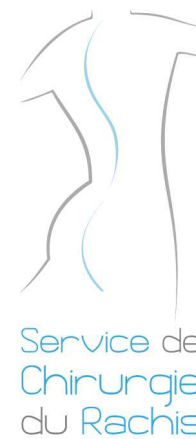


Prise en charge des fractures thoraco-lombaires en chirurgie minimale invasive

Yann Philippe Charles

Service de Chirurgie du Rachis
Hôpitaux Universitaires de Strasbourg

yann.philippe.charles@chru-strasbourg.fr



Objectifs principaux de la prise en charge

Analyse des critères de stabilité de la fracture

→ **Risque neurologique**

Réduction de l'équilibre sagittal

→ **Résultat fonctionnel à long-terme**



Indications et stratégie

Les critères de stabilité

Colonne antérieure

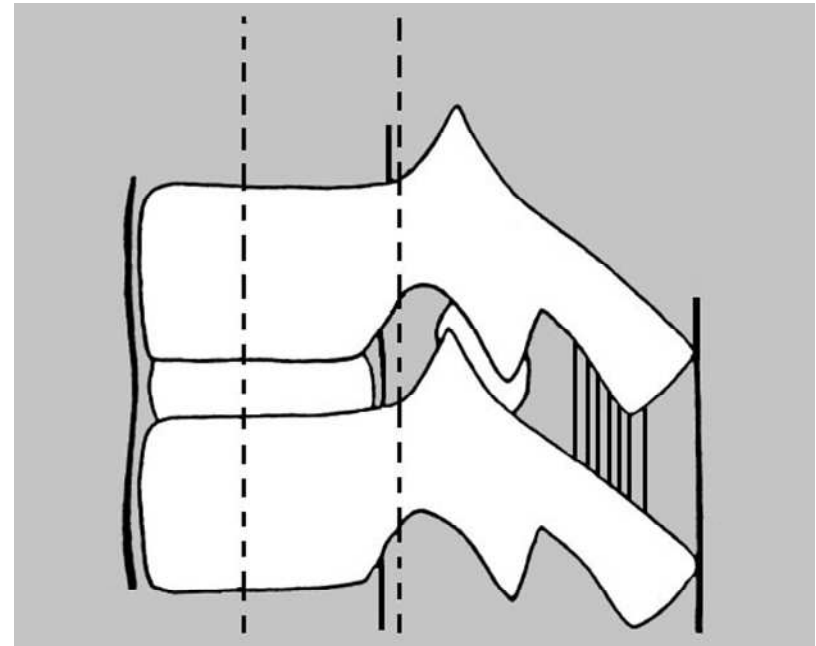
Fractures tassement stables
Entraînent une déformation en cyphose

Colonne moyenne

Touche le mur postérieur
Compression médullaire possible

Colonne postérieure

Touche les articulaires et les ligaments
Fractures très instables

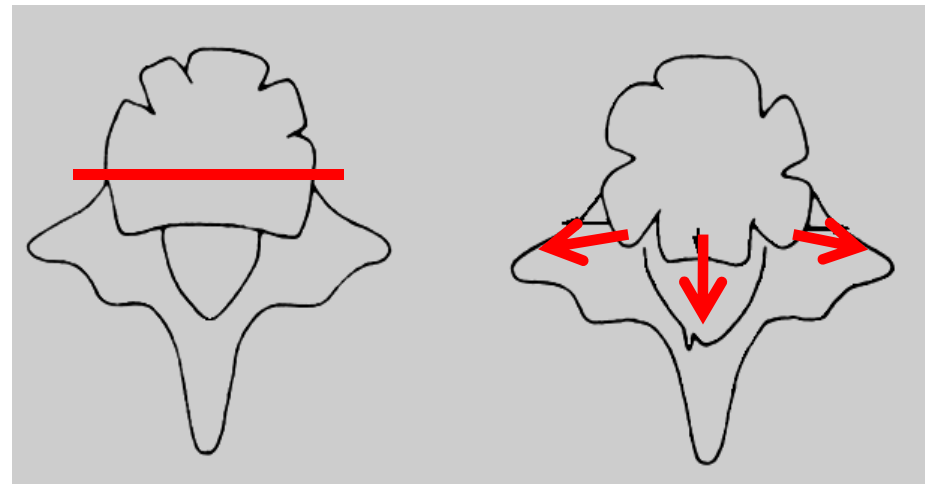


Les fractures par mécanisme de compression

Absence de risque neurologique lorsque le **mur postérieur** est intact

Déformation en cyphose par écrasement du corps vertébral

Risque de paralysie par compression médullaire en cas de **recul du mur postérieur**



Tassement

Burst fracture

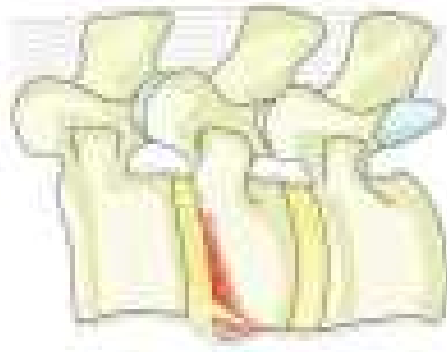
DIAGNOSTICS

AO Spine Thoracolumbar Spine Injury
Classification System*Fracture Description, Neurological Status, and Key Modifiers*

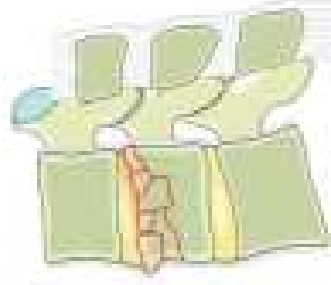
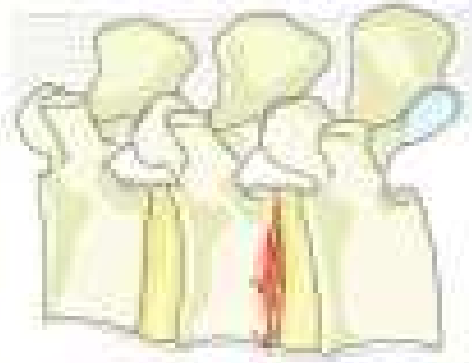
Alexander R. Vaccaro, MD, PhD,* Cumbur Oner, MD, PhD,† Christopher K. Kepler, MD, MBA,*
Marcel Dvorak, MD,‡ Klaus Schnake, MD,§ Carlo Bellabarba, MD,¶ Max Reinhold, MD,||

Bizhan Arabi, MD,** Frank Kandriota, MD, PhD,§ Jens Chapman, MD,††

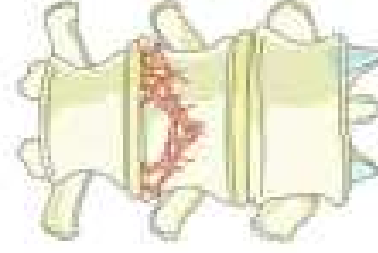
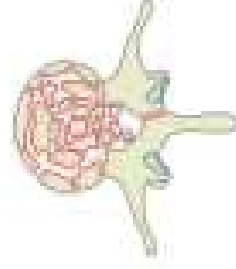
Rajasekaran Sharmuganathan, MD, PhD,‡‡ Luiz Vialle, MD, PhD,††† and for
the AOSpine Spinal Cord Injury & Trauma Knowledge Forum



A1



A3

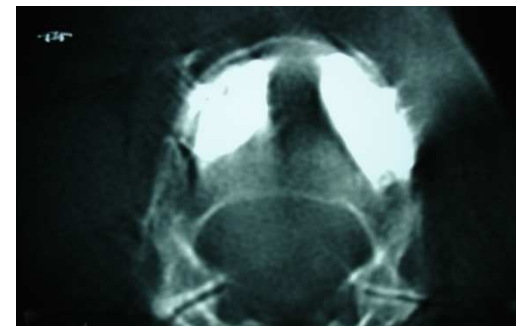
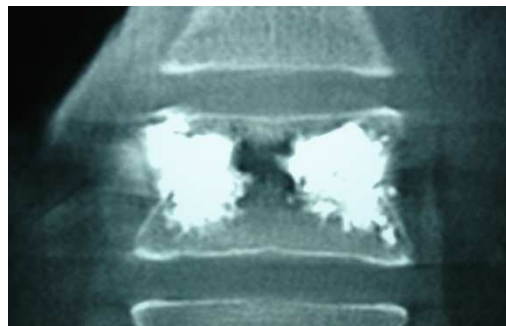
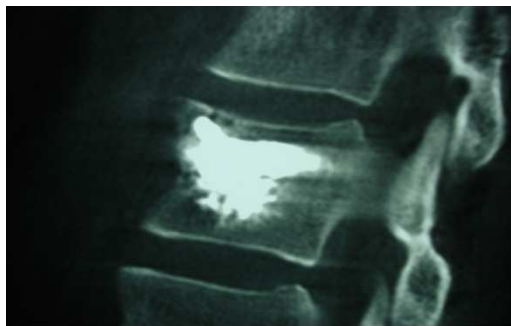
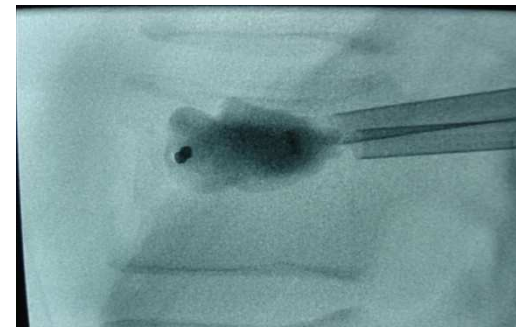
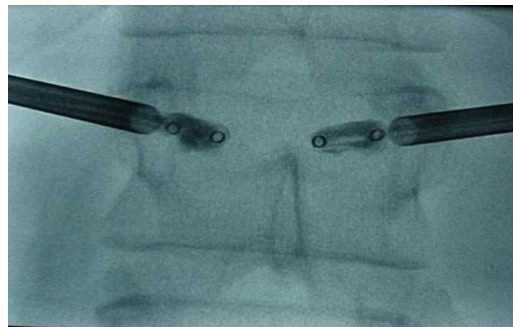
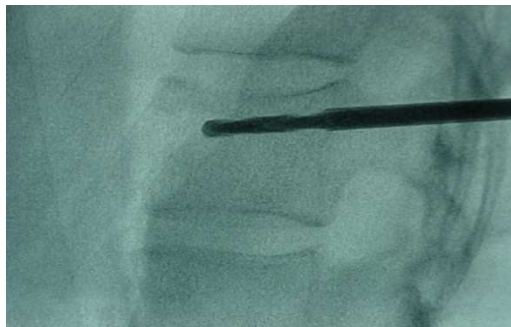


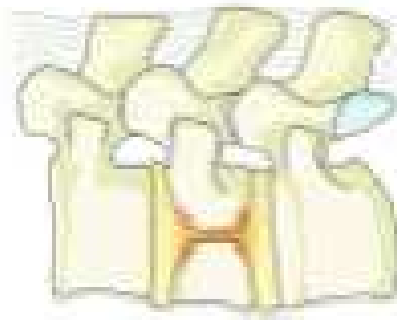
Cimentoplastie et expansion du corps vertébral

Injection de ciment : traitement peu invasif (vertébroplastie ou cyphoplastie)

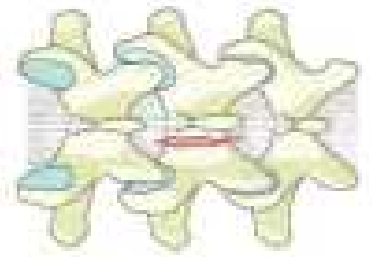
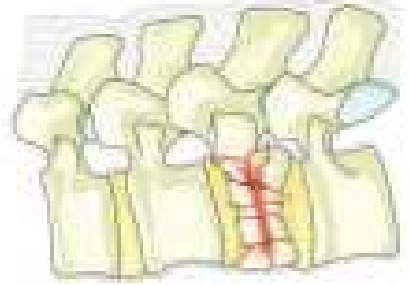
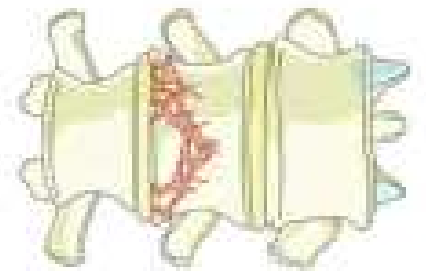
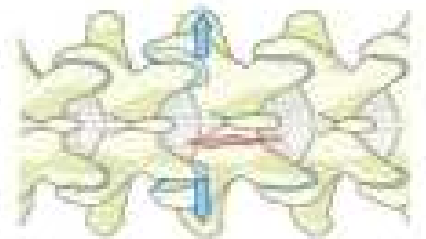
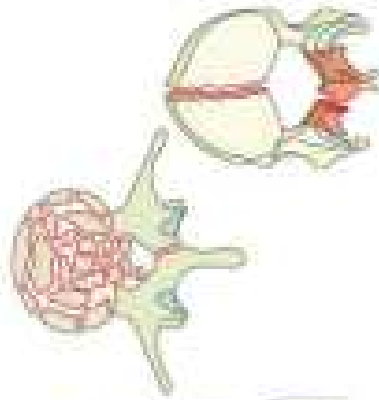
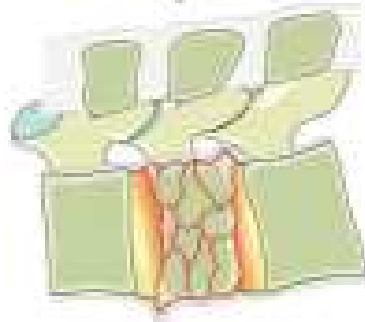
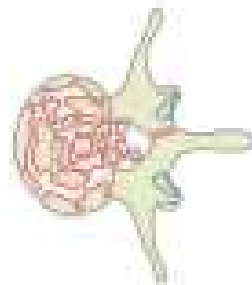
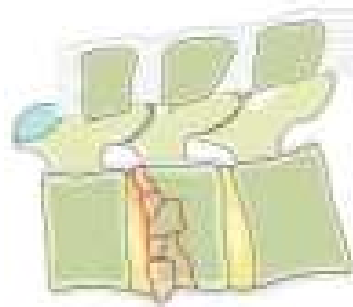
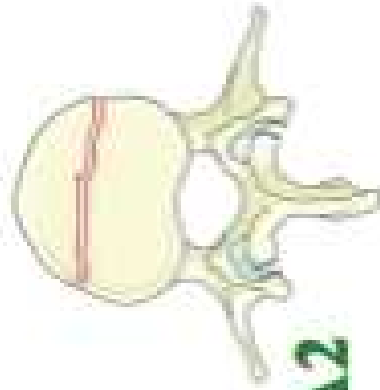
Réduction de la déformation en cyphose

