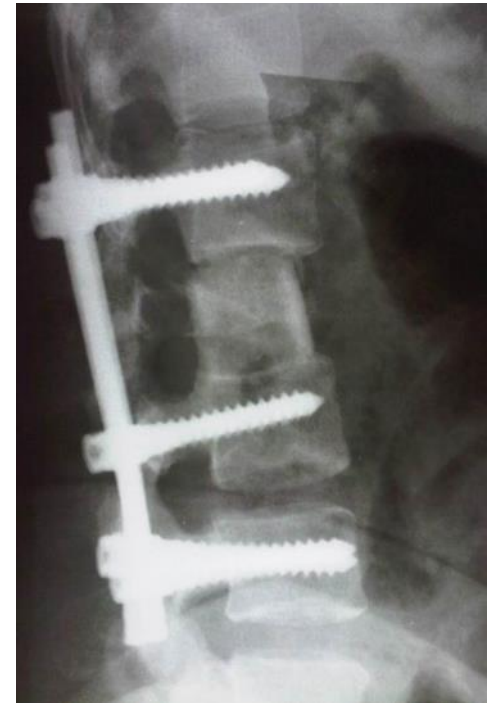


Spinal TB & Cortical bone allograft use

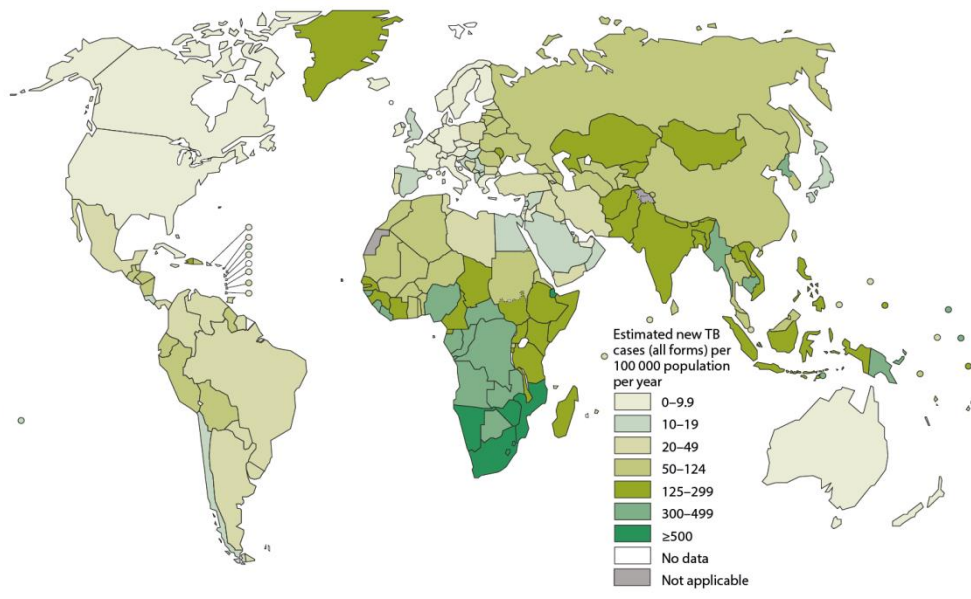


UN Fred. Ukunda
MM. Lukhele





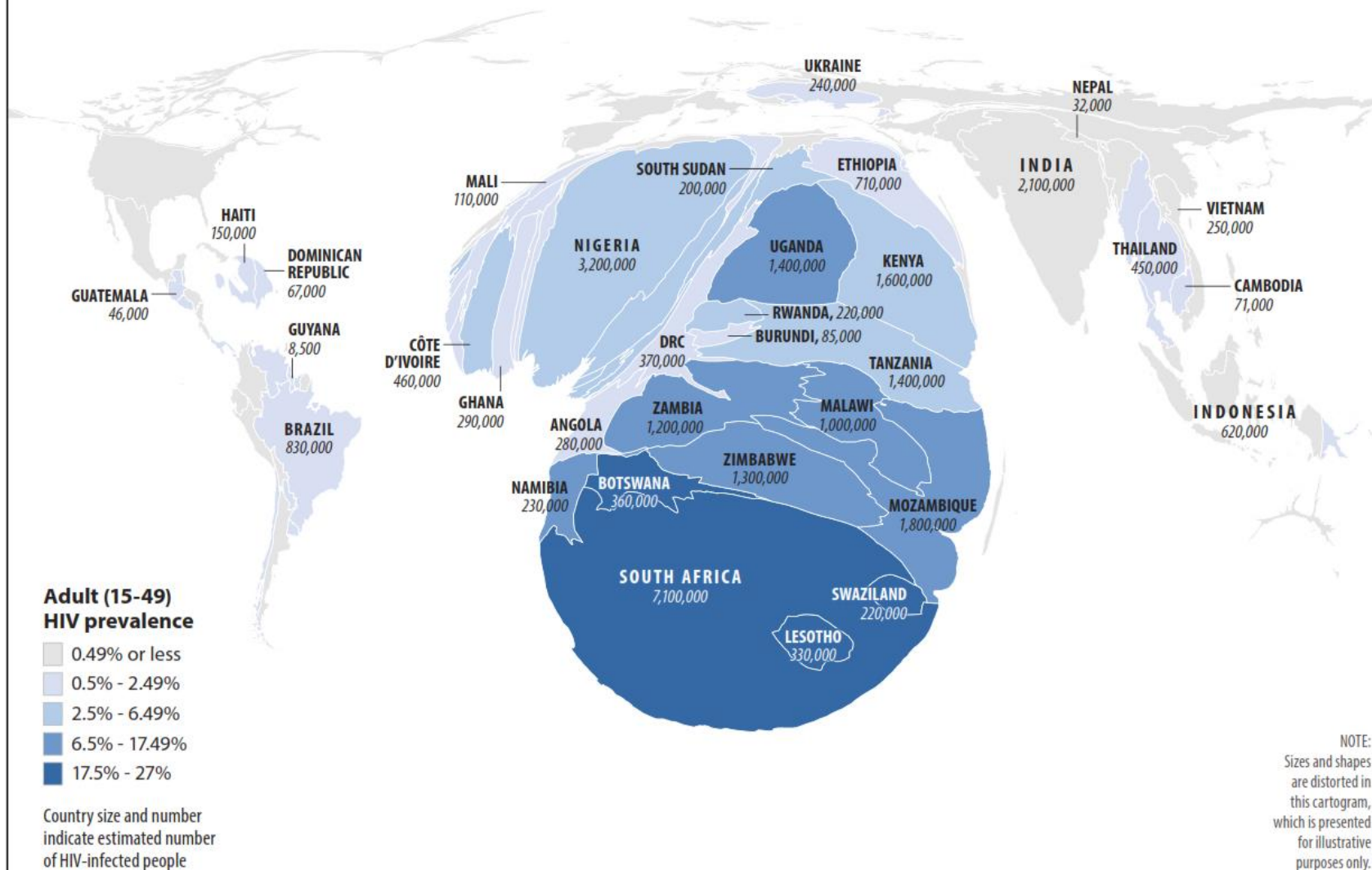
WHO Global Tuberculosis report 2014



- Tuberculosis (TB) endemic
- 70% of adults with TB are HIV (+)
- In HIV (+) patients TB is skeletal in 60% (3-5%)



Adult HIV Prevalence and Estimated Number of Adults and Children Infected with HIV, 2016



NOTE:
Sizes and shapes are distorted in this cartogram, which is presented for illustrative purposes only.



