

Outcome of Long Construct Spine Surgery at the National Orthopaedic Hospital Dala Kano Nigeria

Kawu Ahidjo Abdulkadiri¹, Abubakar Kabir², Nurudeen Aminu Muhammad³, Sani Abdullahi Tsoho⁴, Mamman Muhammad Lawal⁵, Chiroma Muhammad Musa⁶, Aremu Abdurrahman Bolaji⁷

^{1,2,3,4,5,6,7}Department of Orthopaedics National Orthopaedic Hospital Dala Kano, Nigeria

ABSTRACT

Background: Long construct spine surgery (T10 to S1 or S2AI) is a major intervention for complex spinal disorders, yet functional outcomes in resource-limited settings are poorly characterised. This study aimed to determine functional outcomes and identify predictors of favourable outcomes following long construct spine surgery at a Nigerian tertiary hospital.

Methods: A retrospective cohort study of 117 patients who underwent long construct spine surgery (T10–S1 or S2AI) at the National Orthopaedic Hospital Dala, Kano, from January 2019 to December 2025 was conducted. Functional outcomes assessed at minimum 12-month follow-up included: ability to walk 100 metres comfortably, ability to stand for 10 minutes without discomfort, ability to return to previous job or migrate to a new job, and ability to fulfil sexual obligations. Multivariate logistic regression identified predictors of favourable outcomes.

Results: The mean age was 54.6±12.8 years; 68 patients (58.1%) were male. At final follow-up, 78 patients (66.7%) could walk 100 metres comfortably, 82 (70.1%) could stand for 10 minutes, 41 (35.0%) had returned to work or migrated to new employment, and 52 (44.4%) reported ability to fulfil sexual obligations. Independent predictors of favourable outcomes included: age <60 years (adjusted OR 2.8, 95% CI: 1.4–5.6), absence of postoperative complications (OR 3.2, 95% CI: 1.5–6.8), and sagittal balance restoration (PI-LL mismatch ≤10°) (OR 2.5, 95% CI: 1.2–5.2).

Conclusions: Long construct spine surgery in this Nigerian cohort achieves favourable mobility outcomes in approximately two-thirds of patients, but return to work and sexual function remain limited. Younger age, absence of complications, and restoration of sagittal balance are key predictors of success.

KEYWORDS: Long construct spinal fusion; T10–S1 fusion; functional outcomes; return to work; sexual function; predictors; Nigeria

ARTICLE DETAILS

Published On:
22 July 2026

Available on:
<https://ijmscrs.com>

INTRODUCTION

Long construct spine surgery—defined as instrumentation extending from the lower thoracic spine (T10) to the sacrum (S1) or with S2-alar-iliac (S2AI) fixation—is a major surgical intervention for complex spinal disorders including adult spinal deformity, severe degenerative scoliosis, and advanced spondylolisthesis. The goals of such surgery are to eliminate pain, correct deformities, restore spinal stability, and ultimately improve the patient's overall quality of life [1,2]. Long constructs from T10 to the pelvis provide robust stabilisation but entail significant surgical morbidity and functional limitations due to the extensive fusion [3].

While several studies have reported satisfactory radiographic outcomes and improvements in patient-reported outcomes following long spinal fusion, the functional outcomes that matter most to patients—particularly in resource-limited settings—are less frequently reported. In Nigeria, where social support systems are limited and return to gainful employment is essential for survival, functional outcomes such as walking ability, standing tolerance, return to work, and sexual function are paramount [4].

Studies from high-income countries have demonstrated that long spinal fusion can result in sustained improvements in walking ability and patient-reported outcomes for more than

Outcome of Long Construct Spine Surgery at the National Orthopaedic Hospital Dala Kano Nigeria

five years postoperatively [5]. A study by Sakaguchi et al. quantified the minimal clinically important differences in gait and balance ability following corrective long spinal fusion for adult spinal deformity [6]. However, mobility often temporarily decreases after surgery before improving, and overcorrection of sagittal alignment can detrimentally affect mobility status [7]. Sexual dysfunction due to lumbar stiffness has been shown to significantly improve after long-segment spinal fusion, with predictors of improvement including sagittal vertical axis improvement and decreased postoperative back pain [8,9]. A systematic review found a general trend towards improvement in sexual activity and function after spine surgery [10].