Consolidation immédiate permettant de s'affranchir d'un corset





A2



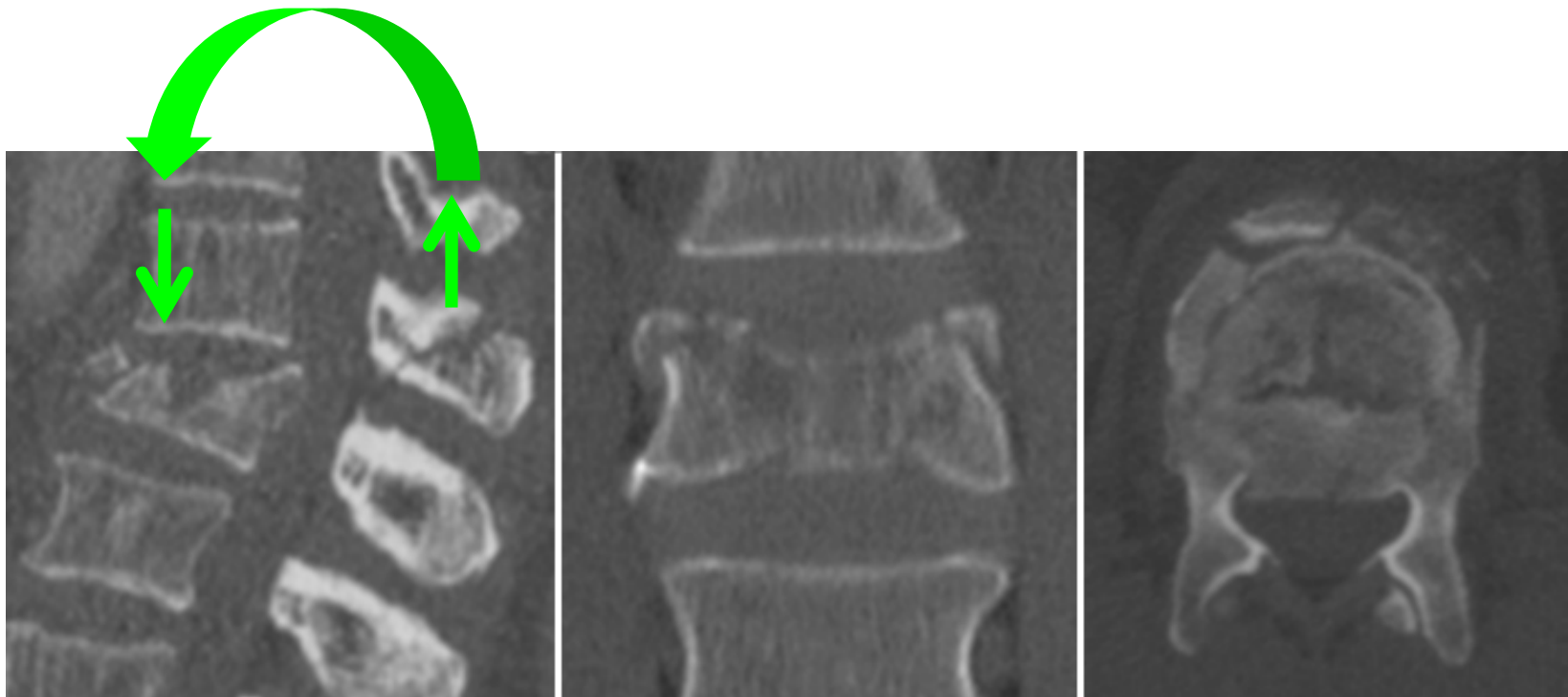
A3

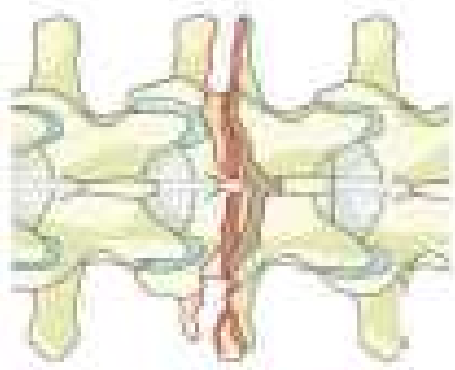
A4

Les fractures par mécanisme de flexion ou torsion

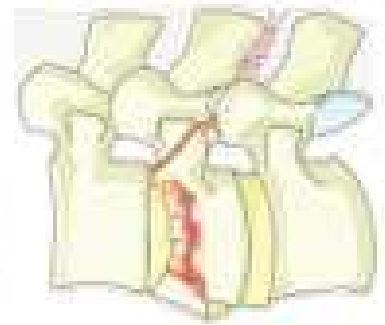
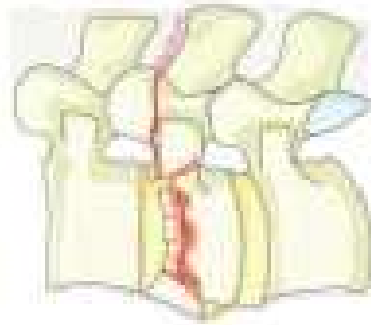
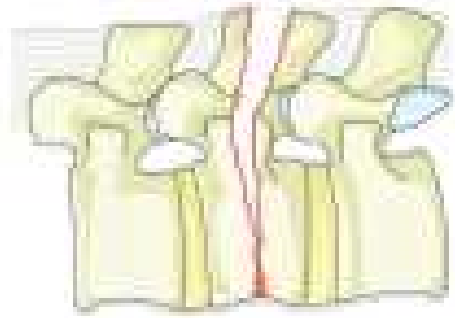
Toujours instables car les 3 colonnes sont atteintes

Il existe un risque de paralysie important

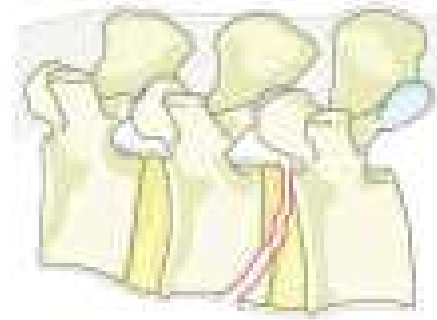
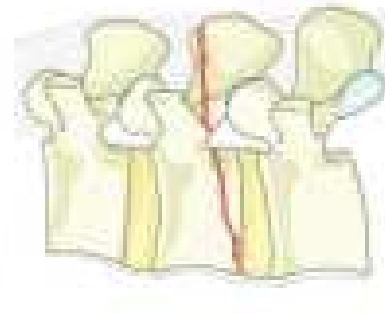
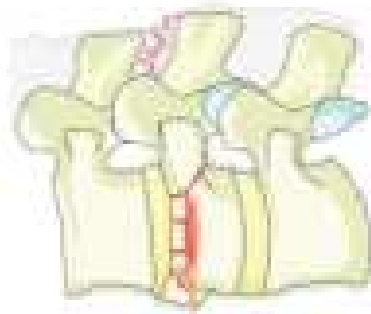




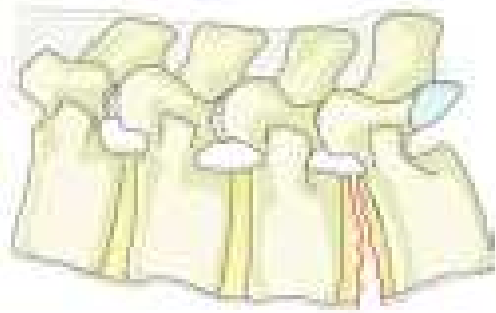
B1



B2



B3

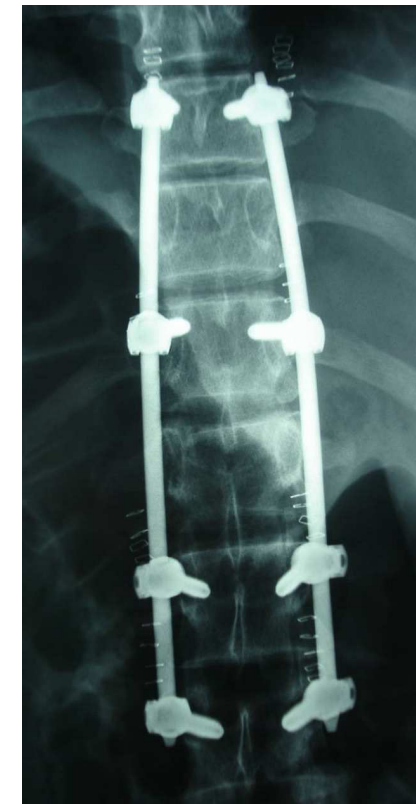
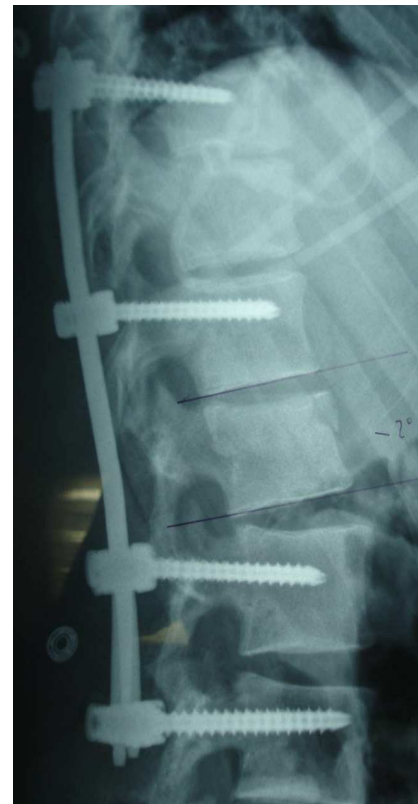
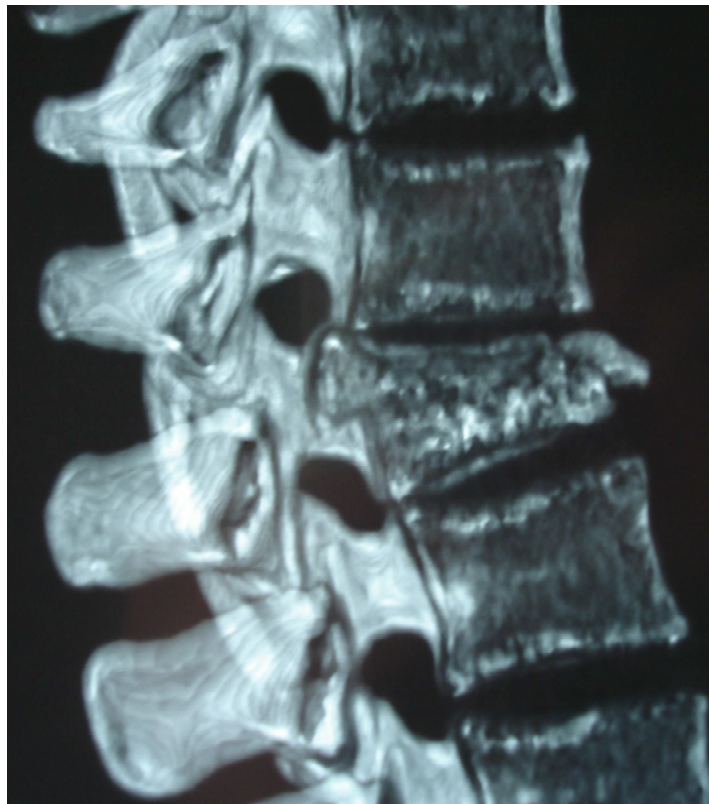


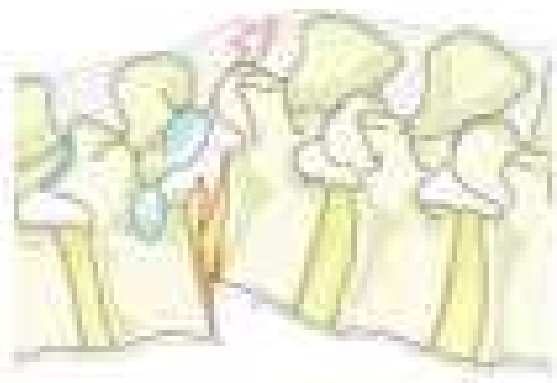
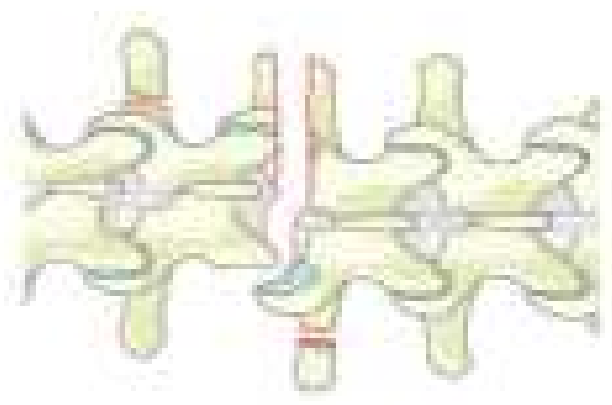
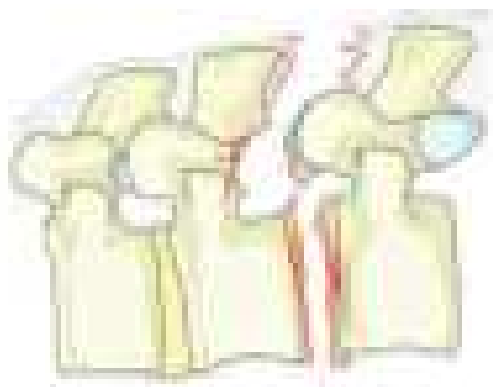
Traitement d'une fracture instable

