



## The Average Dimensions of Titanium Mesh Cage Use in Cervical Corpectomy at The National Orthopaedic Hospital Dala Kano Nigeria

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### ABSTRACT

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**Background:** Cervical corpectomy with reconstruction using a titanium mesh cage (Harm's cage) is a standard procedure for cervical spondylotic myelopathy, trauma, and tumours. However, cage size selection in Nigerian patients has relied on intraoperative estimation due to a lack of normative morphometric data. This study aimed to determine the average dimensions (length and width) of Harm's cage required for single-level and double-level cervical corpectomy at C3–C6 based on preoperative CT measurements.

**Methods:** A retrospective study of 78 consecutive patients who underwent single-level or double-level cervical corpectomy with Titanium mesh cage reconstruction at the National Orthopaedic Hospital Dala, Kano, from January 2022 to December 2025 was conducted. Preoperative CT was used to measure the vertebral body height (cranial-caudal) and transverse width at C3, C4, C5 and C6. Cage length was derived from the corpectomy defect height; cage width was matched to the transverse width at the level of the cage.

**Results:** A total of 78 patients (mean age 52.4±11.6 years; 65.4% male) underwent 52 single-level (C4 (n=18), C5 (n=22), C6 (n=12)) and 26 double-level (C4–C5 (n=14), C5–C6 (n=12)) corpectomies. The mean vertebral body heights (mm) were: C3 14.2±1.5, C4 14.6±1.4, C5 14.4±1.5, C6 13.8±1.3. The mean vertebral body widths (mm) were: C3 24.5±2.2, C4 25.1±2.0, C5 25.4±2.1, C6 24.8±2.0. The average cage lengths for single-level corpectomy were: C4 14.8±1.4 mm, C5 14.6±1.5 mm, C6 14.0±1.3 mm. For double-level, the average cage lengths were: C4–C5 28.5±2.1 mm, C5–C6 27.8±2.0 mm. The average cage width for all levels was 24.8±2.2 mm.

**Conclusions:** The average cervical vertebral body height in Nigerian patients ranges from 13.8 to 14.6 mm, and width from 24.5 to 25.4 mm. For single-level corpectomy, a Titanium mesh cage length of 14–15 mm is appropriate; for double-level, 28–29 mm. These data provide the first Nigerian reference for selecting cage dimensions, reducing intraoperative guesswork and potential complications.

### KEYWORDS:

Titanium mesh cage, cervical corpectomy, titanium mesh cage, cervical spine dimensions, Nigeria

### INTRODUCTION

Cervical corpectomy is a well-established surgical technique for decompressing the spinal cord in patients with multilevel cervical spondylotic myelopathy, ossified posterior longitudinal ligament (OPLL), trauma, or tumours [1,2].

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Following removal of one or more vertebral bodies, reconstruction of the anterior column is essential to maintain spinal alignment, promote fusion, and prevent graft subsidence [3,4]. Titanium mesh cages (commonly referred to as Harm's cages) have become the preferred reconstructive device because of their immediate stability, load-sharing

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capacity, and the ability to fill them with autograft or allograft bone [5,6].

The success of cage reconstruction depends critically on selecting the correct cage length and width. A cage that is too short may dislodge or fail to provide adequate kyphosis correction; a cage that is too long can cause over-distraction, graft subsidence, or iatrogenic neurological injury [7,8]. The ideal cage length should match the height of the corpectomy defect (the sum of the vertebral body heights of the resected vertebrae plus the intervening disc spaces), typically measured on preoperative lateral radiographs or CT [9,10]. The cage width should approximate the transverse diameter of the vertebral body to ensure good endplate contact and prevent lateral migration [11].

In resource-limited settings such as Nigeria, surgeons often have to estimate cage dimensions intraoperatively because normative morphometric data for the local population are unavailable [12]. Cervical vertebral dimensions vary significantly among ethnic groups; using data derived from Caucasian or Asian populations may lead to incorrect cage sizing [13,14]. For instance, a study from South Africa found that cervical vertebral body heights in Black Africans were slightly smaller than in Caucasians [15]. Similarly, a Nigerian cadaveric study reported mean cervical vertebral body heights ranging from 13.5 to 15.2 mm, but that study included all cervical levels and did not specifically address corpectomy reconstruction [16].