Despite these insights from high-income settings, the functional outcomes of long construct spine surgery in Nigeria have not been characterised. The National Orthopaedic Hospital Dala, Kano, is a major referral centre for spinal surgery in northern Nigeria, managing a high volume of complex spinal disorders including post-tuberculous kyphosis and degenerative scoliosis [11]. Understanding the functional outcomes in this setting is essential for patient counselling, surgical planning, and resource allocation [12].

This study aimed to: (1) determine the functional outcomes of long construct spine surgery in a Nigerian cohort, specifically assessing ability to walk 100 metres comfortably, ability to stand for 10 minutes without discomfort, ability to return to previous job or migrate to a new job, and ability to fulfil sexual obligations; and (2) identify predictors of favourable outcomes.

METHODOLOGY

Study Design and Setting

This was a retrospective cohort study conducted at the National Orthopaedic Hospital Dala, Kano, Nigeria – a 250-bed tertiary orthopaedic referral centre. The study period was 1 January 2019 to 31 December 2025. Ethical approval was obtained and individual patient consent was waived due to the retrospective nature.

Participants

All consecutive adult patients (≥ 18 years) who underwent long construct spine surgery (T10–S1 or T10–S2AI) during the study period were eligible. Inclusion criteria: (1) posterior spinal fusion with instrumentation extending from T10 to S1 or with S2AI fixation; (2) minimum 12-month follow-up; (3) complete medical records and functional outcome documentation. Exclusion: patients with incomplete records, loss to follow-up, or death within 12 months. A total of 117 patients met the inclusion criteria.

Definition of Long Construct

Long construct spine surgery was defined as posterior instrumented fusion extending from T10 (or higher) to S1, with or without S2AI screw fixation for pelvic anchorage. S2AI screws were used when additional lumbopelvic fixation

was required for sagittal balance restoration or in patients with osteoporosis.

Data Collection

Data were extracted from patient case files, operative notes, physiotherapy records, and outpatient follow-up charts. Variables collected included: age, sex, diagnosis, levels fused, use of S2AI screws, preoperative and postoperative sagittal parameters (pelvic incidence-lumbar lordosis mismatch), length of hospital stay, and postoperative complications.

Functional Outcome Measures

Four functional outcomes were assessed at minimum 12-month follow-up, based on patient interviews and physiotherapist assessments:

1. Ability to walk 100 metres comfortably: Defined as the ability to walk 100 metres on level ground without stopping due to pain, fatigue, or shortness of breath, with or without walking aids.
2. Ability to stand for 10 minutes without discomfort: Defined as the ability to stand upright for 10 minutes without needing to sit or lean due to pain or discomfort.
3. Ability to return to previous job or migrate to a new job: Defined as return to the same occupation held before surgery, or successful transition to a different form of gainful employment within 12 months of surgery.
4. Ability to fulfil sexual obligations: Based on patient self-report using a binary response (yes/no) to the question: “Has your ability to engage in sexual activity returned to a satisfactory level?”

Each outcome was recorded as binary: achieved (1) or not achieved (0). A composite favourable outcome was defined as achieving at least three of the four outcomes.

Statistical Analysis

Data were analysed using SPSS version 26. Continuous variables are presented as mean $\pm$ SD, categorical as frequencies (%). Univariate logistic regression identified factors associated with each outcome and the composite outcome ($p < 0.10$). Variables significant in univariate analysis were entered into multivariate logistic regression models with stepwise forward selection. Adjusted odds ratios (OR) with 95% confidence intervals (CI) were calculated. Statistical significance was set at $p < 0.05$.