Réduction et stabilisation par ostéosynthèse obligatoire

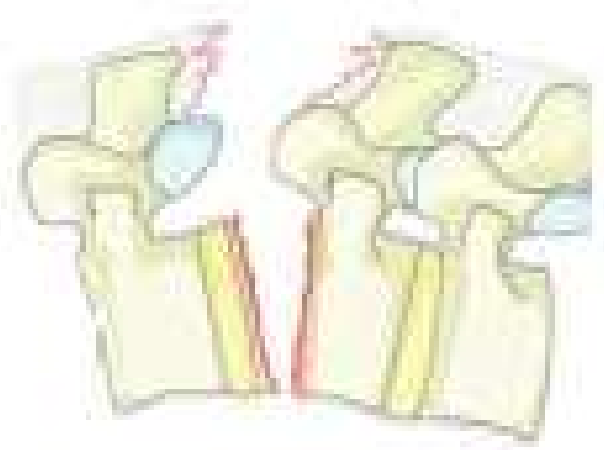
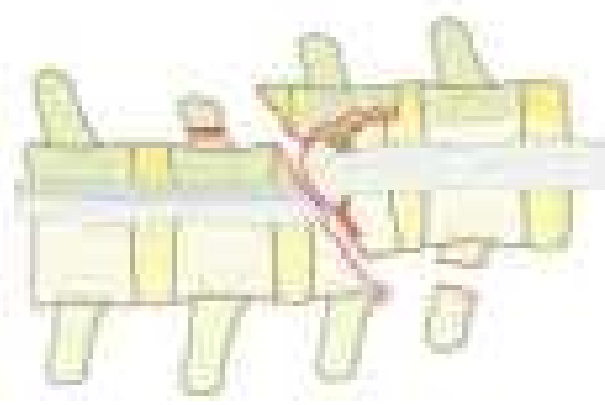
Décompression urgente (< 6 h) par laminectomie en cas de déficit neurologique

Chirurgie minimale invasive adaptée lorsque le bilan neurologique est normal





C



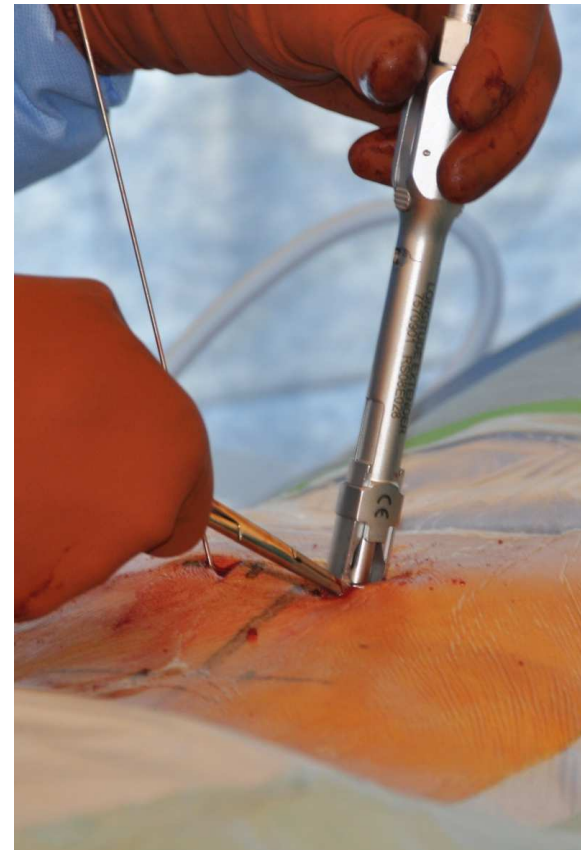
Pourquoi instrumenter en percutané ?

Préservation des muscle / réduction du saignement

Diminution de la morbidité

Récupération plus rapide

Risque d'infection faible

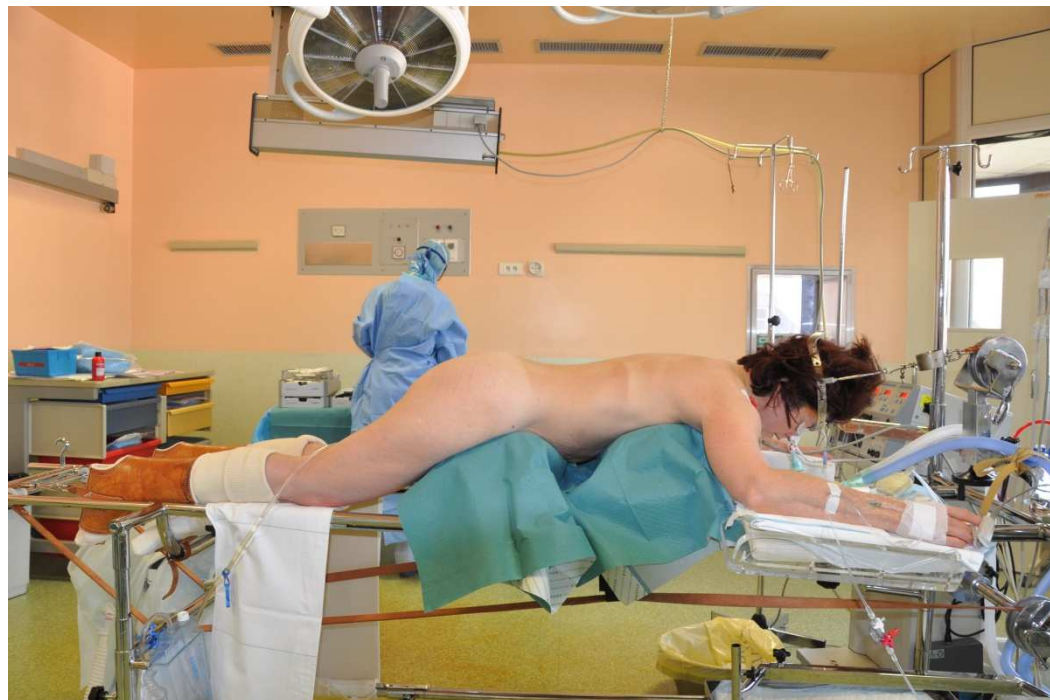


Techniques de réduction par l'instrumentation percutanée

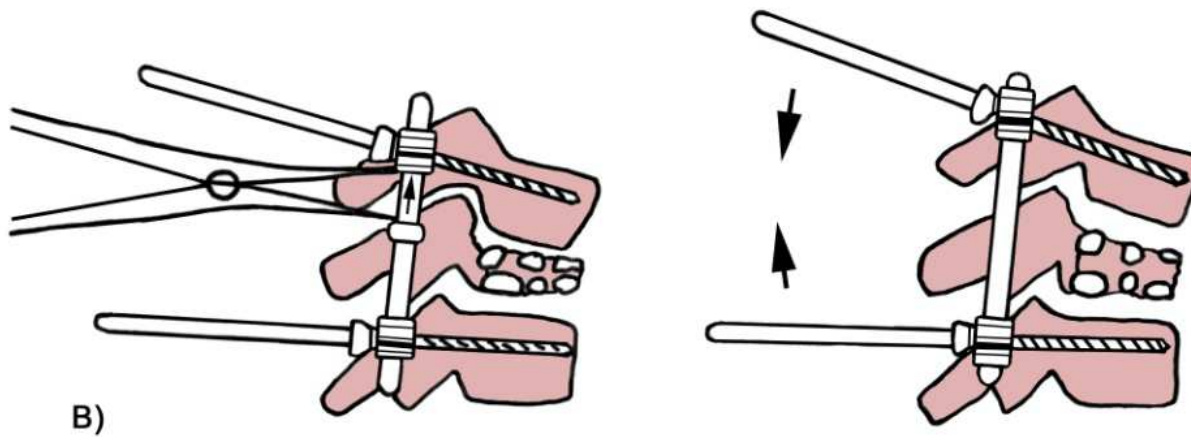
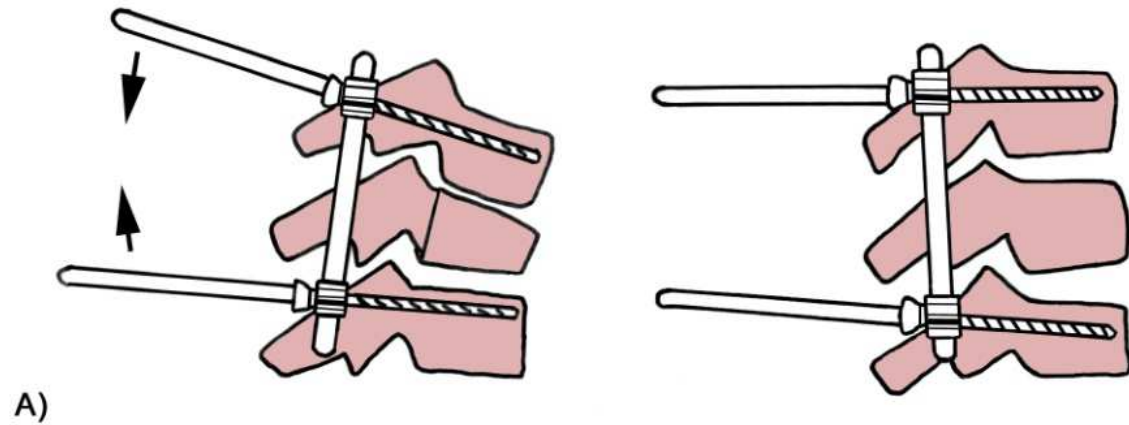
Réduction sur table d'opération

Installation en position de lordose

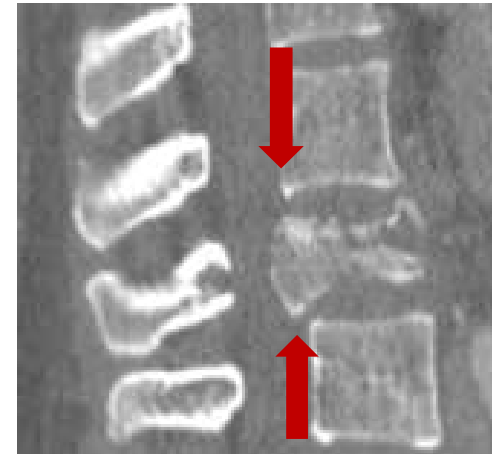
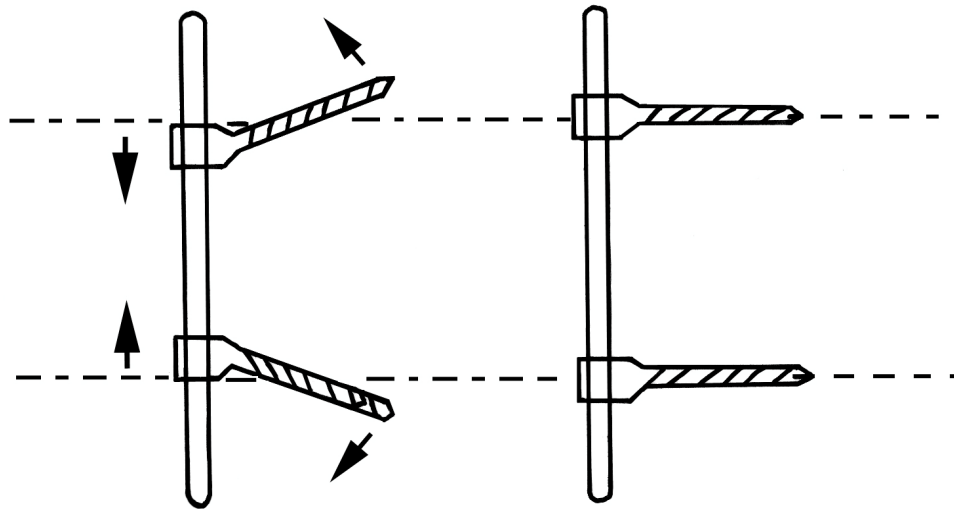
Traction sur halo et sur les membres inférieurs sur table de Cotrel



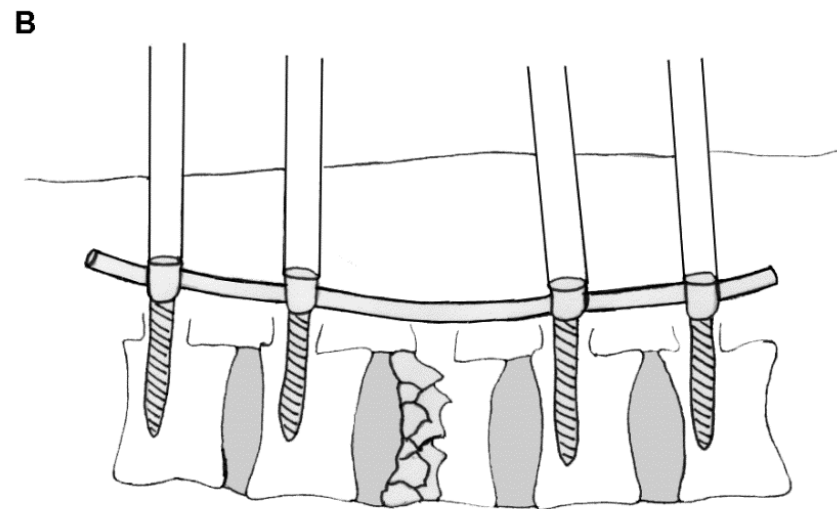
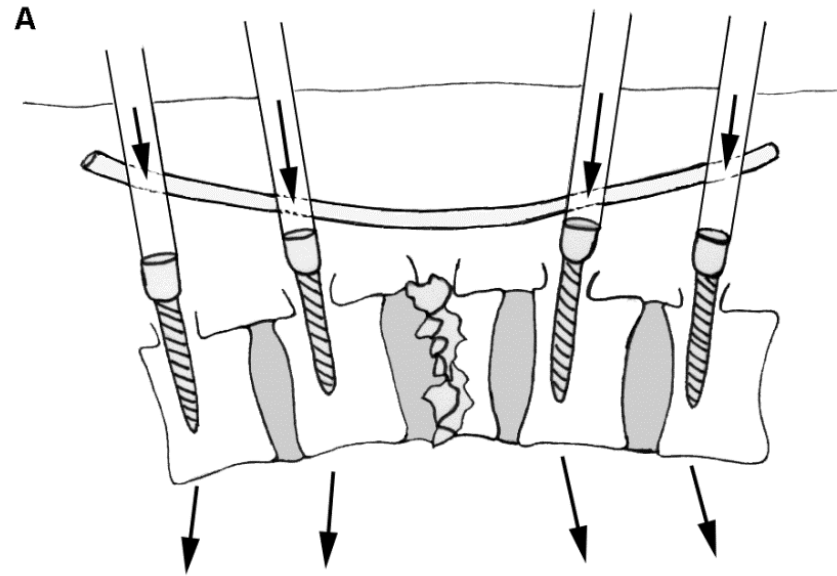
Principe de réduction de l'AO sur vis de Schanz