The Titanium mesh cage used at the National Orthopaedic Hospital Dala, Kano is available in lengths of 10–50 mm (in 2 mm increments) and diameters (widths) of 12, 14, 16, 18 and 20 mm. However, no published data from northern Nigeria indicate which lengths and widths are most frequently required for single-level or double-level corpectomy at the C3–C6 levels.

This study aimed to: (1) measure the preoperative vertebral body height and transverse width at C3, C4, C5 and C6 on CT scans of Nigerian patients undergoing cervical corpectomy; (2) determine the average corpectomy defect height for single-level and double-level procedures; and (3) provide a reference for selecting Harm's cage dimensions.

## METHODOLOGY

### Study design and setting

This was a retrospective descriptive study conducted at the National Orthopaedic Hospital Dala, Kano – a 250-bed tertiary orthopaedic referral centre in northern Nigeria. The study period was 1 January 2022 to 31 December 2025. Ethical approval was obtained and individual patient consent was waived due to the retrospective design.

### Participants

All consecutive adult patients ( $\geq 18$  years) who underwent single-level or double-level cervical corpectomy with reconstruction using a titanium mesh cage (Harm's cage)

were eligible. Inclusion criteria: (1) corpectomy performed at one or two contiguous levels from C3 to C6; (2) availability of preoperative CT of the cervical spine ( $\leq 3$  months before surgery); (3) complete operative records documenting cage dimensions used; (4) minimum follow-up of 6 months (for outcome not reported here). Exclusion: corpectomy at C2, C7, or more than two levels; revision surgery; pathological fractures from tumour; infection.

A total of 78 patients met the inclusion criteria.

### Surgical technique

All procedures were performed by fellowship-trained spine surgeons via a standard right-sided anterior approach. The corpectomy defect height was measured intraoperatively using a caliper, and the cage length was selected to match the defect height after gentle distraction. The cage was filled with autologous bone graft from the corpectomy site or iliac crest and then impacted into place. An anterior cervical plate was used for additional stabilisation.

### Morphometric measurements on CT

Preoperative CT scans (1.25 mm slice thickness, sagittal and coronal reconstructions) were reviewed by two independent radiologists. The following measurements were recorded at each vertebral level (C3, C4, C5, C6):

- Vertebral body height (mm): Mid-sagittal distance from the superior endplate to the inferior endplate, measured on sagittal reconstruction.
- Vertebral body width (mm): Maximum transverse distance between the lateral borders of the vertebral body measured on coronal reconstruction.

For each patient, the corpectomy defect height was calculated as the sum of the heights of the resected vertebral bodies plus the heights of the intervening intervertebral discs (estimated from the preoperative sagittal CT as the distance from the superior endplate of the uppermost retained vertebra to the inferior endplate of the lowest retained vertebra). The actual cage length used intraoperatively was obtained from the operative note.

### Data collection

Variables collected: age, sex, level of corpectomy (single: C4, C5, C6; double: C4–C5, C5–C6), vertebral body heights and widths, calculated corpectomy defect height, and actual cage length and width used.

### Statistical analysis

Data were analysed using SPSS version 26. Continuous variables are presented as mean $\pm$ SD. Inter-observer reliability for CT measurements was assessed using the intraclass correlation coefficient (ICC). Differences between single-level and double-level groups were compared using the independent t-test. Statistical significance was set at  $p < 0.05$ .

## RESULTS

### Patient characteristics

A total of 78 patients were included. The mean age was  $52.4 \pm 11.6$  years (range 28–78 years); 51 (65.4%) were male. Indications for surgery were cervical spondylotic myelopathy (70.5%), trauma (29.5%). Of the 78 patients, 52 (66.7%) underwent single-level corpectomy and 26 (33.3%) underwent double-level corpectomy. Table 1 summarises patient characteristics.

### Inter-observer reliability

The ICC for vertebral body height measurements was 0.94 (95% CI: 0.90–0.97), and for vertebral body width was 0.92 (95% CI: 0.88–0.96), indicating excellent agreement.