RESULTS

Patient Characteristics

A total of 117 patients were included. The mean age was 54.6 ± 12.8 years (range 22–82). There were 68 males (58.1%) and 49 females (41.9%). The most common indications were degenerative scoliosis ($n=52$, 44.4%), post-tuberculous kyphosis ($n=28$, 23.9%), and adult spinal deformity ($n=37$, 31.6%). S2AI screws were used in 41 patients (35.0%). The mean number of fused levels was 6.8 ± 1.4 (range 5–10). Table 1 presents the baseline characteristics.

Outcome of Long Construct Spine Surgery at the National Orthopaedic Hospital Dala Kano Nigeria

Table 1. Baseline Characteristics of 117 Patients Undergoing Long Construct Spine Surgery

Characteristic	Category n (%)
Age (years) Mean±SD	54.6 ± 12.8
<60 years	72 (61.5)
≥60 years	45 (38.5)
Sex	
Male	68 (58.1)
Female	49 (41.9)
Diagnosis	
Degenerative scoliosis	52 (44.4)
Post-tuberculous kyphosis	28 (23.9)
Adult spinal deformity	37 (31.6)
S2AI screws used	
Yes	41 (35.0)
No	76 (65.0)
Number of fused levels Mean±SD	6.8 ± 1.4
PI-LL mismatch	
Preoperative (°)	18.4 ± 8.6
Postoperative (°)	8.2 ± 5.4
≤10° (restored)	78 (66.7)
Postoperative complications	
Yes	32 (27.4)
No	85 (72.6)

Functional Outcomes at 12 Months

Table 2 presents the functional outcomes at 12 months post-surgery. The most commonly achieved outcome was ability to stand for 10 minutes without discomfort (70.1%, n=82), followed by ability to walk 100 metres comfortably (66.7%,

n=78), ability to fulfil sexual obligations (44.4%, n=52), and ability to return to work or migrate to a new job (35.0%, n=41). The composite favourable outcome (≥3 of 4 outcomes) was achieved in 68 patients (58.1%).

Table 2. Functional Outcomes at 12-Month Follow-Up (N=117)

Functional Outcome Achieved	n (%)
Walk 100 metres comfortably	78 (66.7)
Stand for 10 minutes without discomfort	82 (70.1)
Return to previous job or migrate to new job	41 (35.0)
Fulfil sexual obligations	52 (44.4)
Composite favourable outcome (≥3 of 4)	68 (58.1)

Predictors of Composite Favourable Outcome

Univariate analysis identified age <60 years, absence of postoperative complications, sagittal balance restoration (PI-

LL mismatch ≤10°), and absence of S2AI screw-related pain as factors associated with the composite favourable outcome (p<0.10). Table 3 presents the univariate analysis.

Table 3. Univariate Analysis of Factors Associated with Composite Favourable Outcome

Factor	Favourable (n=68)	Unfavourable (n=49)	OR (95% CI)	p-value
Age <60 years	48 (70.6)	24 (49.0)	2.5 (1.2–5.2)	0.01
Male sex	42 (61.8)	26 (53.1)	1.4 (0.7–2.9)	0.34
No complications	58 (85.3)	27 (55.1)	4.7 (2.0–11.2)	<0.001
S2AI screws used	26 (38.2)	15 (30.6)	1.4 (0.6–3.1)	0.40
PI-LL mismatch ≤10°	52 (76.5)	26 (53.1)	2.9 (1.3–6.3)	0.008
Degenerative diagnosis	32 (47.1)	20 (40.8)	1.3 (0.6–2.7)	0.50

Outcome of Long Construct Spine Surgery at the National Orthopaedic Hospital Dala Kano Nigeria

Multivariate logistic regression (Table 4) identified three independent predictors of the composite favourable outcome:

- Age <60 years: adjusted OR = 2.8 (95% CI: 1.4–5.6), $p=0.004$
- Absence of postoperative complications: adjusted OR = 3.2 (95% CI: 1.5–6.8), $p=0.002$

- Sagittal balance restoration (PI-LL mismatch $\leq 10^\circ$): adjusted OR = 2.5 (95% CI: 1.2–5.2), $p=0.01$

Sex, diagnosis, and use of S2AI screws were not significant predictors in the multivariate model.

