was relatively smaller, (3.2 vs 4.23 mm) suggesting thicker cortical bone in the afrocentric population, with possible benefit of a greater screw purchase.

Acknowledgement

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References

1. Saetia K, Phankhonsab A. C2 Anatomy for Translaminar Screw Placement Based on Computerised Tomographic Measurements. Asian Spine Journal 2015; 9(2)
2. Cassinelli EH, Lee M, Skalak A, Ahn NU, Wright NM. Anatomic considerations for the placement of C2 laminar screws. Spine (Phila Pa 1976) 2006; 31: 2767-71
3. Dean CL, Lee MJ, Robbin M, Cassinelli EH. Correlation between computed tomography measurements and direct anatomic measurements of the axis for consideration of C2 laminar screw placement. Spine J 2009;9:258-62
4. Kim YJ, Rhee WT, Lee SB, You SH, Lee SY. Computerised tomographic measurements of morphometric parameters of the C2 for the feasibility of laminar screw fixation in Korean population. J Korean Neurosurg Soc 2008;44:15-8
5. Meng XZ, Xu JX. The options of C2 fixation for os odontoideum: a radiographic study for the C2 pedicle and lamina anatomy. Eur Spine J 2011;20:1921-7