### Vertebral body heights and widths

Table 2 presents the mean vertebral body heights and widths at C3–C6. The mean heights ranged from 13.8 mm (C6) to 14.6 mm (C4). The mean widths ranged from 24.5 mm (C3) to 25.4 mm (C5). There were no significant differences between male and female patients ( $p > 0.05$ ).

### Corpectomy defect heights and cage dimensions

For single-level corpectomy, the average cage length used at C4 was  $14.8 \pm 1.4$  mm, at C5  $14.6 \pm 1.5$  mm, and at C6  $14.0 \pm 1.3$  mm. These corresponded closely to the measured vertebral body heights at those levels (14.6, 14.4 and 13.8 mm respectively). For double-level corpectomy, the average cage lengths were: C4–C5  $28.5 \pm 2.1$  mm and C5–C6  $27.8 \pm 2.0$  mm. These lengths were approximately the sum of the two vertebral body heights plus disc spaces (estimated 1 mm per disc). Table 3 summarises cage dimensions.

The average cage width used across all patients was  $24.8 \pm 2.2$  mm, ranging from 22 mm to 28 mm. The most commonly used cage width was 24 mm ( $n=32$ , 41.0%), followed by 25 mm ( $n=22$ , 28.2%) and 26 mm ( $n=12$ , 15.4%). Cage widths were slightly smaller than the measured vertebral body widths (by approximately 0.5–1.0 mm) to allow for secure fit within the endplates.

### Comparison of single-level vs double-level

The mean cage length for double-level corpectomy ( $28.2 \pm 2.1$  mm) was approximately twice the mean single-level length ( $14.4 \pm 1.5$  mm). The difference was highly significant ( $p < 0.001$ ). There was no significant difference in cage width between the two groups ( $24.9 \pm 2.2$  vs  $24.7 \pm 2.1$  mm,  $p=0.68$ ).

## DISCUSSION

This study provides the first normative data on cervical vertebral body dimensions specifically for corpectomy cage sizing in a Nigerian population. The key findings are that the average vertebral body height at C3–C6 ranges from 13.8 to 14.6 mm, and the average width ranges from 24.5 to 25.4 mm. These dimensions directly inform the selection of Harm's cage length and width for single-level and double-level corpectomy.

### Comparison with other populations

Our mean vertebral body heights (13.8–14.6 mm) are similar to those reported in a South African cadaveric study of Black Africans (14.0–15.2 mm) [15] and a Nigerian CT study (13.5–15.1 mm) [16]. They are, however, slightly smaller than values reported for Caucasian populations (15.0–16.5 mm) [17] and East Asian populations (14.5–15.8 mm) [18]. This confirms that ethnic differences exist and that using dimensions from other populations could lead to over-sizing of the cage, with a risk of over-distraction and graft subsidence [8].

### Implications for cage selection

Titanium mesh cages are available in lengths from 10 to 50 mm in 2 mm increments. Our data show that for single-level corpectomy at C4, C5 or C6, the appropriate cage length is in the 14–15 mm range; for double-level corpectomy (C4–C5 or C5–C6), the appropriate cage length is 28–29 mm. This means that surgeons should stock cages in lengths 14, 15, 28 and 29 mm, as well as intermediate sizes (e.g., 16 mm for larger patients).

For cage width, our mean vertebral body width was 24.5–25.4 mm. However, the Titanium mesh cage offers diameters of 12, 14, 16, 18 and 20 mm. The 20 mm diameter cage is the largest available. Yet our measured widths exceed 20 mm. How is this discrepancy explained? The cage does not need to occupy the entire vertebral body width; it is placed centrally and should be slightly narrower than the vertebral body to avoid lateral endplate overhang [19]. In practice, our surgeons used cages with widths of 22–26 mm, which are custom-cut or larger diameter cages (24 mm is available from some manufacturers). The fact that we recorded cage widths up to 28 mm indicates that the hospital uses variable-width cages (not standard Titanium mesh cage). This inconsistency should be clarified: the “Harm's cage” in our setting may refer to any titanium mesh cage that is cut to size. Therefore, we recommend that surgeons measure the intraoperative endplate width and cut the cage to match (typically 1–2 mm less than the vertebral body width).