M. tuberculosis

- “Acid-fast bacillus”, strict aerobe and strongly dependent on oxygen tension
- Lungs most commonly infected
- Musculoskeletal system
 - Extrapulmonary manifestations commonly **Spine** – 2 adjacents vertebrae
 - Bone destruction (spinal defect).
 - Deformity (kyphosis).
 - Paraplegia

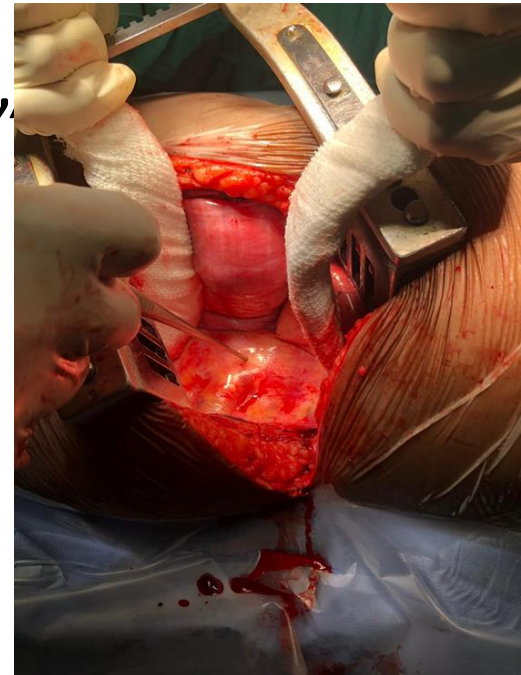
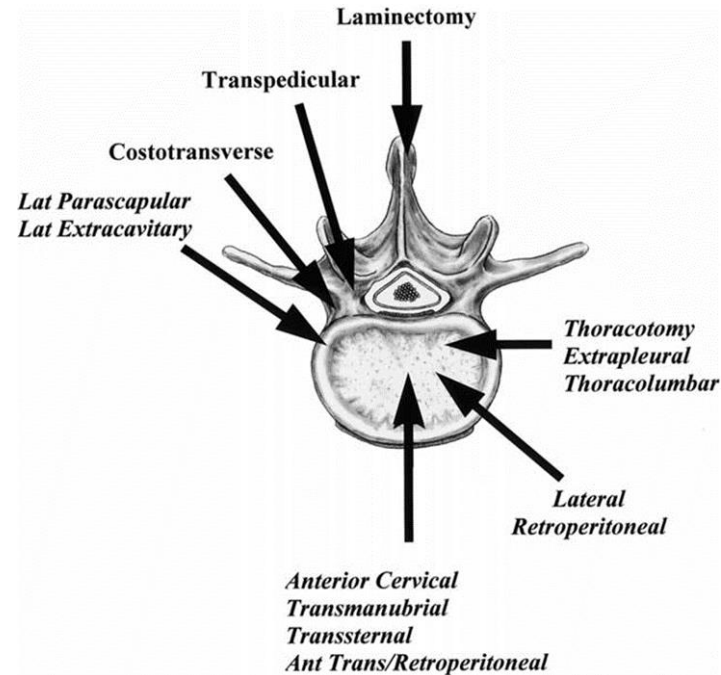


- 1950's Treatment was primarily supportive - dismal neurological, functional and cosmetic outcomes
- The contemporary development of Streptomycin (effective ATB drug), Imaging modalities, Anesthesia, Operative techniques and spinal instrumentation
- Improvements in the diagnosis, management and outcome of spinal TB



Treatment

- Medical therapy – mainstay
MRC reports
 - 9-12 months
 - DOTs
- **Hodgson** (1956) popularized Gold standard Anterior surgery – “Hong Kong” Procedure
 - Challenges
 - Approach (adhesions, diaphragm, ureter)
 - **Loss of correction**
 - Graft type (rib, iliac crest)
 - Instrumentation



Alternative - Titanium mesh



Alternative - Allograft

- Albee F. reported independently on Transplantation of a portion of the tibia into spine. So is Hibbs R. Pott's disease in early 1900s
- Cloward RD 1952 reported on use of bank bone in lumbar spine surgery
- Recent advances in bone procurement, sterilization, preparation and storage – Renew interest



Obvious criticism of structural allografts

- Human tissue
- Structural fresh frozen allografts preservation of structural integrity – potential risk
 - Disease and infection transmission (Virus risk is negligible 1 in 1 million)
 - Graft versus host reaction



Benefits

- Structural bone allograft has the advantage of potential for biologic fusion at graft–host interface
- Purported benefits
 - Immediate restoration of anterior column support
 - Donor site morbidity elimination
 - Decrease surgical time and blood loss
 - Solid biologic fusion



*Summary of published studies on thoracolumbar tuberculous spondylitis
involving treatment only using anterior surgery**