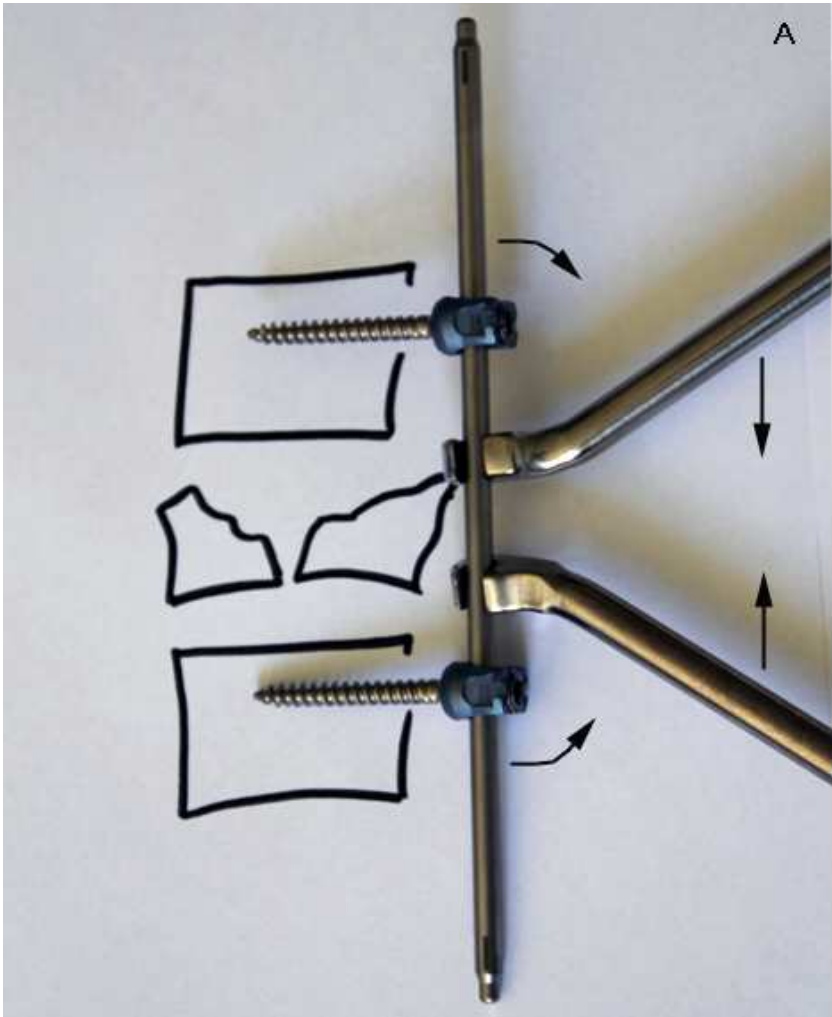
Le piège de la vis polyaxiale

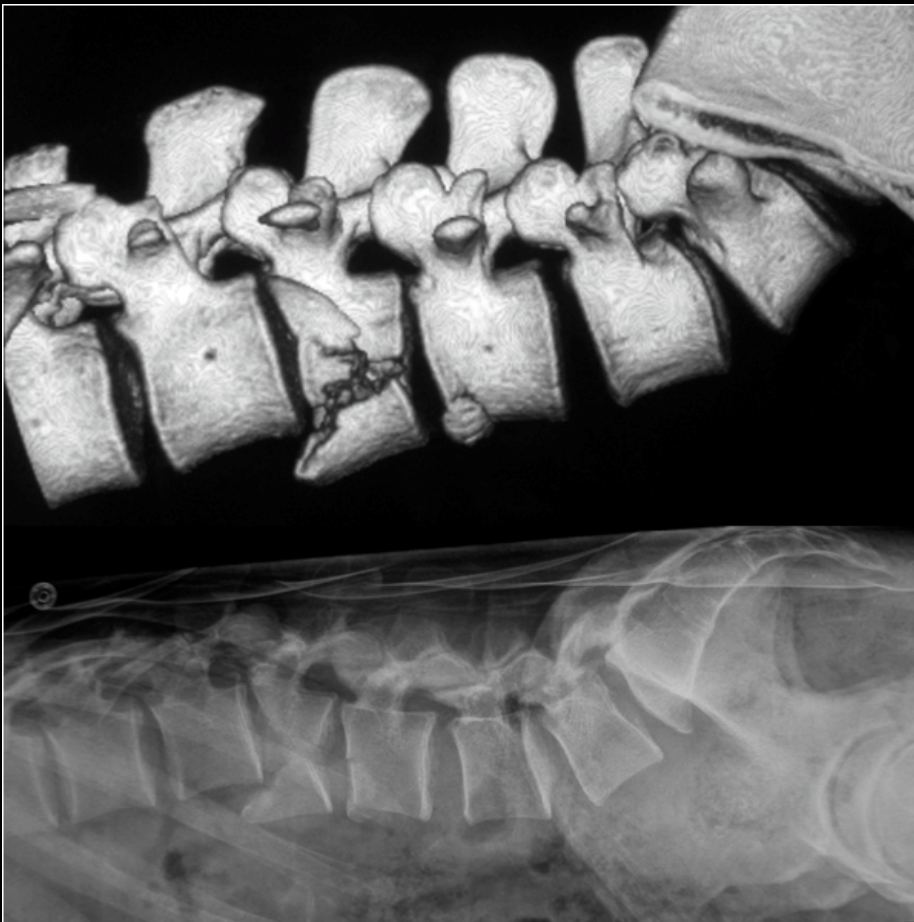


Réduction de fracture sur persuadeur

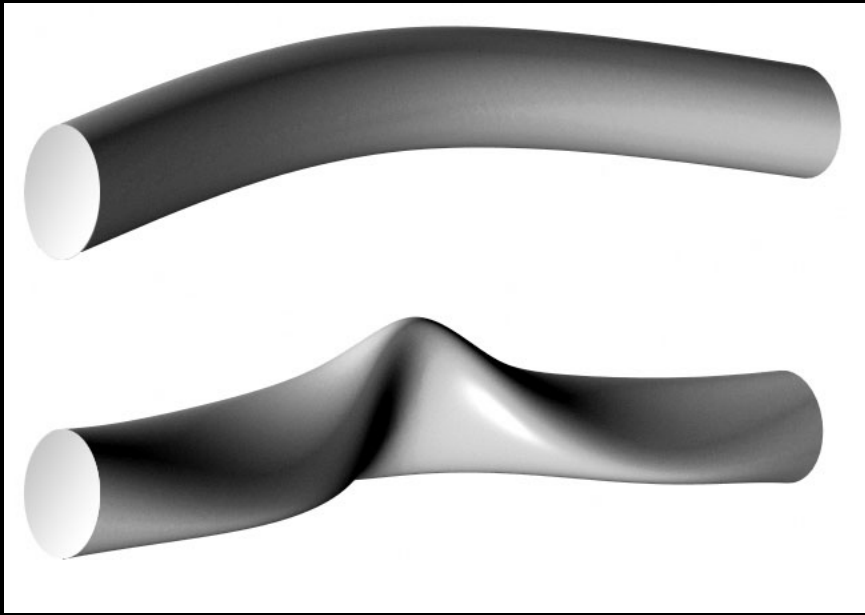
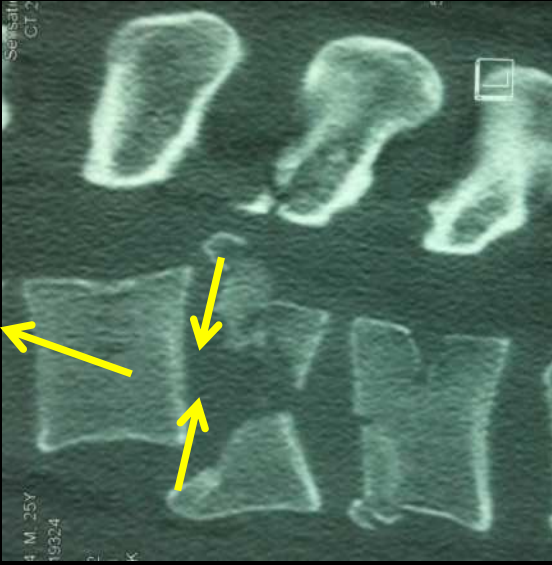


Cintrage in situ





Décompression indirecte du canal rachidien



Remodelage du mur postérieur

Qualité du remodelage lié au
ligamentotaxis peropératoire

Remodelage progressif TDM

Eur Spine J (2003) 12:255–260
DOI 10.1007/s00586-002-0499-2

ORIGINAL ARTICLE

V. J. M. Leferink
J. M. M. Nijboer
K. W. Zimmerman
E. F. M. Veldhuis
E. M. ten Vergert
H. J. ten Duis

**Burst fractures
of the thoracolumbar spine:
changes of the spinal canal
during operative treatment and follow-up**

Obstruction canalaire: 76,5% pre-op → 18,4 post-op → 2,4% à 2 ans de recul

SPINE Volume 31, Number 20, pp E739–E746
©2006, Lippincott Williams & Wilkins, Inc.

■ **Ultrasound-Guided Spinal Fracture Repositioning,
Ligamentotaxis, and Remodeling After Thoracolumbar
Burst Fractures**

Lutz Arne Mueller, MD,* Jürgen Degreif, MD, PhD,† Rainer Schmidt, MD, PhD,*
David Pfander, MD, PhD,* Raimund Forst, MD, PhD,* Pol Maria Rommens, MD, PhD,‡
Lars Peter Mueller, MD, PhD,‡ and Lothar Rudig, MD, PhD‡

Etat neurologique ASIA B-D:

Chirurgie ouverte ou mini-open

Réduction + laminectomie

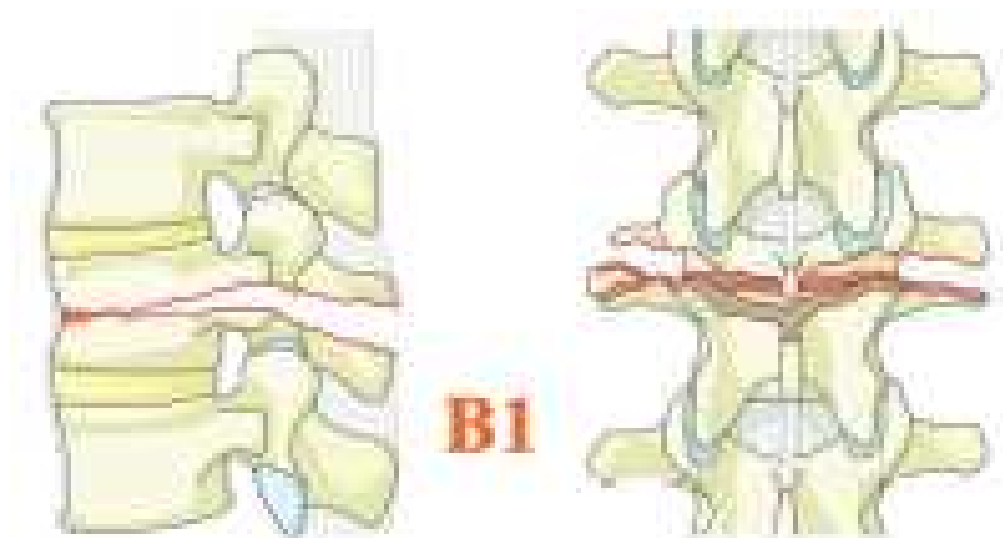
Support de la colonne antérieure

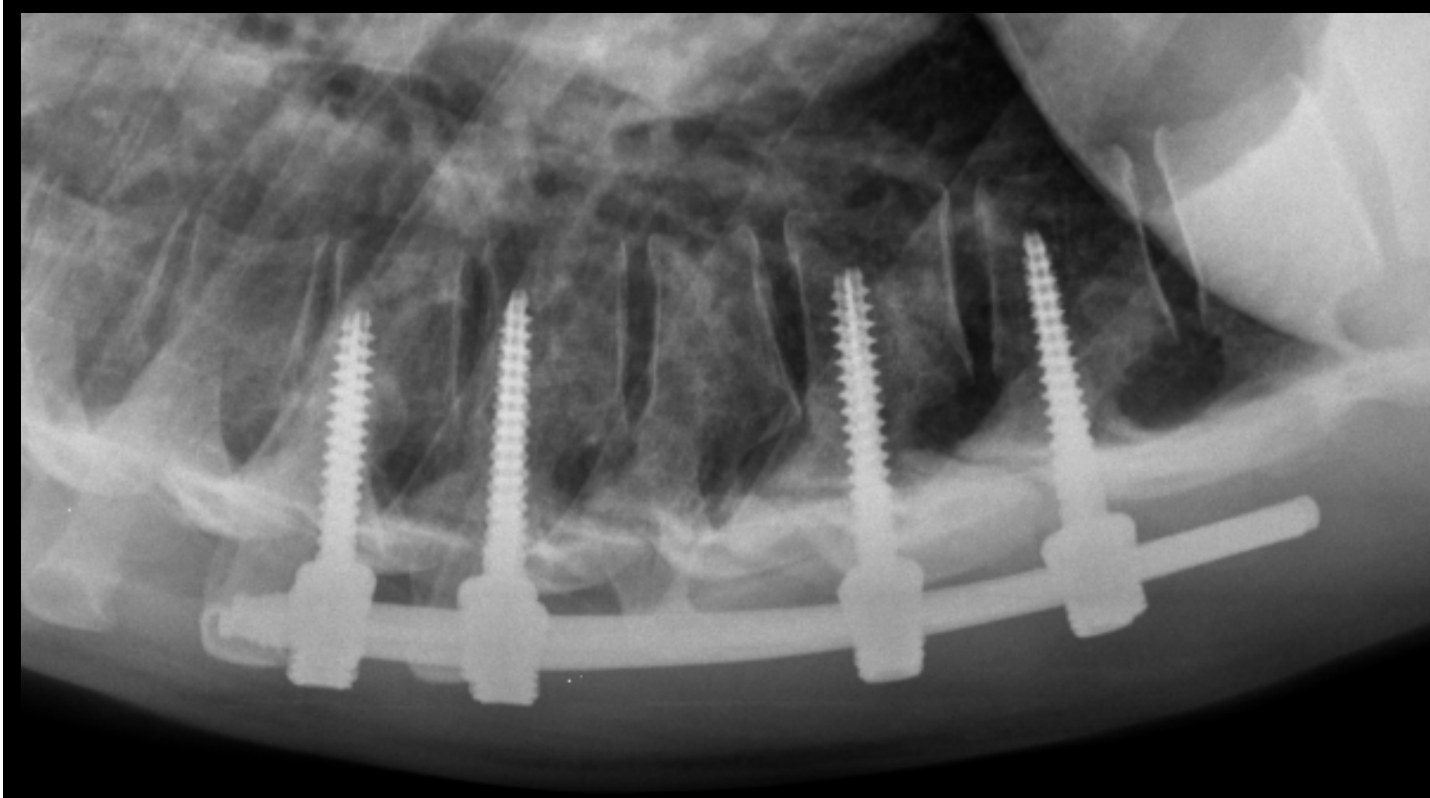
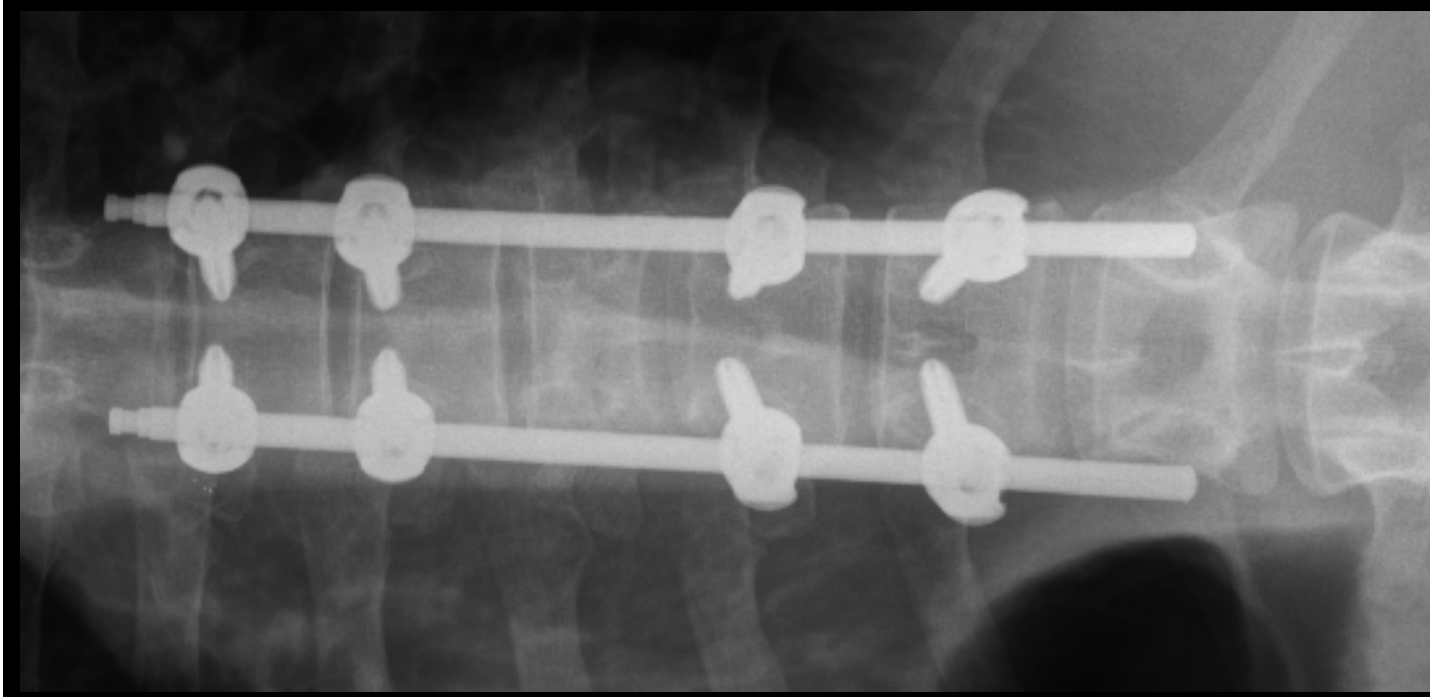
Fractures purement osseuses

Fracture B1 = Fracture de Chance

Consolidation os sur os

Ostéosynthèse simple suffisante





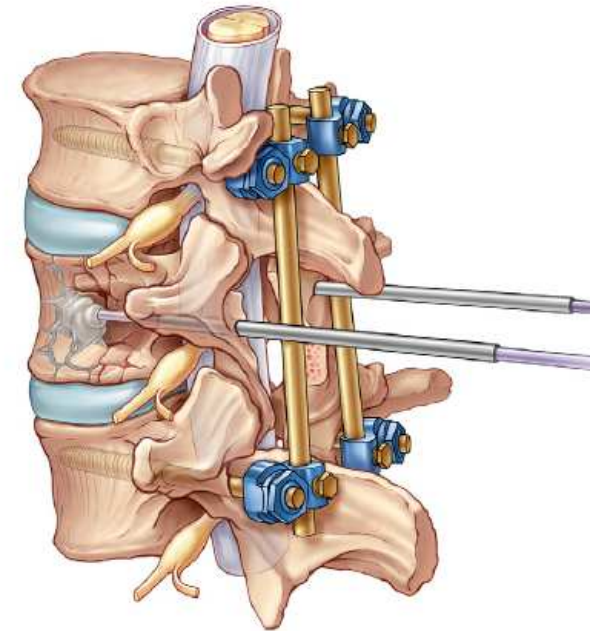
Maintien de la reduction - traitement du défaut antérieur

Thoracolumbar Burst Fractures Treated with Posterior Decompression and Pedicle Screw Instrumentation Supplemented with Balloon-Assisted Vertebroplasty and Calcium Phosphate Reconstruction

By Rex A.W. Marco, MD, and Vivek P. Kushwaha, MD

Investigation performed at Memorial Hermann Hospital, Houston, Texas

J Bone Joint Surg Am. 2009;91:20-8 • doi:10.2106/JBJS.G.01668



Arthrodèse postérieure + kyphoplastie dans burst fractures

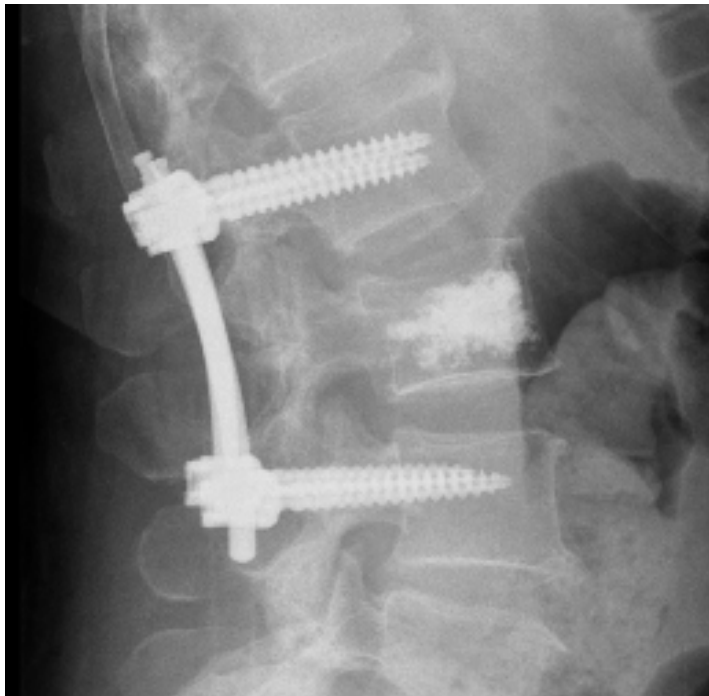
Stabilisation circonférentielle des 3 colonnes

Permet de s'affranchir d'un abord antérieur dans certains cas

Instrumentation percutanée et kyphoplastie

Indiquée dans les burst fractures incomplètes A3

Amélioration du maintien de correction de 25% de hauteur du corps vertébral



Eur Spine J (2010) 19:1281–1287
DOI 10.1007/s00586-010-1444-4

ORIGINAL ARTICLE

Percutaneous kyphoplasty and pedicle screw fixation for the management of thoraco-lumbar burst fractures

Stéphane Fuentes · Benjamin Blondel ·
Philippe Metellus · Jean Gaudart ·
Tarek Adetchessi · Henry Dufour

Orthopaedics & Traumatology: Surgery & Research (2011) 97, 527–532

Percutaneous management of thoracolumbar burst fractures: Evolution of techniques and strategy

B. Blondel^a, S. Fuentes^{b,*}, G. Pech-Gourg^b, T. Adetchessi^b,
P. Tropiano^a, H. Dufour^b

**Quand faut-il greffer la
colonne antérieure?**

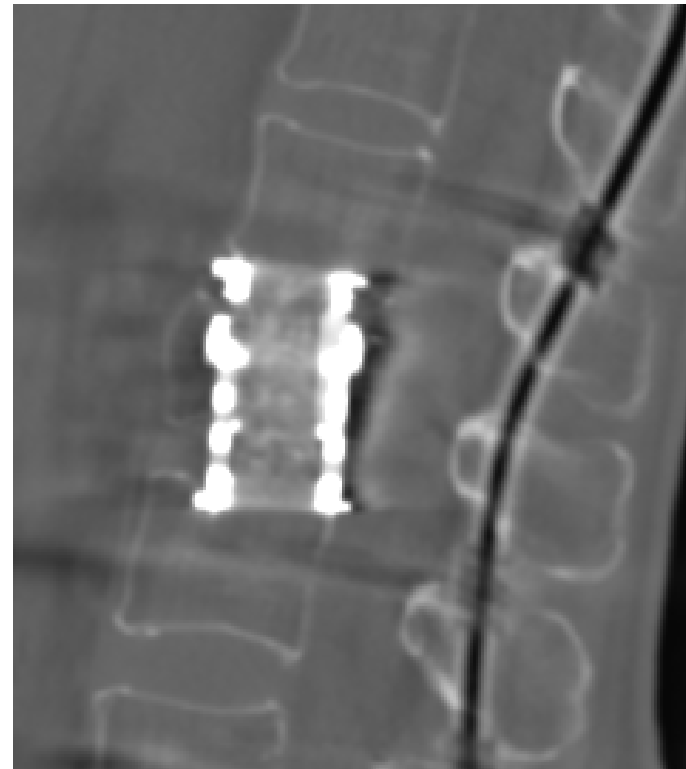
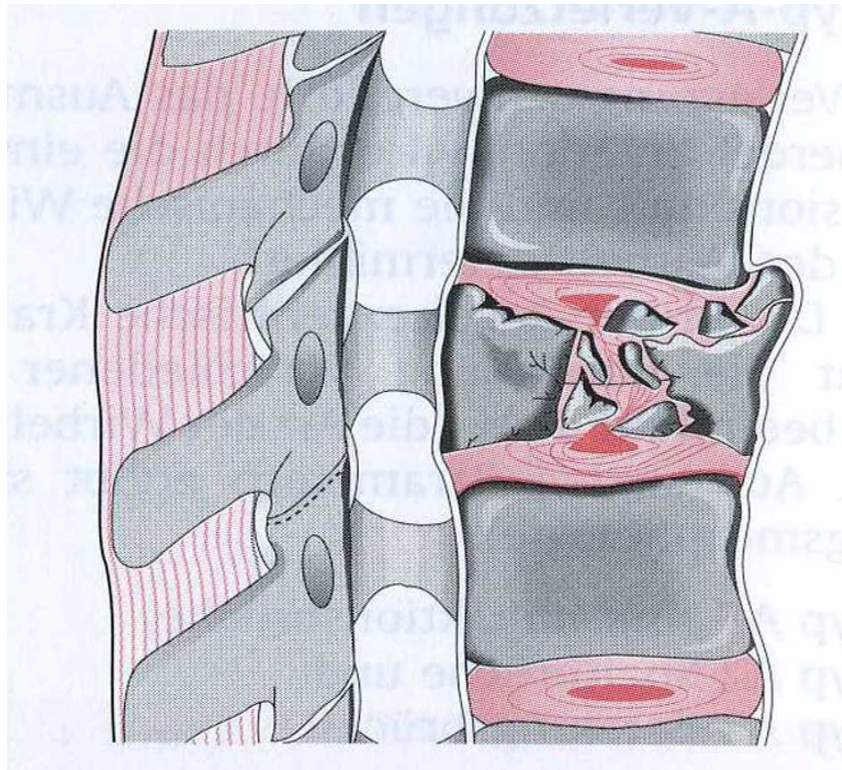