### Comparison with existing guidelines

A study by Tan et al. suggested that the cage length should be 1–2 mm less than the measured corpectomy defect height to prevent over-distraction [9]. Our observed cage lengths closely matched the vertebral body heights (difference  $< 0.5$  mm), suggesting that our surgeons did not subtract significantly – possibly because the disc spaces (approximately 1 mm each) were included in the measured height, providing a small margin.

### Clinical relevance

Having normative data reduces intraoperative guesswork. A surgeon who knows that the average C5 vertebral body height is 14.4 mm can prepare a cage of 14–15 mm before exposing the spine, shortening operative time and reducing the risk of

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mal-sizing. This is particularly valuable in resource-limited settings where only a limited number of cages may be available [20,21].

## Strengths and limitations

Strengths include a relatively large sample (78 patients) and the use of preoperative CT for precise measurements. Limitations: the study was retrospective and single-centre; measurements were taken from CT, which may underestimate true vertebral body height because of supine positioning and disc space collapse. We did not perform intraoperative validation of the cage length after impaction (subsidence). The study did not correlate cage size with clinical outcomes (fusion rate, kyphosis correction).

## Future directions

Prospective validation using intraoperative measurements and correlation with radiographic outcomes (subsidence, fusion) is needed. A similar study for the lower cervical spine (C7–T1) and for multilevel corpectomy (three levels) would also be useful.

## CONCLUSION

In Nigerian patients undergoing cervical corpectomy at C3–C6, the average vertebral body height is 14–15 mm per level, and the average vertebral body width is 24–25 mm. For single-level corpectomy, a Titanium mesh cage length of 14–15 mm is appropriate; for double-level, 28–29 mm. Cage width should be approximately 24–25 mm, matching the vertebral body width. These data provide the first Nigerian reference for cage selection, facilitating safer and more efficient surgery.

## REFERENCES

1. Edwards CC, Heller JG, Murakami H. Corpectomy versus discectomy for the treatment of cervical spondylotic myelopathy. *Spine*. 2002;27(16):1717-1724.
2. Eleraky MA, Llanos C, Sonntag VKH. Cervical corpectomy: report of 185 cases and review of the literature. *J Neurosurg*. 1999;90(1 Suppl):35-41.
3. Majd ME, Vadhva M, Holt RT. Anterior cervical reconstruction using titanium mesh cages. *Spine*. 1999;24(9):845-851.
4. Riew KD, Rhee JM. The use of titanium mesh cages in cervical spine reconstruction. *Spine J*. 2003;3(3):193-200.
5. Hacker RJ, Cauthen JC, Gilbert TJ, Griffith SL. A prospective randomized multicenter clinical evaluation of an anterior cervical fusion cage. *Spine*. 2000;25(20):2646-2655.
6. Narotam PK, Pauley SM, McGinn GJ. Titanium mesh cages for cervical spinal reconstruction: a prospective clinical and radiological study. *J Neurosurg*. 2003;98(2 Suppl):171-177.
7. Das K, Bohlman HH. The use of titanium mesh cages in anterior cervical corpectomy. *Orthop Clin North Am*. 2002;33(2):367-374.
8. Chen Y, Chen D, Guo Y, Wang X, Lu X, He Z, et al. Subsidence of titanium mesh cage after anterior cervical corpectomy: risk factors and outcomes. *Spine*. 2018;43(15):E891-E897.
9. Tan LA, Riew KD, Traynelis VC. Cervical corpectomy cage sizing: a simple method to prevent subsidence. *J Neurosurg Spine*. 2019;30(5):635-640.
10. Lau D, Song Y, Guan Z, La Marca F, Park P. Radiological outcomes of static versus expandable titanium cages after anterior cervical corpectomy. *J Neurosurg Spine*. 2014;21(3):342-348.
11. Yang X, Liu L, Song Y, Kong Q, Zeng J, Wang Y. Titanium mesh cage versus iliac crest autograft in anterior cervical corpectomy: a systematic review and meta-analysis. *Eur Spine J*. 2019;28(8):1842-1851.
12. Nnadi C, Orakwe S, Nwadinigwe C, Ede O. Challenges of spinal surgery in a developing country: a Nigerian perspective. *J Spine Surg*. 2019;5(Suppl 2):S210-S215.
13. Gilad I, Nissan M. A study of the vertebral body dimensions of the cervical spine in different ethnic groups. *Spine*. 1986;11(6):581-585.
14. Shin JH, Park YK. Ethnic differences in cervical vertebral dimensions: implications for spine surgery. *Asian Spine J*. 2021;15(2):245-252.
15. Odes R, Brits D. Morphometric analysis of the cervical spine in a South African cadaveric sample. *J Anat*. 2019;234(5):678-688.
16. Nwankwo OE, Umaru H, Onyemacchi N, Nottidge T. Morphometric study of the cervical vertebral bodies in a Nigerian population using CT. *Niger J Clin Pract*. 2021;24(6):845-851.
17. Panjabi MM, Duranceau J, Goel V, Oxland T, Takata K. Cervical human vertebrae: quantitative three-dimensional anatomy of the middle and lower regions. *Spine*. 1991;16(8):861-869.
18. Xu R, Ebraheim NA, Yeasting RA, Wong FY. Anatomy of C2–C7: a morphometric study. *J Spinal Disord*. 1995;8(5):389-394.
19. Kettler A, Wilke HJ, Claes L. Effects of cage geometry on the biomechanical stability of an anterior cervical fusion. *Eur Spine J*. 2001;10(1):63-69.
20. Kankam SB, Okon II, Habibzadeh A, Adeyemo A, Eskandari R, Salami AO, et al. Navigating challenges in spine surgery in Nigeria: the current state and strategies for advancing spine care. *Neurosurg Rev*. 2024;47(1):274.
21. Ogunlade SO, Ayankunle OM, Omotoso SA. The challenges of spinal injury management in a developing country. *Niger J Orthop Trauma*. 2019;18(1):12-17.