Table 4. Multivariate Logistic Regression – Predictors of Composite Favourable Outcome

Predictor	Adjusted OR	95% CI	p-value
Age <60 years	2.8	1.4 – 5.6	0.004
Absence of postoperative complications	3.2	1.5 – 6.8	0.002
PI-LL mismatch $\leq 10^\circ$ (sagittal balance restored)	2.5	1.2 – 5.2	0.01

Hosmer-Lemeshow goodness-of-fit: $\chi^2=4.2$, $p=0.84$.

Predictors of Individual Outcomes

Age <60 years was a significant predictor for all four individual outcomes. Absence of complications predicted walking ability (OR=2.8, $p=0.01$) and return to work

(OR=3.4, $p=0.005$). Sagittal balance restoration predicted standing ability (OR=2.6, $p=0.02$) and sexual function (OR=2.3, $p=0.04$). Table 5 summarises the predictors for each outcome.

Table 5. Predictors of Individual Functional Outcomes (Multivariate Analysis)

Outcome	Significant Predictor	Adjusted OR	95% CI	p-value
Walk 100 metres	Age <60 years	2.6	1.3–5.2	0.006
	No complications	2.8	1.3–6.1	0.01
Stand 10 minutes	Age <60 years	2.4	1.2–4.8	0.01
	PI-LL $\leq 10^\circ$	2.6	1.2–5.6	0.02
Return to work	Age <60 years	3.1	1.5–6.4	0.002
	No complications	3.4	1.5–7.7	0.005
Sexual function	Age <60 years	2.2	1.1–4.4	0.03
	PI-LL $\leq 10^\circ$	2.3	1.1–4.8	0.04

Complications and Their Impact

Postoperative complications occurred in 32 patients (27.4%). The most common complications were surgical site infection ($n=9$, 7.7%), screw loosening ($n=7$, 6.0%), proximal junctional kyphosis ($n=5$, 4.3%), and S2AI screw-related pain ($n=4$, 3.4%). Patients with complications were significantly less likely to achieve the composite favourable outcome (31.3% vs 68.2%, $p<0.001$).

DISCUSSION

This study provides the first comprehensive assessment of functional outcomes following long construct spine surgery in a Nigerian cohort. The findings demonstrate that while the majority of patients achieve favourable mobility outcomes (walking and standing), return to work and sexual function remain limited. Age, complications, and sagittal balance are the strongest predictors of success.

The finding that 66.7% of patients could walk 100 metres comfortably and 70.1% could stand for 10 minutes without discomfort is encouraging. These rates are comparable to those reported in international series. A study by Passias et al. found that a significant majority of patients reported improved capacity for walking (64.2%) and navigating stairs (52.6%) following long-segment fusion to the pelvis [7,13].

The improvement in walking speed after long fusion has been quantified, with a minimal clinically important difference of 0.10 m/s for the 10-metre walk test [6].

The slightly higher rate of standing ability compared with walking ability may reflect the fact that standing is less demanding in terms of energy expenditure and coordination, though it requires adequate trunk stability and sagittal balance. The importance of sagittal balance restoration is underscored by its independent association with favourable outcomes in our multivariate analysis (OR=2.5). Restoration of PI-LL mismatch to $\leq 10^\circ$ is a well-established surgical goal in adult spinal deformity surgery [14].

The 35.0% return-to-work rate is concerning. In high-income countries, return-to-work rates after long spinal fusion range from 50% to 70% [13]. The lower rate in our cohort may reflect several factors: the physically demanding nature of many occupations in Nigeria, limited vocational rehabilitation services, the high proportion of patients with post-tuberculous kyphosis (23.9%) who may have chronic disability, and inadequate workplace accommodations. The strong association between complications and failure to return to work (OR=3.4) suggests that preventing complications is critical for vocational recovery.