Authors & Year	No. of Cases (affected vertebrae)	FU (mos)	Type of Graft (no.)	Region (no. of cases)	Preop	Postop	Loss of Correction (°)	Final Correction
Korkusuz et al., 1997	119 (1 level) 55 (2 levels) 11 (. 2 levels)	90	iliac & costal autograft	total (185) cervical (11) thoracic (84) thoracolumbar (50) lumbar (40)	16.2	7.1	12.2 (min in 5 cases treated w/ addition- al internal fixation)	
Govender & Parbhoo, 1999	22 (1 or 2 levels) 19 (. 2 levels)	77	fresh frozen femoral allograft		54	22	unknown	42%
Yilmaz et al., 1999	8 (1 level) 14 (2 levels) 10 (3 levels) 4 (2 levels)	29	iliac & costal autograft (28) fibular allograft (10)	total (38) thoracic (10) thoracolumbar (22) lumbar (6)	59 (involvement of 1 or 2 levels) 52 (involvement of 3 or 4 levels)	range 10–28 range 0–30	max loss of 3° in 16 patients	64% (involvement of 1 or 2 levels) 81% (involvement of 3 or 4 levels) correction was main- tained in 21 patients
Benli et al., 2003	23 (1 level) 39 (2 levels) 1 (3 levels)	51	iliac & costal autograft	total (63) thoracic (25) thoracolumbar (21) lumbar (17)	23.4 22.6 24.0 23.5	5.4	1.1 1.2 0.9 1.4	74.2% 69.8% 81.2% 72.4%
Ozdemir et al., 2003†	9 (2 levels) 19 (3 levels)	40	fibular allograft: single-graft in 19 patients; double-graft	total (28) thoracic (9) lumbar (3)	32	6	3	60.3%
Dai et al., 2005	6 (1 level) 2 (skipped lesion) 31 (2 levels)	40	iliac & costal autograft	total (39) cervical (3) thoracic (8) thoracolumbar (16) lumbar (12)	13.5 12.6 16.4 16.2 8.5	21.9 20.6 2.8 0.8	no significant loss of deformity correction	
present study	22 (2 levels)	84	tibial allograft	total (22) thoracic (13) thoracolumbar (5) lumbar (4)	19 21 29 8	3 4 5 21	2 3 2 0	74%

* FU = follow-up.

† One patient in this study experienced implant failure.



Exceptionally high rate of fusion

- Primarily axial loading in line with compressive trabeculae of allograft
- Intimate contact at host-allograft interface (cortices and medullary canal)
- Micromotion at host- allograft junction.
- Allograft construct packed with autograft (local osteoinductive growth factors).
- Rigidity of adjunct fixation



Infection!!

- **No infection involving allograft even in infected host** (vertebral osteomyelitis).
- **Govender and Parbhoo**
 - reported no graft rejections and sepsis in a large series of 47 children with spinal TB treated with fresh-frozen allografts
 - 100% arthrodesis with evidence of cross-trabeculation at 6 months and remodeling at 30 months
- Dietze et al reported similar findings with the use of allografts in patients with spinal instability caused by infection



Govender et al

- The early incorporation of allografts in children:
 - Increased osteogenic potential
 - Increased surface contact area between the allograft and adjacent host vertebral body
 - Graft placement under compression improved stability and early axial loading





■ SPINE

The posterior-only surgical approach in the treatment of tuberculosis of the spine

OUTCOMES USING CORTICAL BONE ALLOGRAFTS

***Bone Joint J* 2018;100-B:1208–13**

U. N. F. Ukunda, M. M. Lukhele



Background

- TB spine results in
 - Destruction of anterior vertebral column
 - Deformity
 - Neurological fall out
- Medical therapy
MRC reports



- *Hodgson(1956)* popularized Gold standard Anterior surgery
- Challenges
 - Approach
 - Adhesions
 - Diaphragm
 - Ureter
 - Loss of correction
 - Type of graft (Rib)
 - Instrumentation



Background (2)

Suk et al.(2002 & 2005)

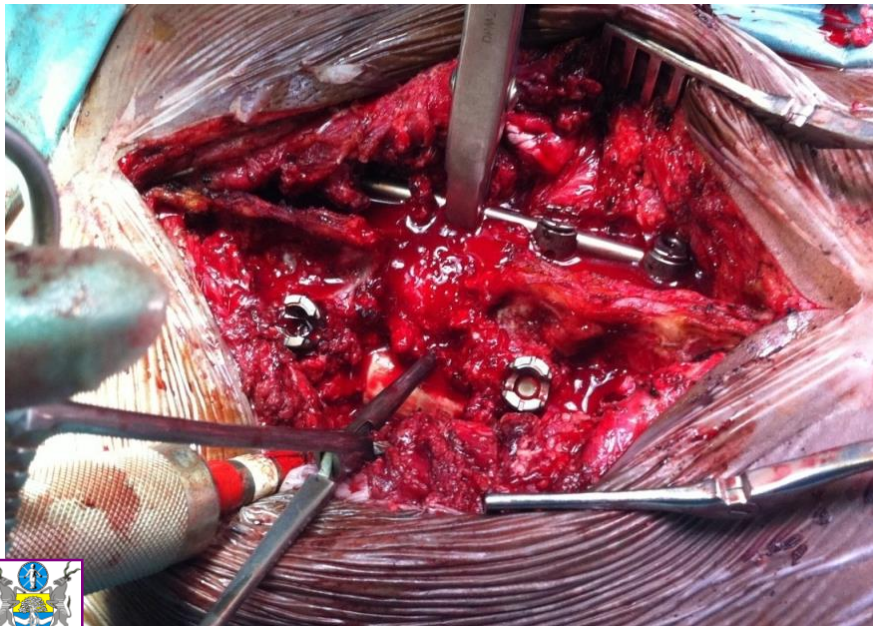
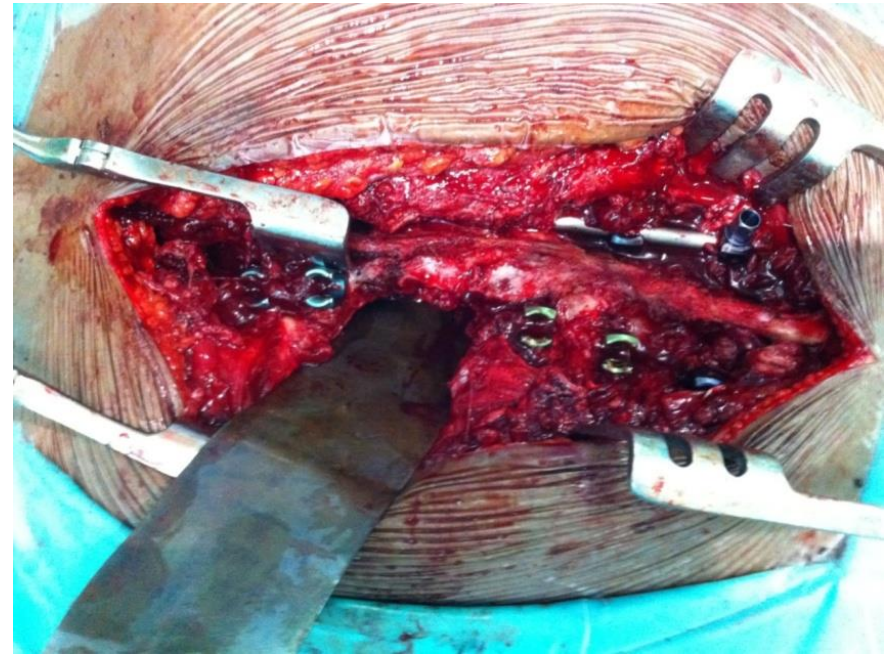
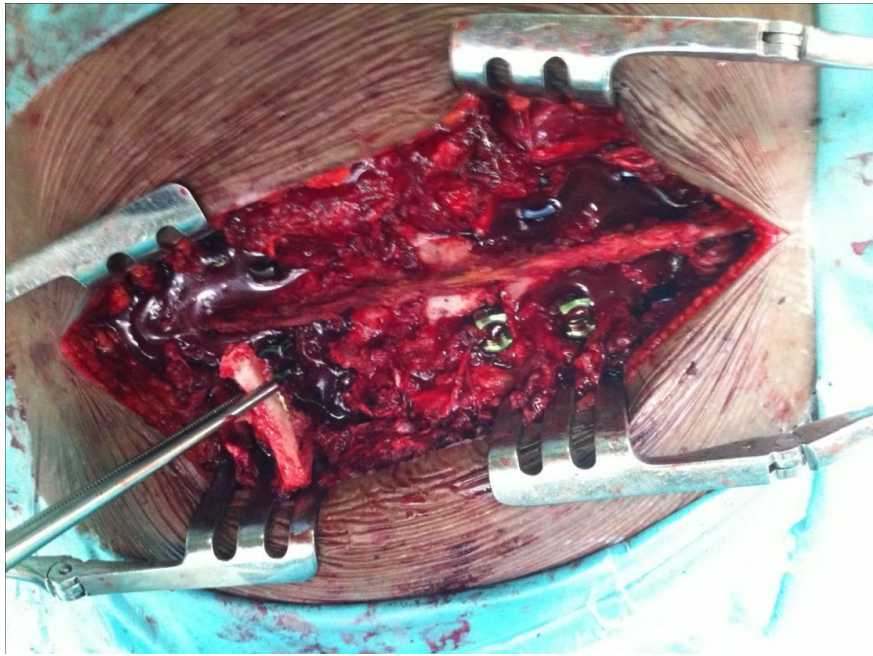
- One stage Posterior surgery
- Reduced operative time and complications
- Significant Sagittal correction