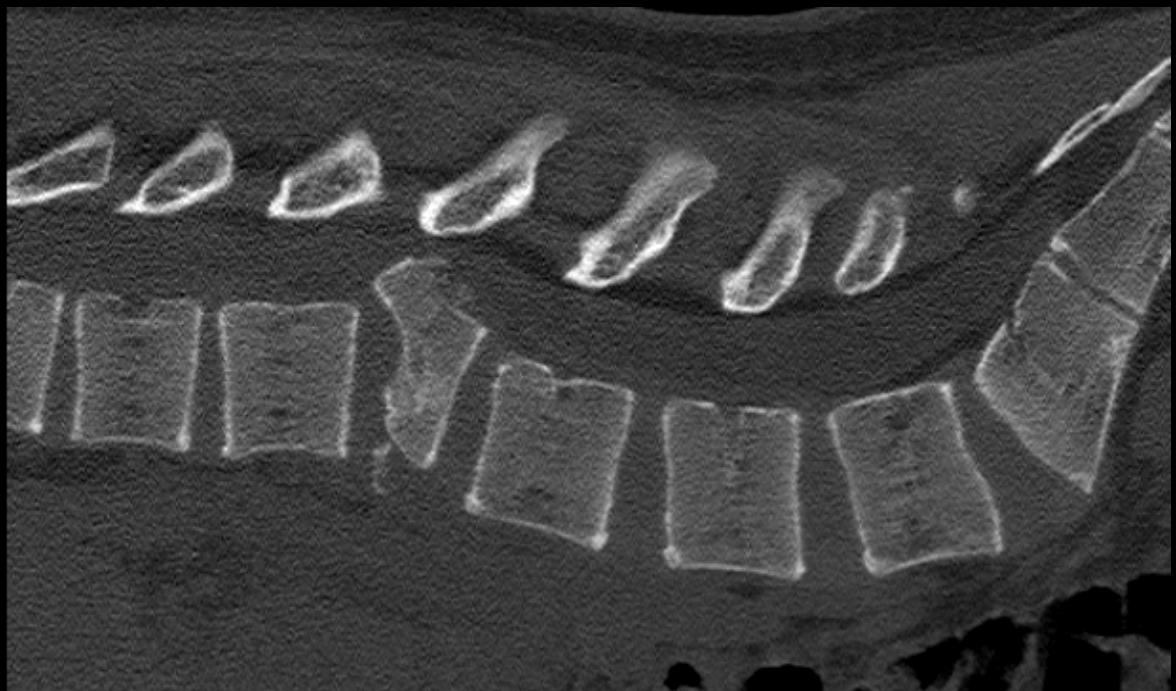
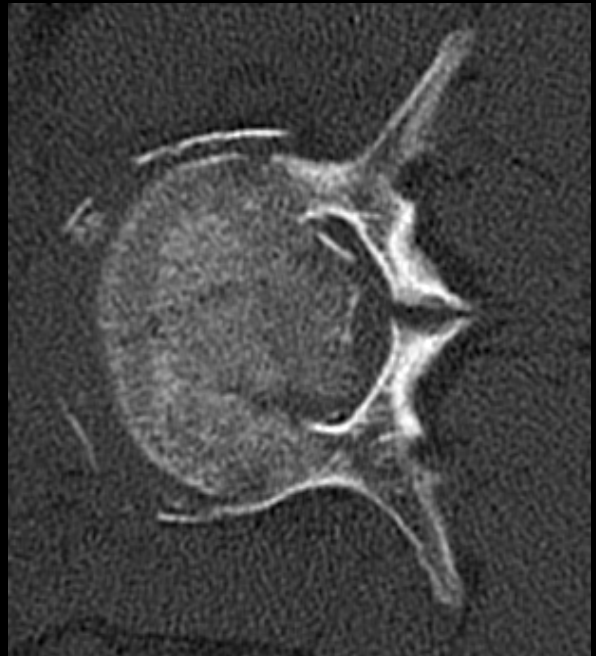
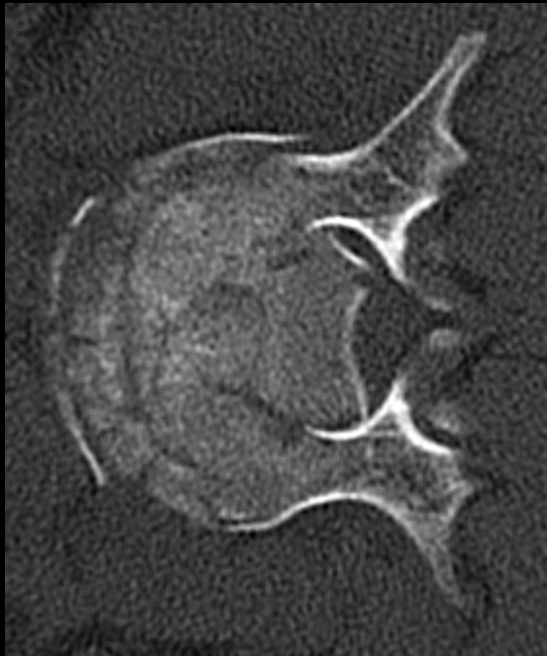
Reconstruction de la colonne antérieure

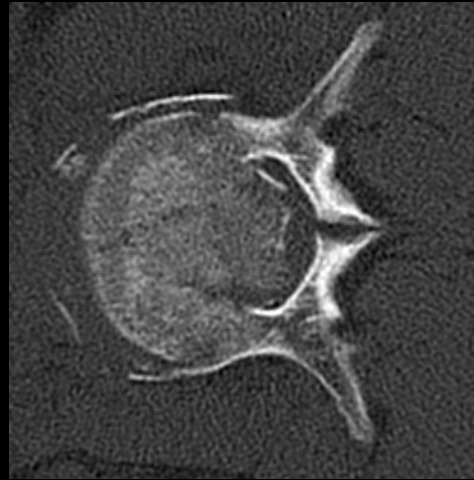
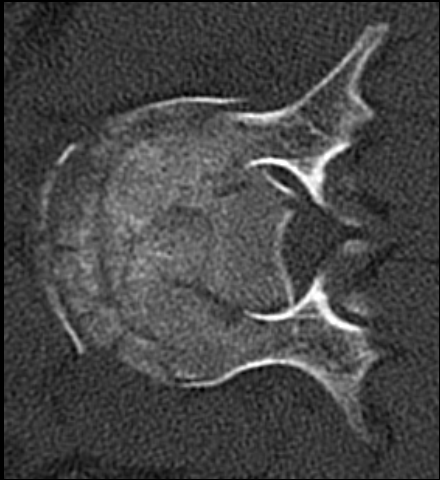
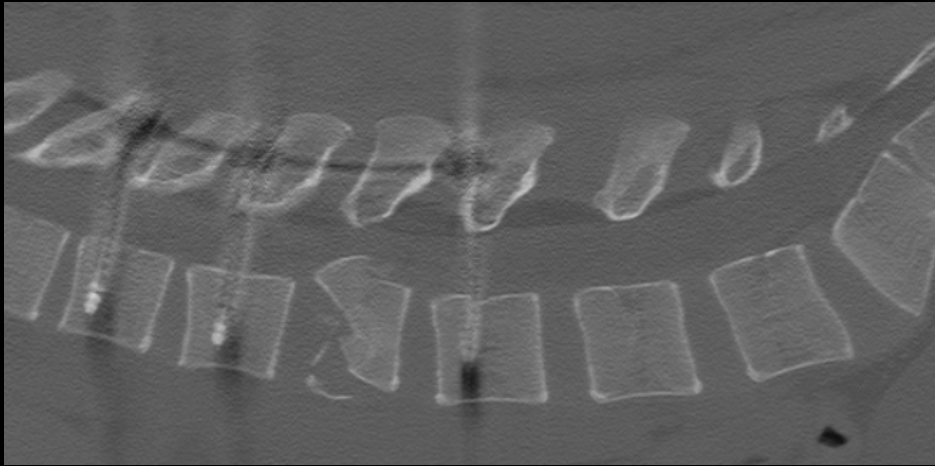
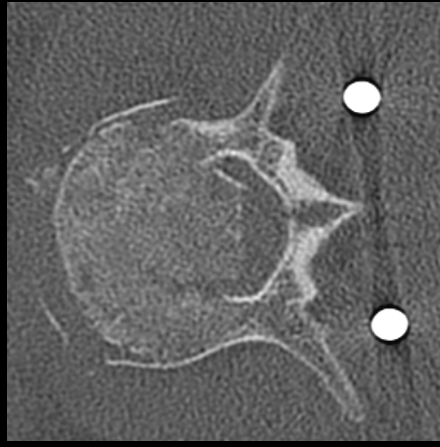
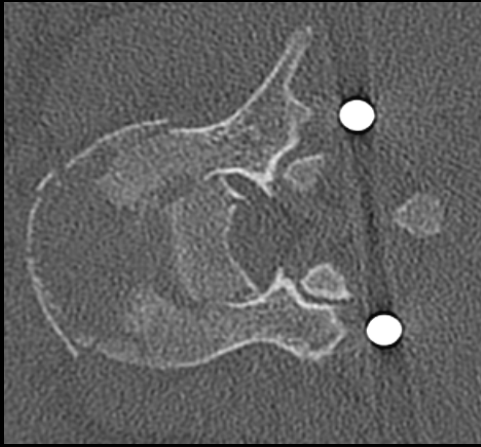
Defect osseux important: fractures diabololo **A2** ou burst fractures **A4**

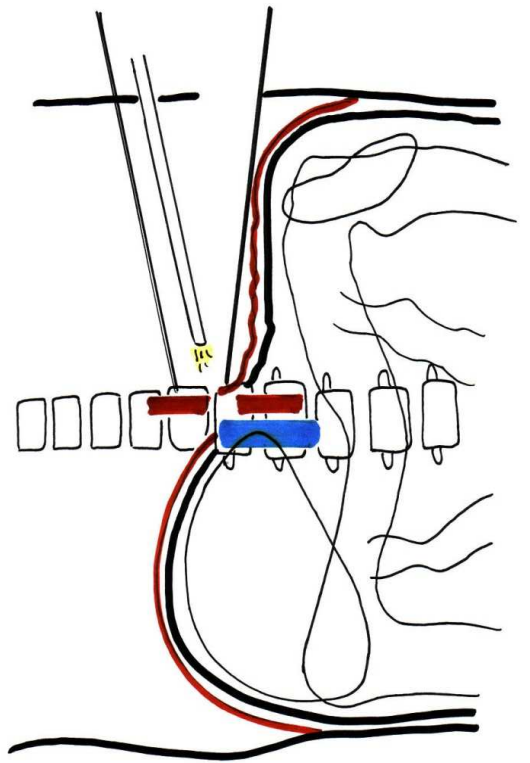
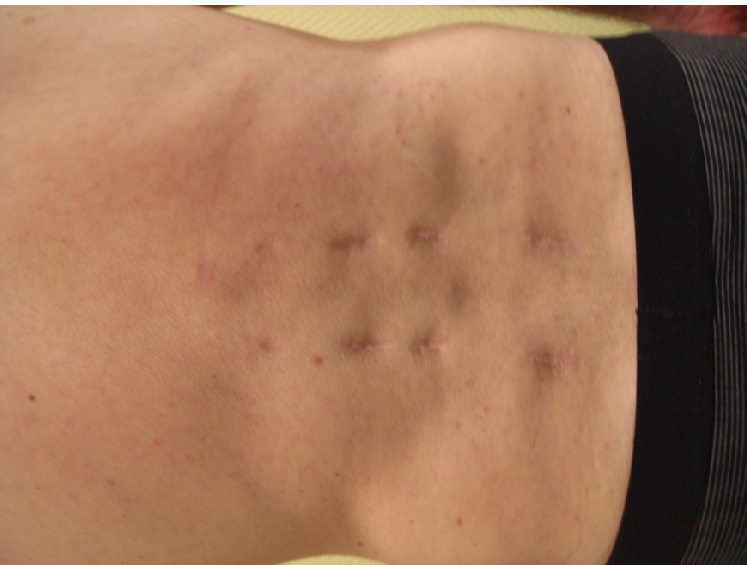
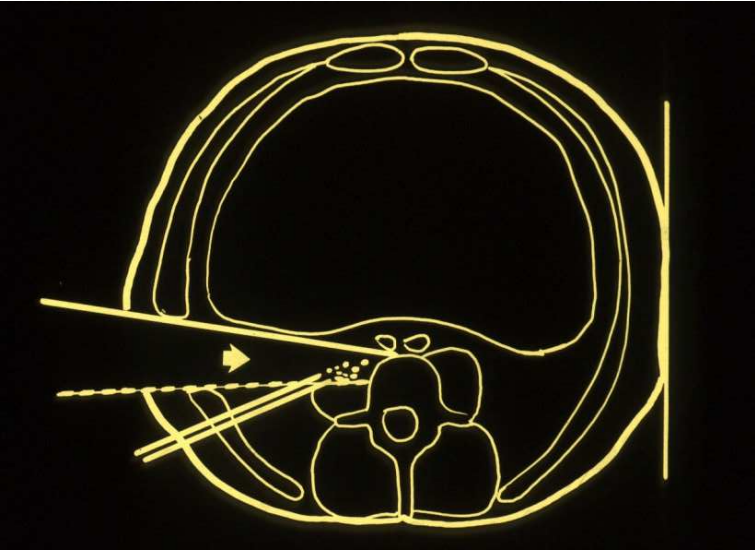
Réduction > 50% dans le disque au-dessus de la fracture dans les fractures **A3**