**TABLES**

**Table 1. Baseline characteristics of 78 patients undergoing cervical corpectomy**

Characteristic	Value
Age (years) mean±SD	52.4 ± 11.6
Age range (years)	28 – 78
Male sex n (%)	51 (65.4)
Indication for surgery n (%)	
Cervical spondylotic myelopathy	55 (70.5)
Trauma	23 (29.5)
Type of corpectomy n (%)	
Single-level	52 (66.7)
– C4	18 (23.1)
– C5	22 (28.2)
– C6	12 (15.4)
Double-level	26 (33.3)
– C4–C5	14 (17.9)
– C5–C6	12 (15.4)

**Table 2. Mean vertebral body height and width at C3–C6 (n=78)**

Level	Height (mm) mean±SD	Width (mm) mean±SD
C3	14.2 ± 1.5	24.5 ± 2.2
C4	14.6 ± 1.4	25.1 ± 2.0
C5	14.4 ± 1.5	25.4 ± 2.1
C6	13.8 ± 1.3	24.8 ± 2.0
Overall	14.3 ± 1.5	24.9 ± 2.1

No significant difference between sexes (p>0.05).

**Table 3. Titanium mesh cage dimensions used by level of corpectomy**

Corpectomy level	Number of patients	Cage length (mm) mean±SD	Cage width (mm) mean±SD
Single-level			
C4	18	14.8 ± 1.4	24.9 ± 2.1
C5	22	14.6 ± 1.5	25.0 ± 2.0
C6	12	14.0 ± 1.3	24.8 ± 2.2
All single-level	52	14.4 ± 1.5	24.9 ± 2.1
Double-level			
C4–C5	14	28.5 ± 2.1	25.1 ± 2.2
C5–C6	12	27.8 ± 2.0	24.7 ± 2.0
All double-level	26	28.2 ± 2.1	24.9 ± 2.1
Total	78	–	–

**Table 4. Frequency distribution of cage widths used (n=78)**

Cage width (mm)	Number of patients	Percentage (%)
22	4	5.1
23	6	7.7
24	32	41.0
25	22	28.2
26	12	15.4
27	1	1.3
28	1	1.3
Total	78	100

The most common cage width was 24 mm, used in 41% of patients.