- In SA, the use of Allograft (Anterior approach) - effective

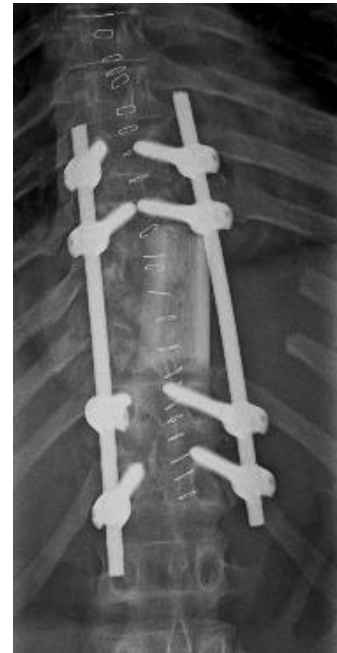
Govender and Riemer

- ☐ No results of posterior only approach using allograft in the literature
- ☐ Unit experience with approach
- ☐ Ethical and administrative approval obtained





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Aim

- The aim was to report the outcome of single-stage posterior surgery using bone allografts
- The secondary aim was to look at graft incorporation, neurological recovery and Oswestry Disability Index (ODI)



Patients and Methods

- 24 patients with Thoracolumbar spine TB underwent between 2008 and 2015.
 - Single-stage posterior spinal surgery
 - Anterior column reconstruction using cortical bone allograft, and
 - Posterior instrumentation
- ☐ A unilateral approach for 21 with active TB, and
- ☐ A bilateral approach with decompression and closing-opening wedge osteotomy for 3 patients with healed TB



Characteristics of the patients

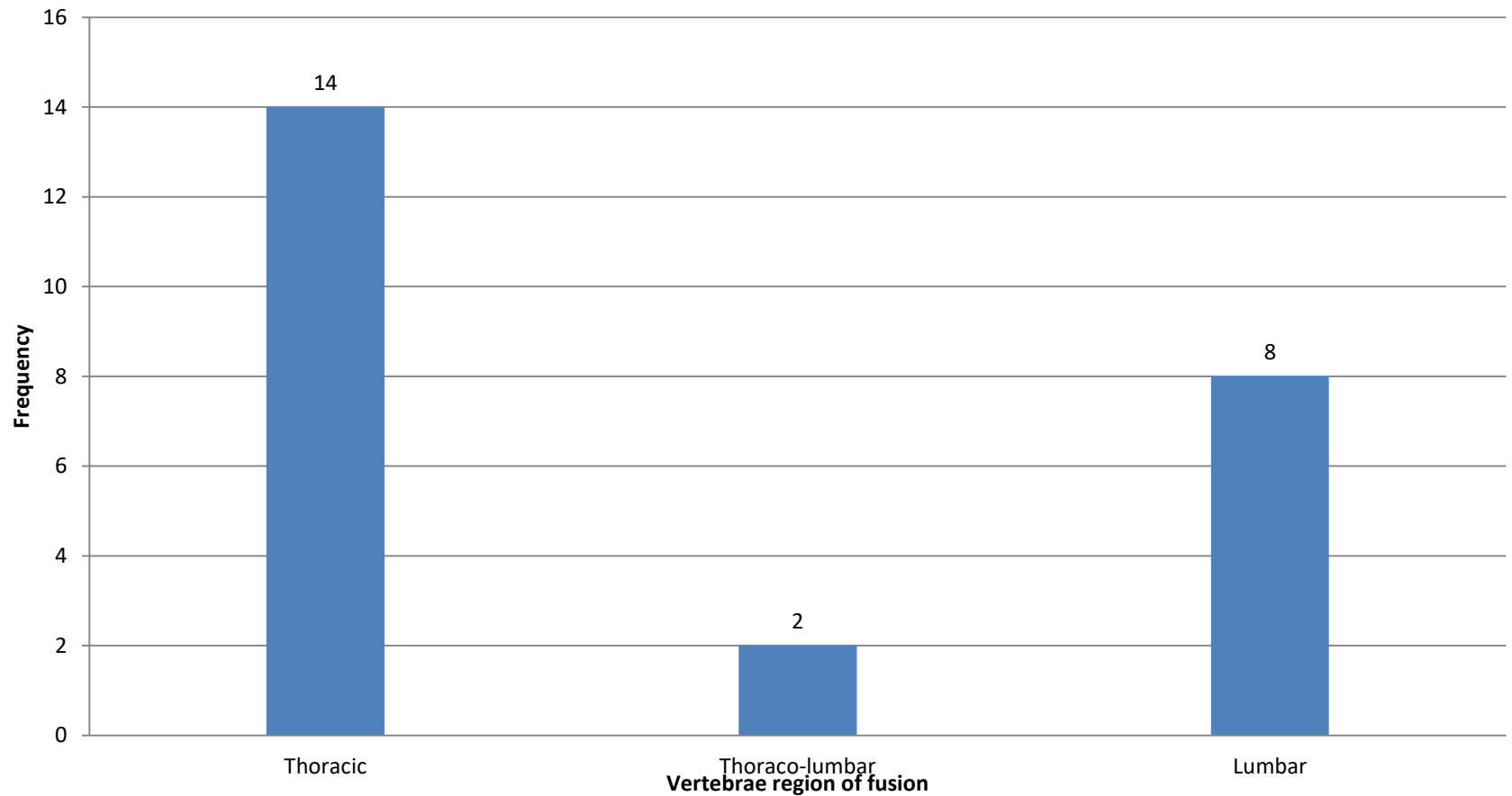
Table I. Characteristics of the patients