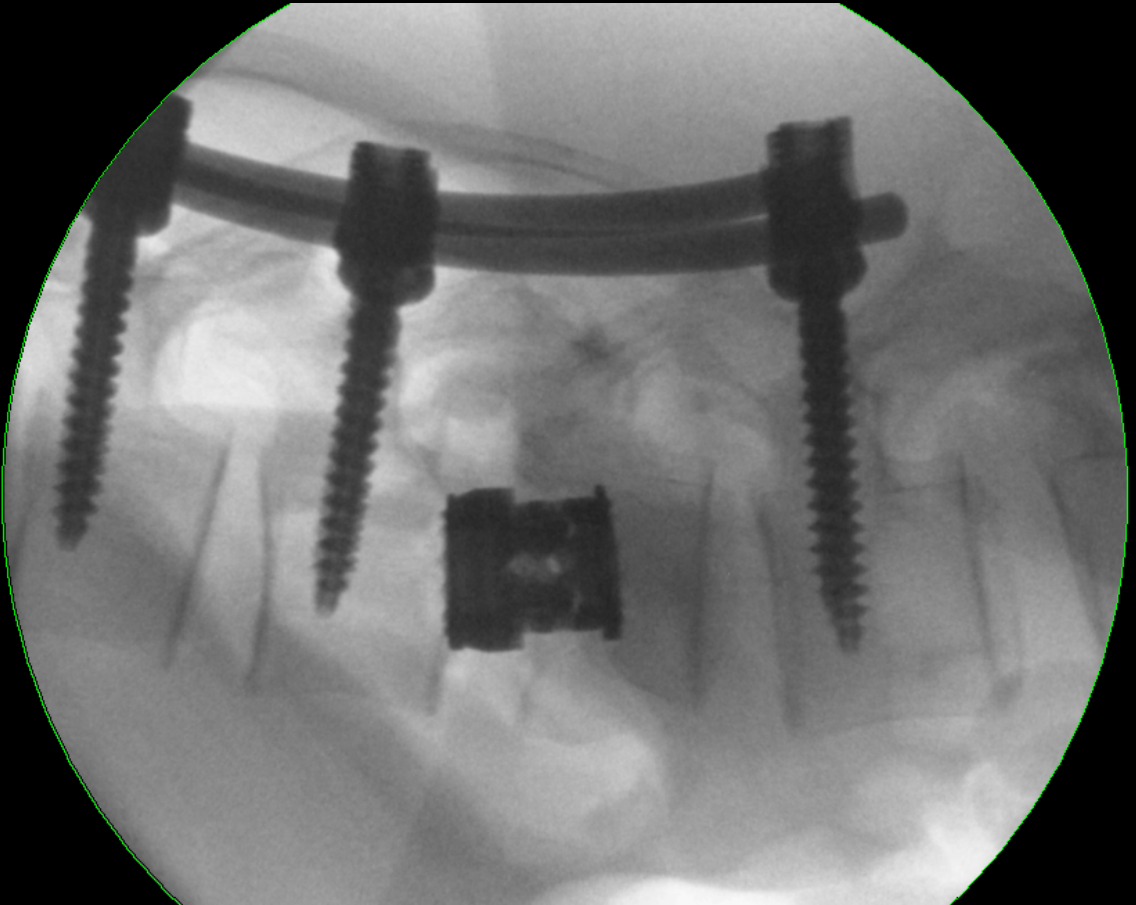
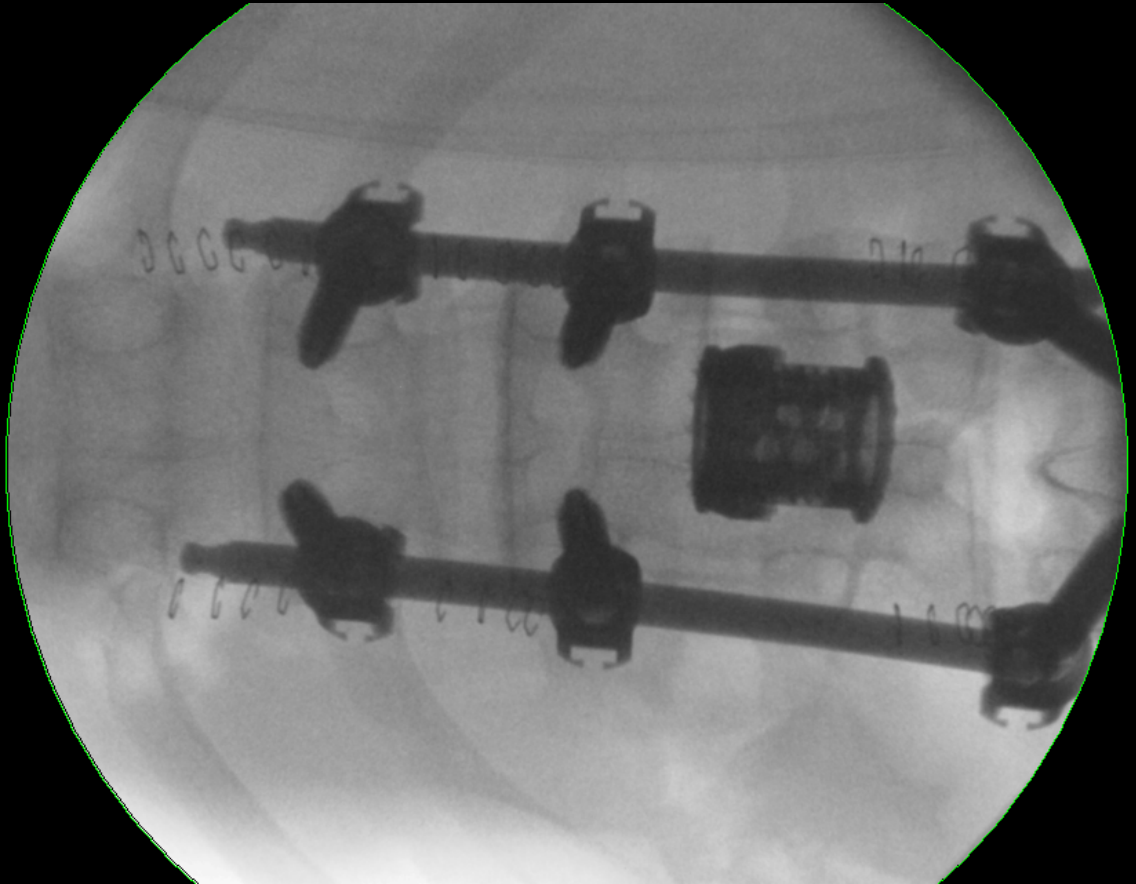
Lésions disco-ligamentaires de type B

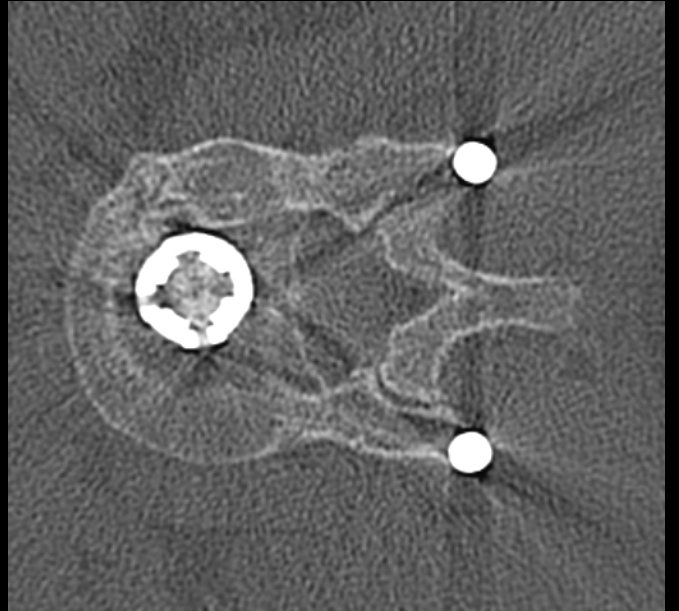
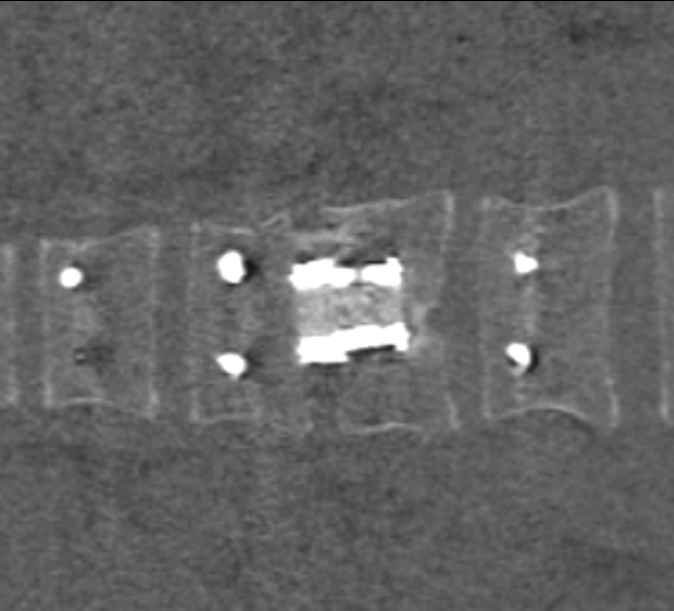
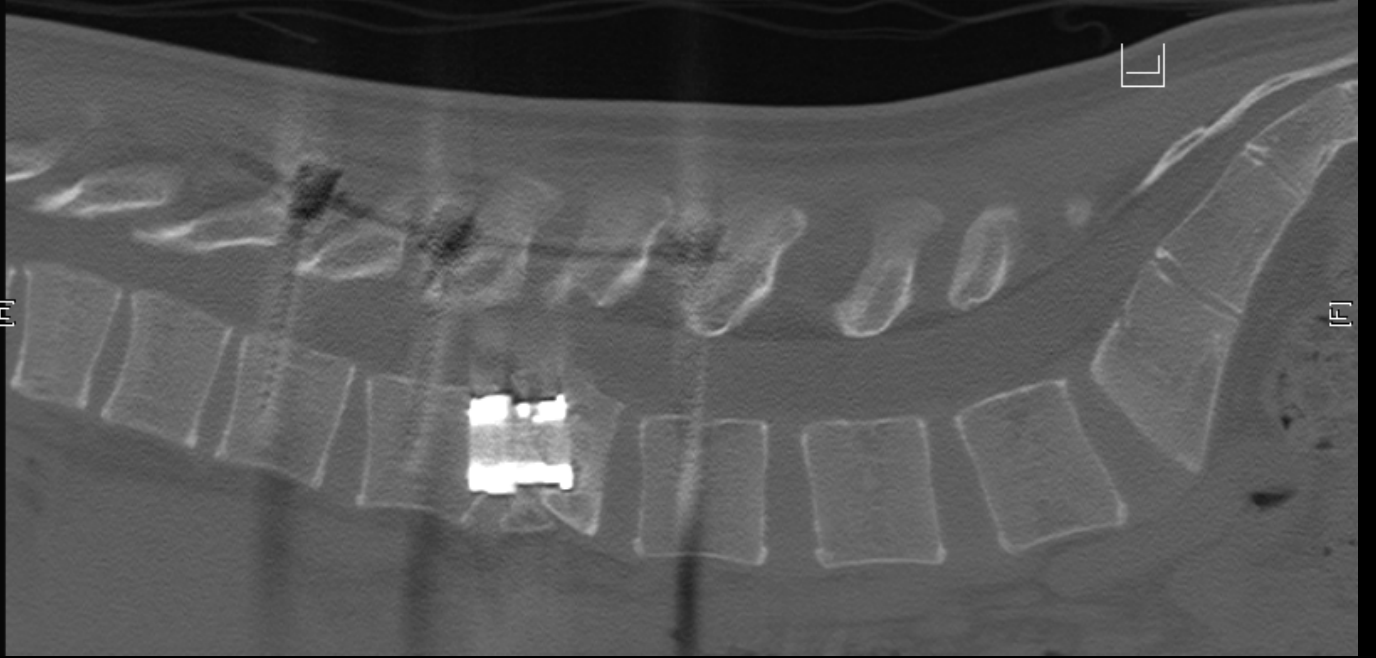