Outcome of Long Construct Spine Surgery at the National Orthopaedic Hospital Dala Kano Nigeria

The 44.4% rate of satisfactory sexual function is consistent with the 40–50% reported in other series of long spinal fusion. Sexual dysfunction after spinal fusion is often related to lumbar stiffness, pain, and neurological compromise. A study by Daniels et al. found that sexual dysfunction scores due to lumbar stiffness significantly improved after surgery for adult spinal deformity, with predictors of improvement including sagittal vertical axis improvement ($P=0.0032$) and decreased postoperative back pain ($P<0.0001$) [8,9]. Similarly, our finding that sagittal balance restoration predicted sexual function ($OR=2.3$) highlights the importance of restoring physiological alignment.

A systematic review of sexual activity after spine surgery found a general trend towards improvement in sexual activity and function after surgery, though evidence from high-quality studies is limited [10]. Anterior lumbar approaches have been associated with a higher incidence of retrograde ejaculation, but this was not relevant to our cohort as all surgeries were performed via a posterior approach.

The three independent predictors identified in our study—age <60 years, absence of complications, and sagittal balance restoration—are consistent with the literature. Age is a well-established predictor of outcomes after spinal surgery, with older patients having lower physiological reserve and higher comorbidity burdens [15]. However, even among elderly patients, patient-reported outcomes consistently improve after surgery and remain positive for an extended period [5]. The importance of sagittal balance restoration cannot be overstated. A study on stiffness-related disability following long segmental posterior instrumentation found that longer fusion levels, higher BMI, and greater postoperative sagittal vertical axis independently affected lumbar stiffness disability [3]. The ability to stand and walk depends critically on maintaining the centre of gravity within the base of support, which requires appropriate spinopelvic alignment [2].

The strong impact of complications on functional outcomes ($OR=3.2$) highlights the need for meticulous surgical technique and perioperative care. Complications such as surgical site infection, screw loosening, and proximal junctional kyphosis not only prolong recovery but also directly impair function [1,16]. Risk factors for loss of lumbar lordosis include two-rod constructs, male sex, lower UIV, and greater intraoperative lordosis, suggesting that multi-rod constructs may better maintain alignment [17,18].

S2AI screws were used in 35% of our patients. Emerging evidence suggests that S2AI screws provide superior biomechanical stability compared with traditional iliac screws, restoring up to 96% of native spine stiffness [19]. A meta-analysis found that while both S2AI and iliac screw fixations have similar outcomes in terms of implant failure, operation time, and postoperative ODI, S2AI may have better outcomes in terms of revision, screw prominence, and wound complications [20]. In our cohort, S2AI use was not an independent predictor of functional outcomes, suggesting

that both techniques can achieve satisfactory results when appropriately applied.

Few Nigerian studies have reported outcomes of long construct spine surgery. A study from Ibadan reported on long-term clinical outcomes of posterior spinal stabilisation using Adeolu's technique, with favourable outcomes in patients with lumbar spondylosis, spinal trauma, and Pott's disease [21]. However, that study did not specifically assess functional outcomes such as return to work or sexual function. Another Nigerian study on minimally invasive spine surgery reported satisfactory patient-reported outcomes, but long constructs were not specifically evaluated [22]. Our study therefore provides novel data on functional outcomes after long construct spine surgery in the Nigerian context.

This study has several strengths, including a relatively large sample size ($n=117$) for a Nigerian cohort and the use of patient-centred functional outcomes rather than purely radiographic measures. However, there are limitations. The retrospective design introduces selection and information bias. Functional outcomes were assessed using binary measures rather than validated instruments such as the Oswestry Disability Index or Scoliosis Research Society-22. The assessment of sexual function was based on patient self-report without a validated questionnaire, which may be subject to social desirability bias. Follow-up was limited to 12 months; longer-term outcomes may differ. The single-centre design limits generalisability.

Implications for Practice

The findings of this study have several implications for Nigerian spine surgeons and patients:

1. Patient counselling: Patients should be counselled that while mobility outcomes are favourable in approximately two-thirds of cases, return to work and sexual function may be more limited.
2. Complication prevention: The strong association between complications and poor outcomes underscores the importance of meticulous surgical technique, infection prevention, and perioperative care.
3. Sagittal balance: Restoration of sagittal balance ($PI-LL$ mismatch $\leq 10^\circ$) should be a primary surgical goal, as it independently predicts favourable outcomes.
4. Rehabilitation: The low return-to-work rate suggests a need for structured vocational rehabilitation programmes.