Variable	HIV-negative (n = 8)	HIV-positive (n = 16)	Total (n = 24)
Median age, yrs (IQR)	35.1 (21 to 49.5)	32 (29 to 37.5)	32 (27.5 to 41.5)
Gender, n (%)			
Male	2 (25)	5 (31.3)	7 (29.2)
Female	6 (75)	11 (68.8)	17 (70.8)
Spine region affected, n (%)			
Thoracic	4 (50)	10 (62.5)	14 (58.3)
Thoracolumbar	1 (12.5)	1 (6.3)	2 (8.3)
Lumbar	3 (37.5)	5 (31.3)	8 (33.3)
Median preoperative kyphosis (IQR)	34 (0 to 15)	30 (24 to 55)	30 (24.5 to 55)

IQR, interquartile range



Affected spine region



Surgical procedures

Surgery

Median surgery duration, minutes (IQR)	280 (230 to 315)
Median level of instrumentation (IQR)	5 (3 to 6)
Graft position, n (%)	
Eccentric	6 (26.1)
Central	17 (73.9)
Blood loss	
Median blood loss, ml (IQR)	700 (350 to 900)
Median high care or intensive care unit stay, days (IQR)	1 (1 to 2)
Median hospital stay (operation to discharge), days (IQR)	11.5 (9 to 21)
Median vertebrae removed (IQR)	1.25 (1 to 1.75)

IQR, interquartile range



Neurological outcome: Pre-op and Post-op

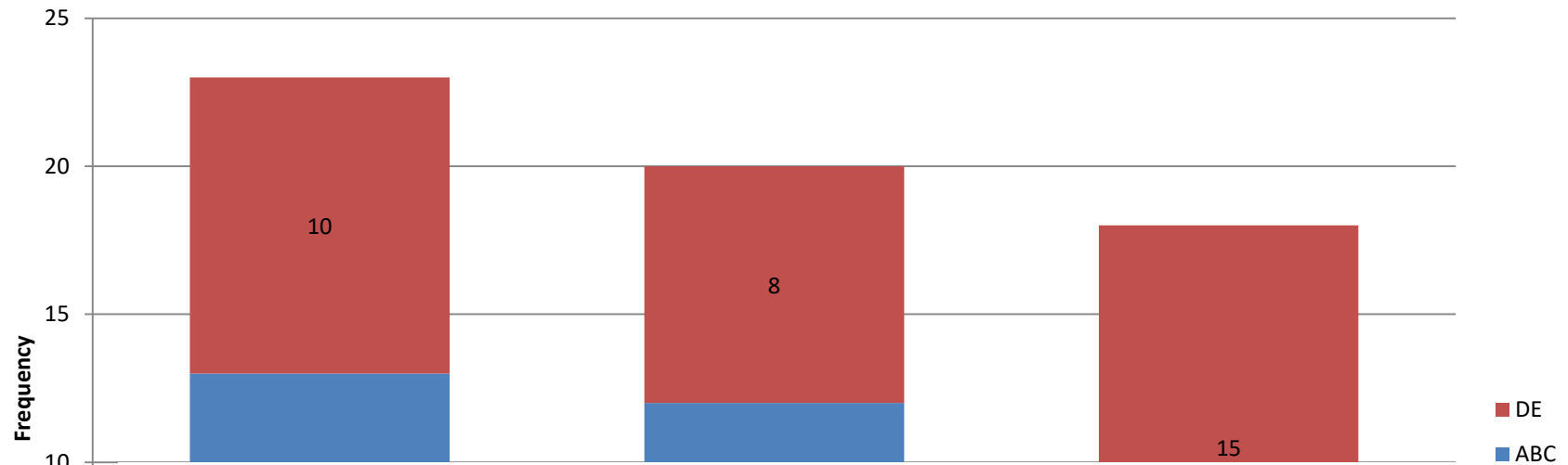


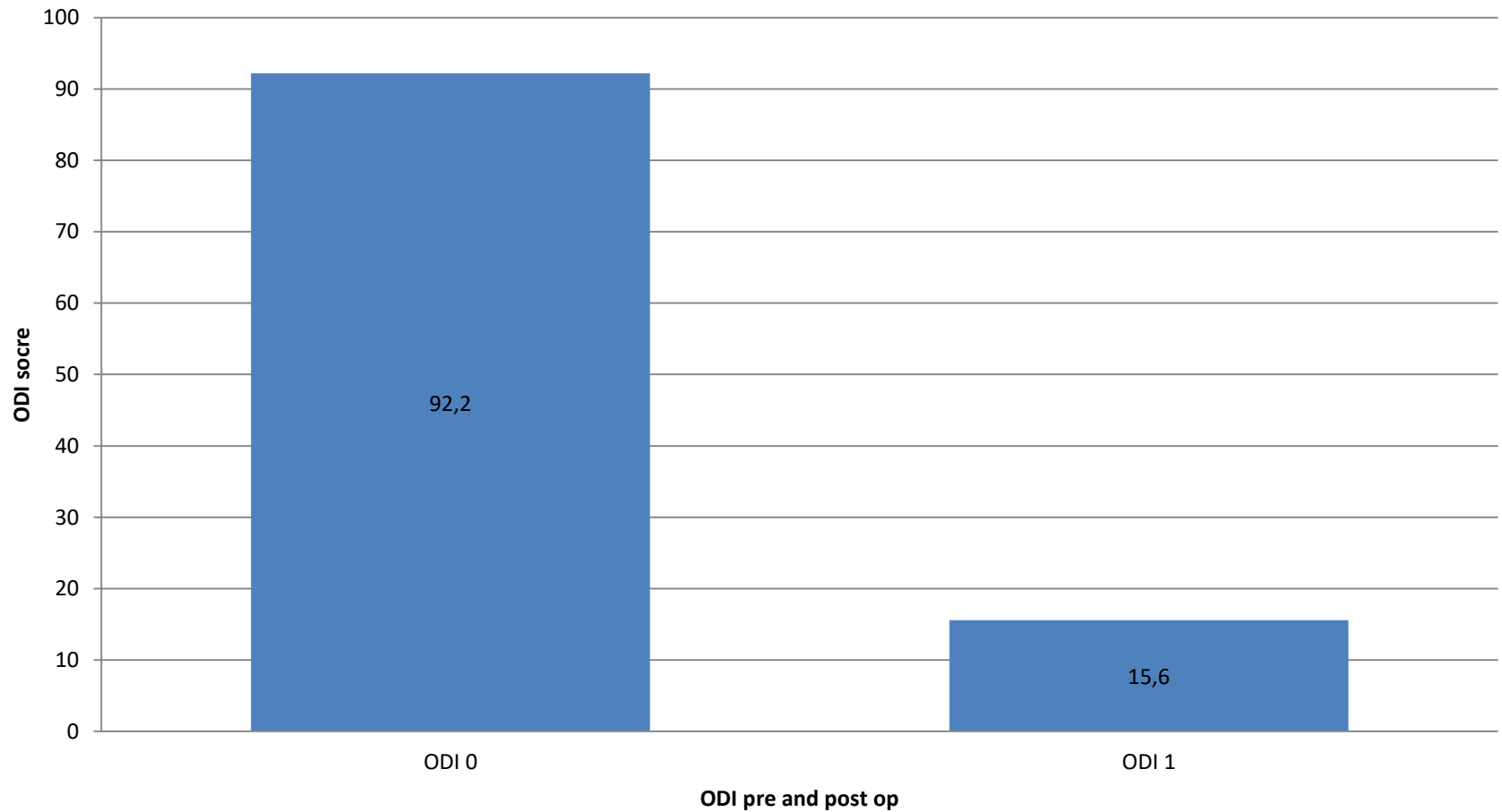
Table III. American Spinal Injury Association (ASIA) scores preoperatively and at the final review

Preoperative ASIA score	Last follow-up ASIA score, n [*]				
	A	B	C	D	E
A			2	1	
B					2
C					6
D					4
E					3

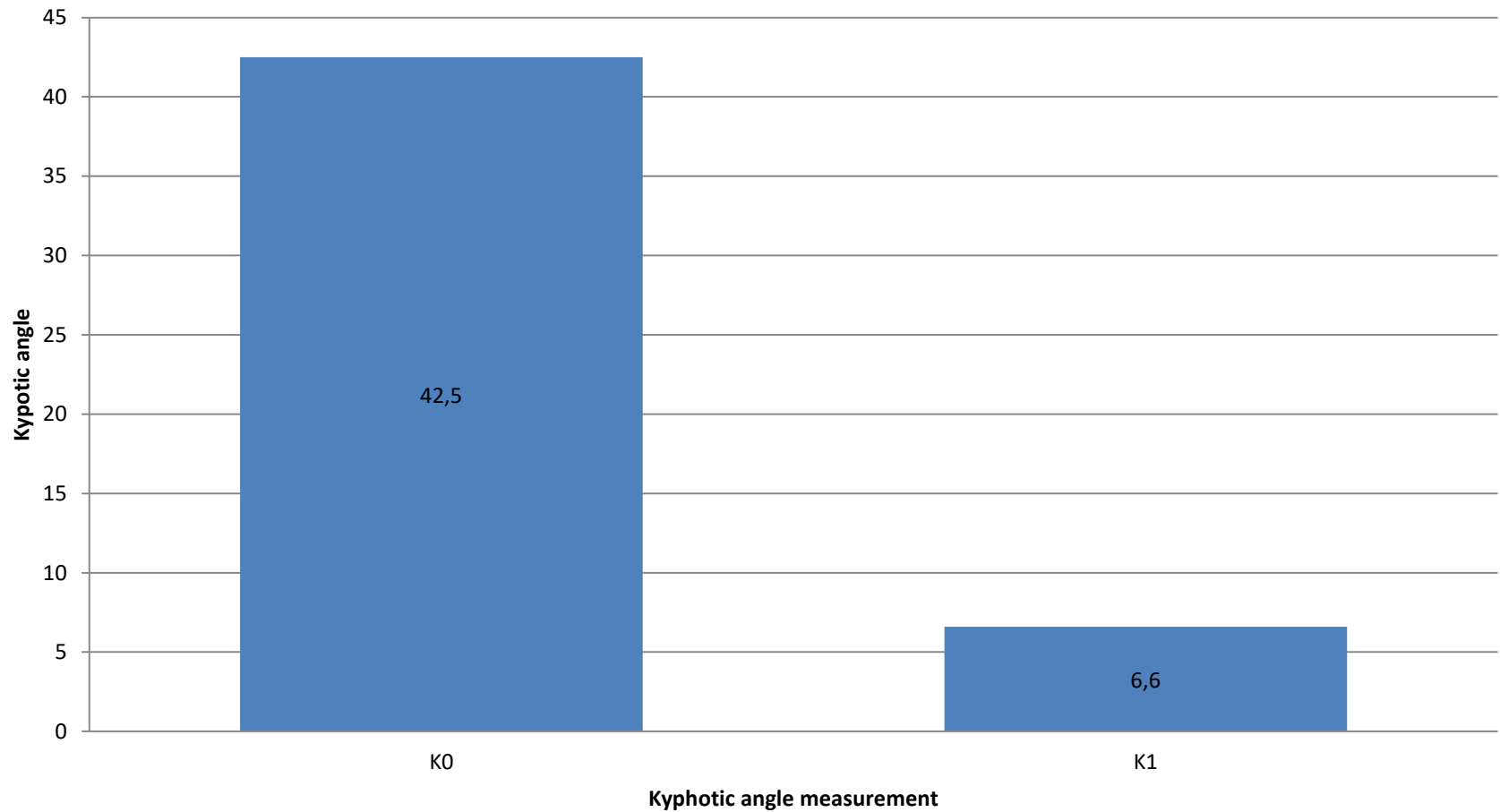
^{*}Four patients were not available for the final ASIA scoring