In conclusion, long construct spine surgery in this Nigerian cohort achieves favourable mobility outcomes in approximately two-thirds of patients, but return to work and sexual function remain limited. Age <60 years, absence of postoperative complications, and restoration of sagittal balance are independent predictors of favourable outcomes. These findings can guide patient selection, surgical planning, and postoperative counselling in resource-limited settings.

REFERENCES

- I. Mikula AL, Pennington Z, Hamouda AM, Nassr A, Freedman B, Sebastian AS, Elder BD, Fogelson JL. Maintenance of intraoperative correction with multi-rod constructs in adult long construct spine fusion surgery. *Clin Neurol Neurosurg.* 2025;249:108729. doi: 10.1016/j.clineuro.2025.108729.
- II. Passias PG, et al. Return to activities of daily living after fusion to the pelvis for adult spinal deformity. *Spine (Phila Pa 1976).* 2024;49(24):1701-7. doi: 10.1097/BRS.0000000000004988.
- III. Zhang J, Liu Y, Zeng Y, et al. Stiffness-related disability following long segmental posterior instrumentation and fusion: is it influenced by postoperative spinopelvic alignment? *Eur Spine J.* 2024;33(9):3552-8. doi: 10.1007/s00586-024-08414-3.
- IV. 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):S210-5. doi: 10.21037/jss.2019.S2.07.
- V. Sawada M, Yamato Y, Hasegawa T, Yoshida G, Banno T, Arima H, Oe S, Nagafusa T, Yamauchi K, Ojima T, Matsuyama Y. Corrective long spinal fusion to the ilium for patients with adult spinal deformity results in good physical function after mid- to long-term postoperative follow-up. *Spine Surg Relat Res.* 2025;9(2):179-87. doi: 10.22603/ssrr.2024-0036.
- VI. Sakaguchi T, Meena U, Tanaka M, Xiang H, Fujiwara Y, Arataki S, Taoka T, Takamatsu K, Yasuda Y, Nakagawa M, Utsunomiya K. Minimal clinically important differences in gait and balance ability in patients who underwent corrective long spinal fusion for adult spinal deformity. *J Clin Med.* 2023;12(20):6500. doi: 10.3390/jcm12206500.
- VII. Ouchida J, Nakashima H, Ito S, Segi N, Yamauchi I, Oishi R, Miyairi Y, Morita Y, Ode Y, Nagatani Y, Okada Y, Tsushima M, Kanemura T, Machino M, Ohara T, Ota K, Tachi H, Tsuji T, Kagami Y, Shinjo R, Imagama S. Longitudinal impact of multi-segment spinal fixation surgery on mobility status and clinical outcomes in adult spinal deformity: a multicenter retrospective study. *Eur Spine J.* 2024;33(10):3894-903. doi: 10.1007/s00586-024-08397-1.
- VIII. Daniels AH, Reid D, Durand W, Disilvestro K, Hamilton DK, Passias P, Kim HJ, Protosaltis T, LaFage V, Smith JS, Shaffrey C, Gupta M, Klineberg E, Schwab F, Burton D, Bess S, Ames C, Hart R; International Spine Study Group. Sexual dysfunction secondary to lumbar stiffness in adult spinal deformity patients before and after long-segment spinal fusion. *World Neurosurg.* 2020;139:e474-9. doi: 10.1016/j.wneu.2020.04.033.
- IX. Daniels AH, Reid D, Durand W, Disilvestro K, Hamilton DK, Passias P, Kim HJ, Protosaltis T, LaFage V, Smith JS, Shaffrey C, Gupta M, Klineberg E, Schwab F, Burton D, Bess S, Ames C, Hart R; International Spine Study Group. Sexual dysfunction secondary to lumbar stiffness in adult spinal deformity patients before and after long-segment spinal fusion. *World Neurosurg.* 2020;139:e474-9. doi: 10.1016/j.wneu.2020.04.033.
- X. Malik AT, Jain N, Kim J, Khan SN, Yu E. Sexual activity after spine surgery: a systematic review. *Eur Spine J.* 2018;27(10):2395-2426. doi: 10.1007/s00586-018-5636-7.
- XI. Nwankwo OE, Umaru H, Onyemaechi N, Nottidge T. Pattern of spinal disorders in a tertiary hospital in Nigeria. *Niger J Clin Pract.* 2020;23(4):499-504. doi: 10.4103/njcp.njcp_79_19.
- XII. 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):265. doi: 10.1007/s10143-024-02503-z.
- XIII. Maayan O, Zhang B, Fourman MS, Clohisy J, Pajak A, Nakarai H, Kazarian GS, Du J, Merrill R, Kaidi A, Knopp R, Akosman I, Samuel J, Andrews L, Shahi P, Lovecchio FC, Kim HJ. Return to activities of daily living after fusion to the pelvis for adult spinal deformity. *Spine (Phila Pa 1976).* 2024;49(24):1701-7. doi: 10.1097/BRS.0000000000004988.
- XIV. Schwab F, Lafage V, Patel A, Farcy JP. Sagittal plane considerations and the pelvis in the adult patient. *Spine (Phila Pa 1976).* 2009;34(17):1828-33. doi: 10.1097/BRS.0b013e3181a13c08.
- XV. Park SJ, Kim HJ, Park JS, Kang DH, Kang M, Jung K, Lee CS. Characterization of patients with poor clinical outcome after adult spinal deformity surgery: a multivariate analysis of mean 8-year follow-up data. *J Clin Med.* 2024;13(19):6000. doi: 10.3390/jcm13196000.
- XVI. O'Leary S, et al. Frailty, bone health, and radiographic predictors of complications after long-segment fusion for adult spinal deformity. *World Neurosurg.* 2026 Jul;211:125028. doi: 10.1016/j.wneu.2026.125028.
- XVII. Mikula AL, Pennington Z, Hamouda M, Nassr A, Sebastian A, Fogelson J, et al. Maintenance of intraoperative correction with multi-rod constructs in adult long construct spine fusion surgery. *Clin Neurol Neurosurg.* 2025;249:108729. doi: 10.1016/j.clineuro.2025.108729.
- XVIII. Mikula AL, Pennington Z, Lakomkin N, Martini ML, Hamouda AM, Nassr A, Freedman B, Sebastian AS, Cross WW, Ames CP, Elder BD,

Outcome of Long Construct Spine Surgery at the National Orthopaedic Hospital Dala Kano Nigeria

- Fogelson JL. Loss of lumbar lordosis in adult long construct spine fusion surgery. *J Neurosurg Spine*. 2025;43(5):559-568.
doi: 10.3171/2025.1.SPINE241261.
- XIX. Zygogiannis K. Emerging techniques in lumbopelvic fixation: biomechanical and clinical perspectives. *Maedica (Bucur)*. 2025;20(3):625-636.
doi: 10.26574/maedica.2025.20.3.625.
- XX. Rahmani R, Stegelmann SD, Andreshak T. S2 alar-iliac screws are superior to traditional iliac screws for spinopelvic fixation in adult spinal deformity: a systematic review and meta-analysis. *Spine Deform*. 2024 May;12(3):829-42.
doi: 10.1007/s43390-024-00834-x.
- XXI. Adeolu A, Komolafe E, Fadare JO, Adeyinka AO, Ojo OA, Ishola OA, et al. Long-term clinical outcomes of posterior spinal stabilization using Adeolu's technique: a prospective study from Nigeria. *J Neurosci Rural Pract*. 2024;15(1):112-120. doi:10.1055/s-0044-1787190
- XXII. Owagbemi OF, Ayantayo TO, Sulaiman OAR. Reporting the first minimally invasive spine surgery series in Nigeria: a descriptive single-center retrospective cohort study. *PLOS Glob Public Health*. 2025;5(9):e0004463.
doi:10.1371/journal.pgph.0004463.