ODI Pre and Post-op outcome



Kyphosis – Pre and Post-op



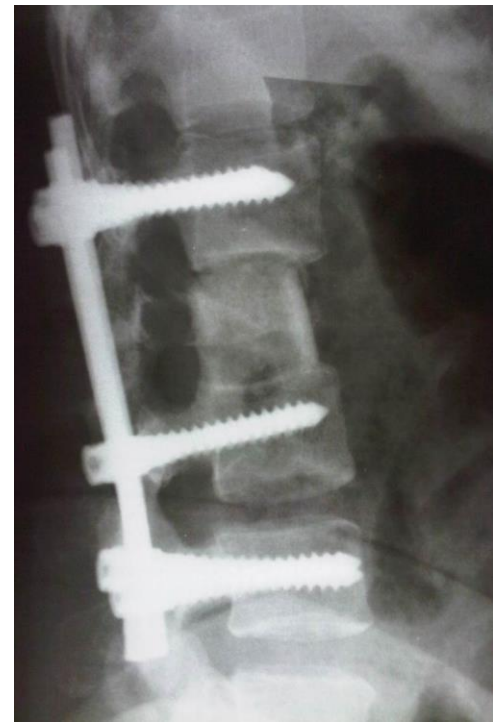
Fusion (12)

- X-rays:
 - Grade 1 fusion (12)
 - Grade 4 Loss Kyphosis correction and displaced graft (1) – Revision

Bridwell et al

- CT scan:
 - Grade 1 fusion (complete) - (8)
 - Grade 2 fusion (partial) - (2)
 - Grade 4 Loss of fusion (1)

Tan GH et al

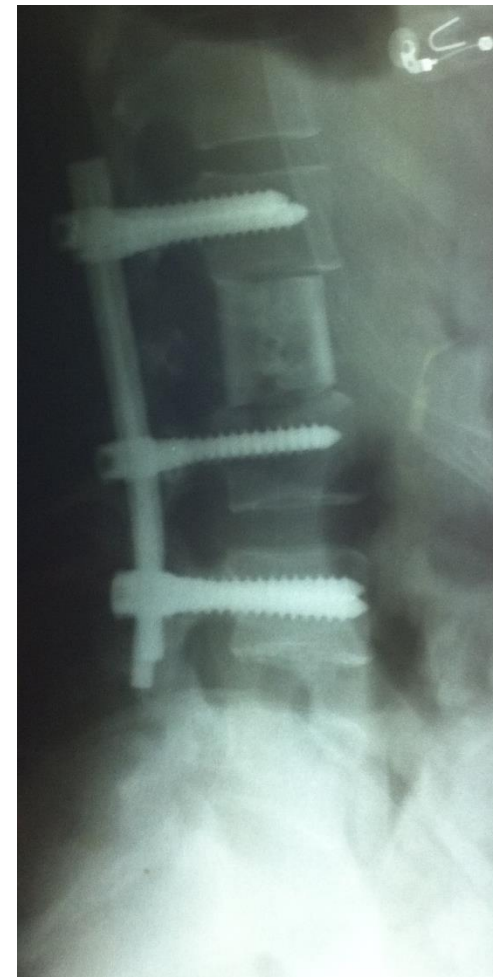
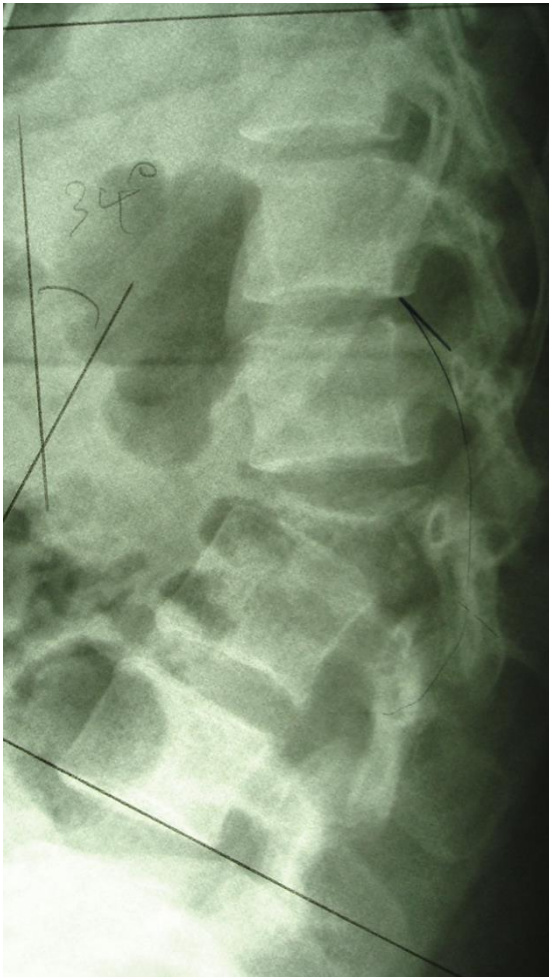


Complications

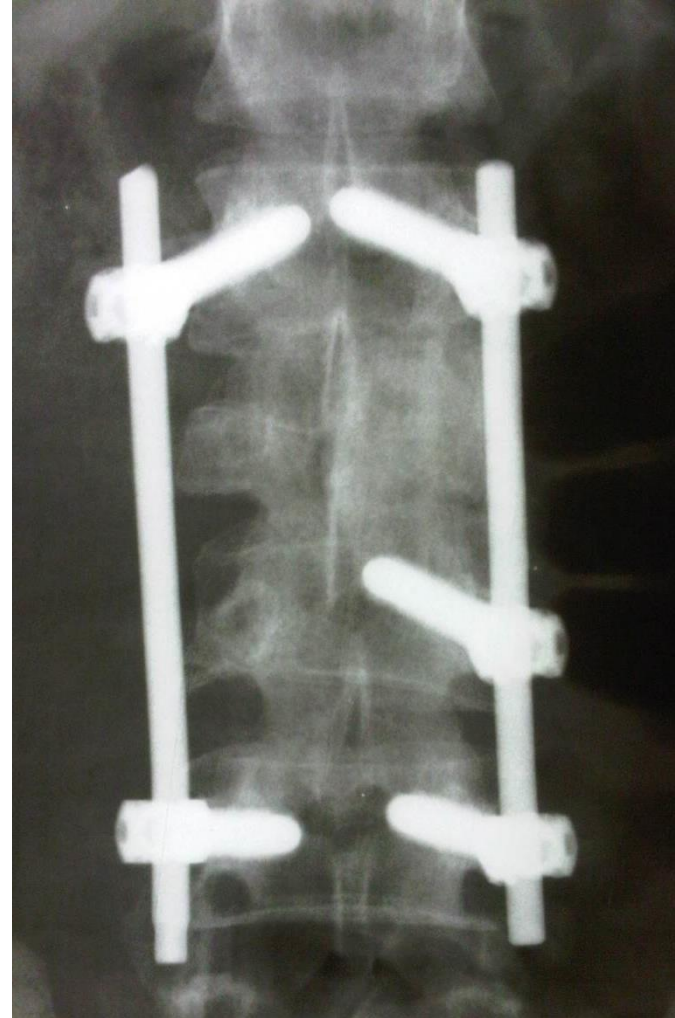
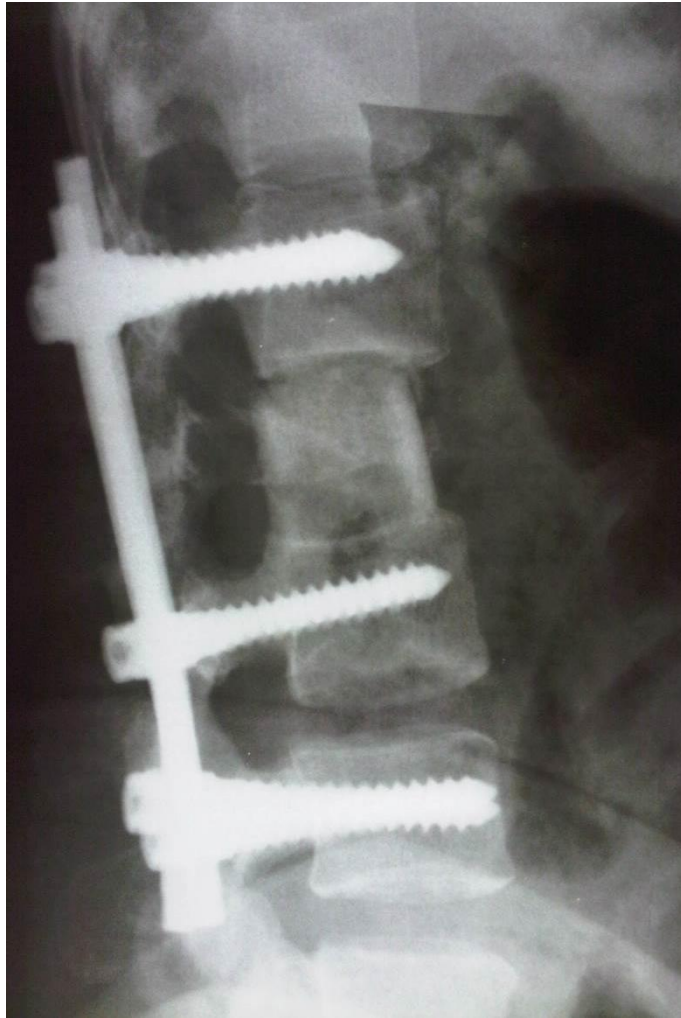
Complications	HIV -	HIV +	Total
Frankel B immediately post op	1	2	3
Chest infection	1	1	1
Death	-	2	2
Loss of correction – no fusion	-	1	1
Bleeding	-	1	1



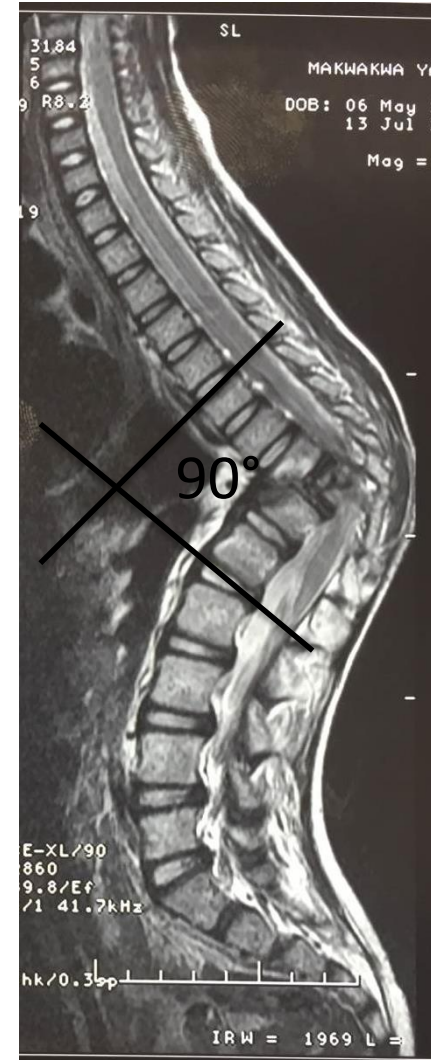
22 yrs. Female HIV (-) Back pain & deformity and ASIA D



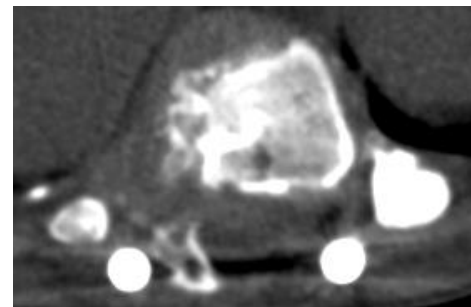
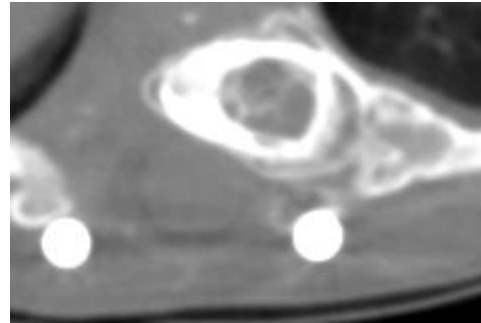
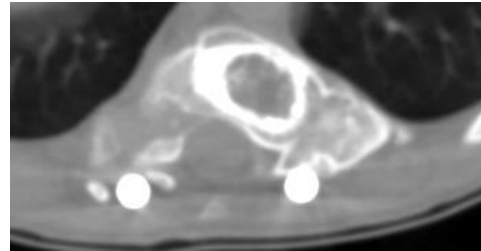
2 yrs Follow up: No back pain ASIA E



10 yrs. Male HIV (+) CD4: 682 and ASIA E



14 yrs



Conclusion

- The posterior-only approach using cortical allografts for anterior column reconstruction achieved good clinical and radiological outcomes.
- Differentiation should be made between flexible (active) and rigid (healed) TB spine.