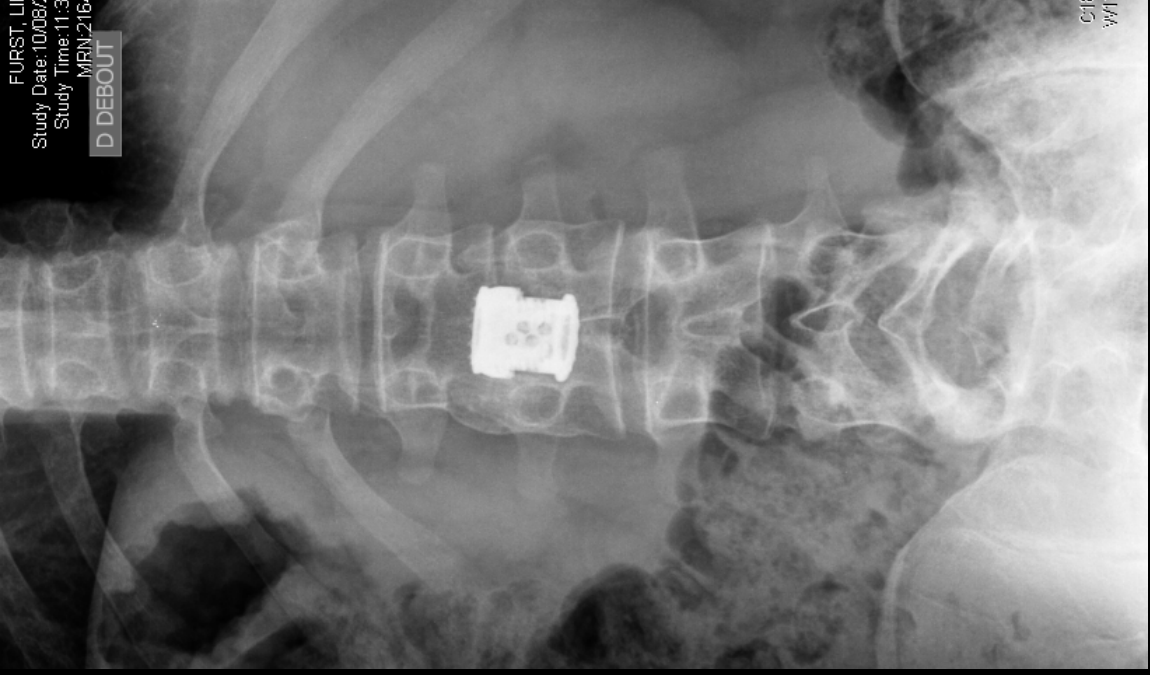






FURST, LIL
Study Date: 10/08/2
Study Time: 11:30
MRN: 2164

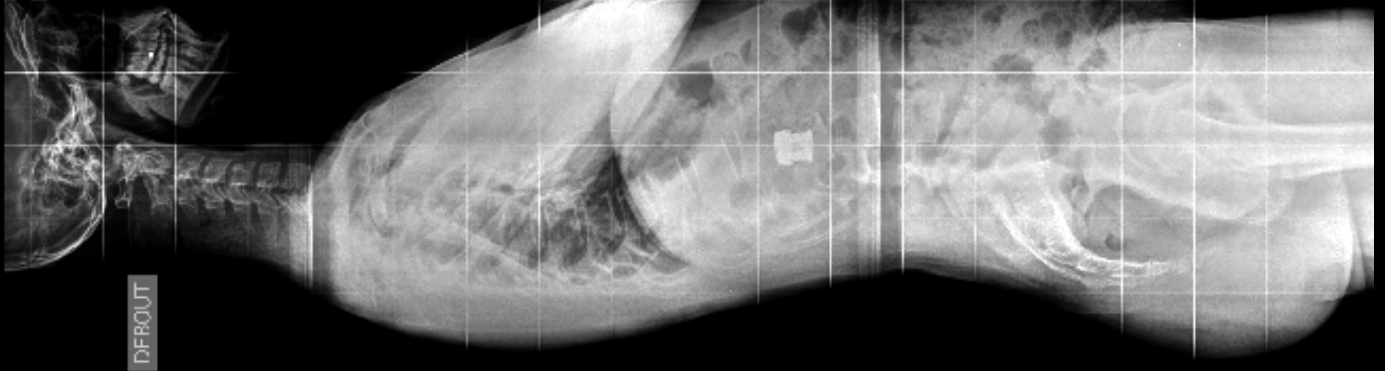
D DEBOUT



C18
W11

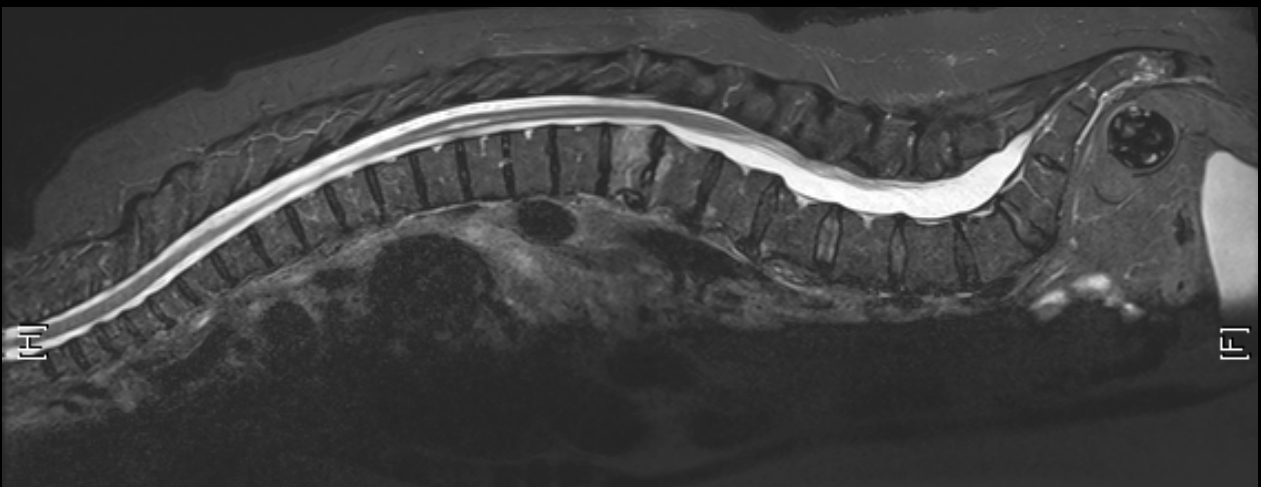
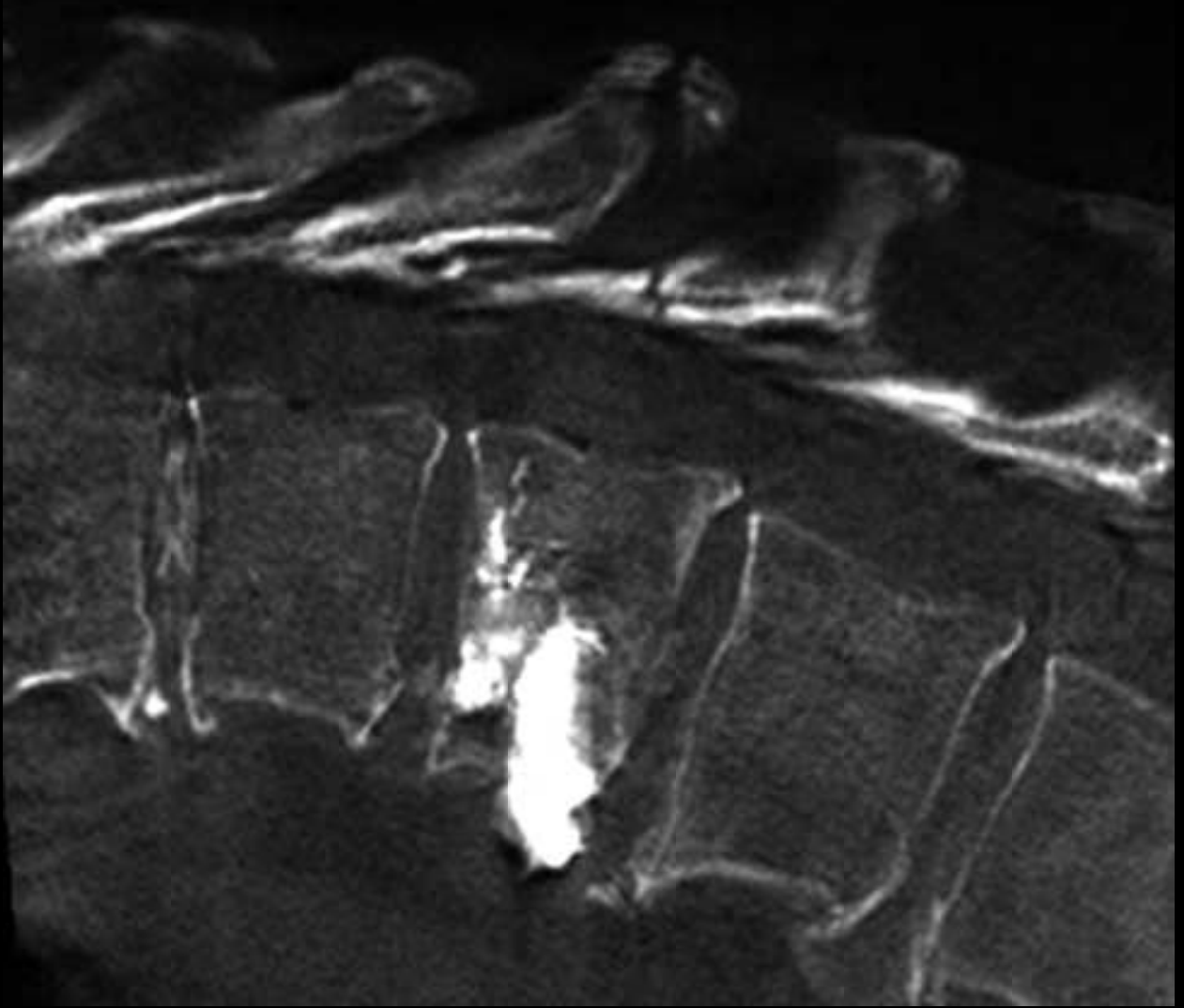


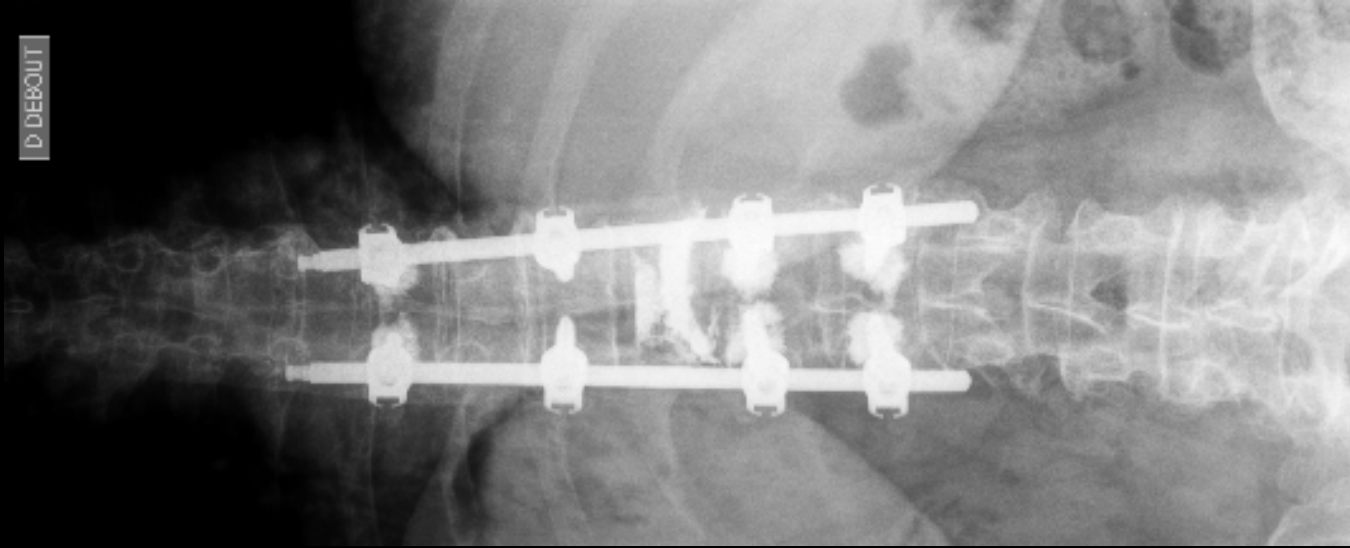
ROFIL



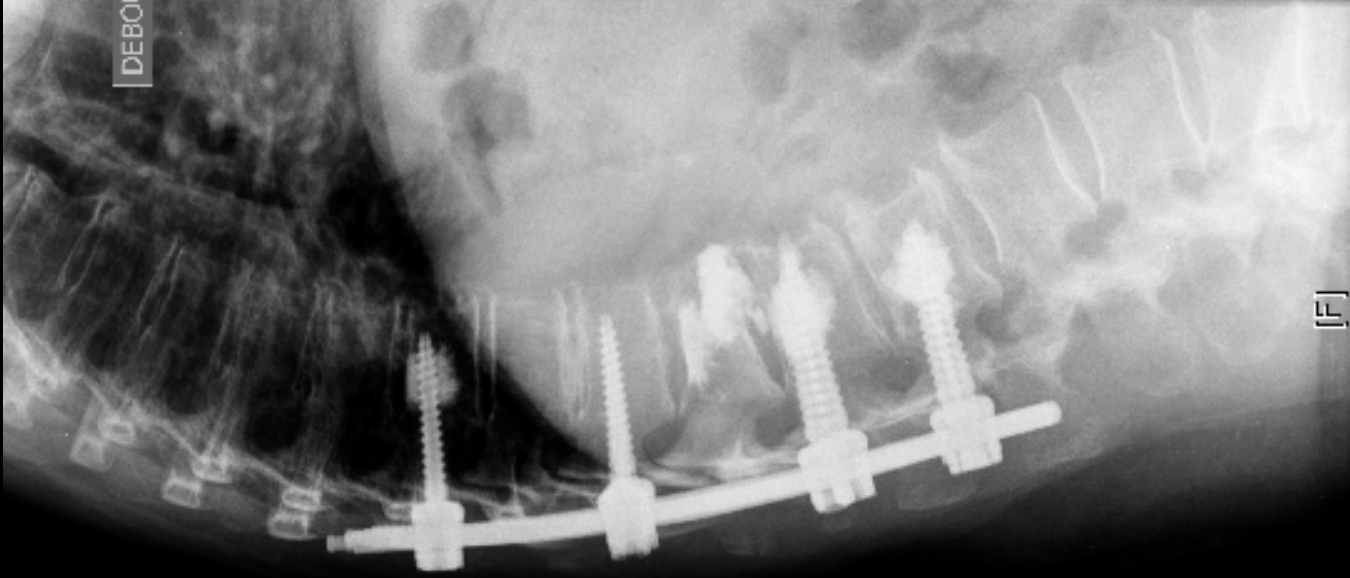
D/FBOUT

Fractures ostéoporotiques





D DEBOUT



DEBOUT

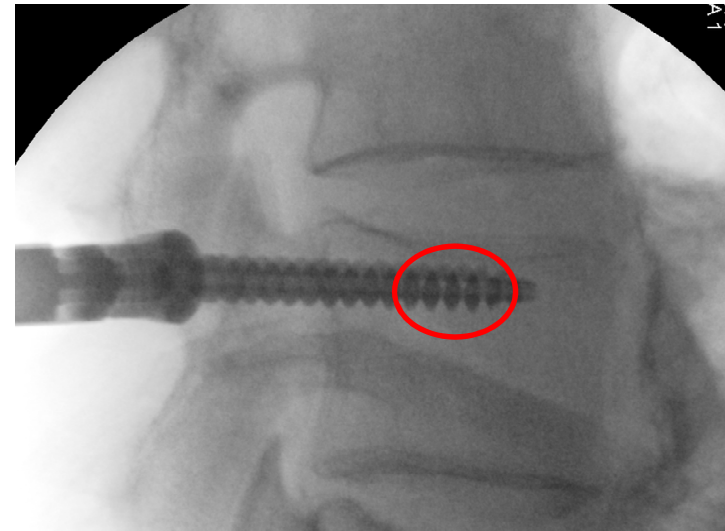
[F]

Aspects techniques sur les vis fenêtrées

Positionnement des vis de manière classique

- pointe carrée utile pour amorcer la corticale
- taraudage du pédicule au plus petit diamètre

Les orifices doivent se situer vers le milieu du corps vertébral



Risques en cas de mauvais choix de longueur

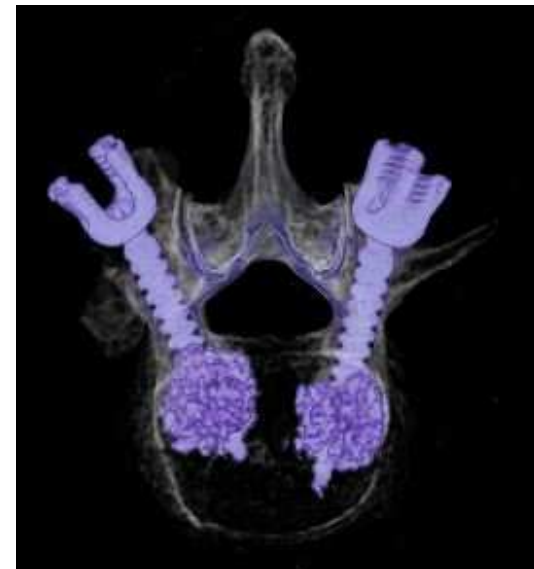
- vis longue et bi-corticale: fuite de ciment antérieure, embolie par la veine azygos
- vis trop courte: injection de volume limité fuite de ciment dans le canal ou dans le trou de conjugaison

Aspects techniques sur les vis fenêtrées

Injection progressive et lente d'environ 2 ml de ciment sous contrôle fluoroscopique

Faible résistance au début de l'injection, augmente lorsque le ciment pénètre l'os

Contrôle précis du volume d'injection et du risque de fuite avec ciment à haute viscosité



Stryker 27.11.2012
12.11.27-07:35:23-STD-1.3.12.2.1107.5.12.9.15178
*22.05.1972

ARCADIS

STUDY 1
27.11.2012
12:33:46
83 IMA 1

kV 69
mA 11.4
DR

LUT Linear



Stryker 27.11.2012
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*22.05.1972

ARCADIS

STUDY 1
27.11.2012
12:33:54
88 IMA 1

kV 69
mA 11.9
DR

LUT Linear



Stryker 27.11.2012
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*22.05.1972

ARCADIS

STUDY 1
27.11.2012
12:33:58
90 IMA 1

kV 69
mA 11.9
DR

LUT Linear



Stryker 27.11.2012
12.11.27-07:35:23-STD-1.3.12.2.1107.5.12.9.15178
*22.05.1972

ARCADIS

STUDY 1
27.11.2012
12:34:11
94 IMA 1

kV 69
mA 11.9
DR

LUT Linear



Stryker 27.11.2012
12.11.27-07:35:23-STD-1.3.12.2.1107.5.12.9.15178
*22.05.1972

ARCADIS

STUDY 1
27.11.2012
12:35:04
98 IMA 1

kV 69
mA 11.9
DR

LUT Linear



Flux du ciment autour de l'extrémité de la vis

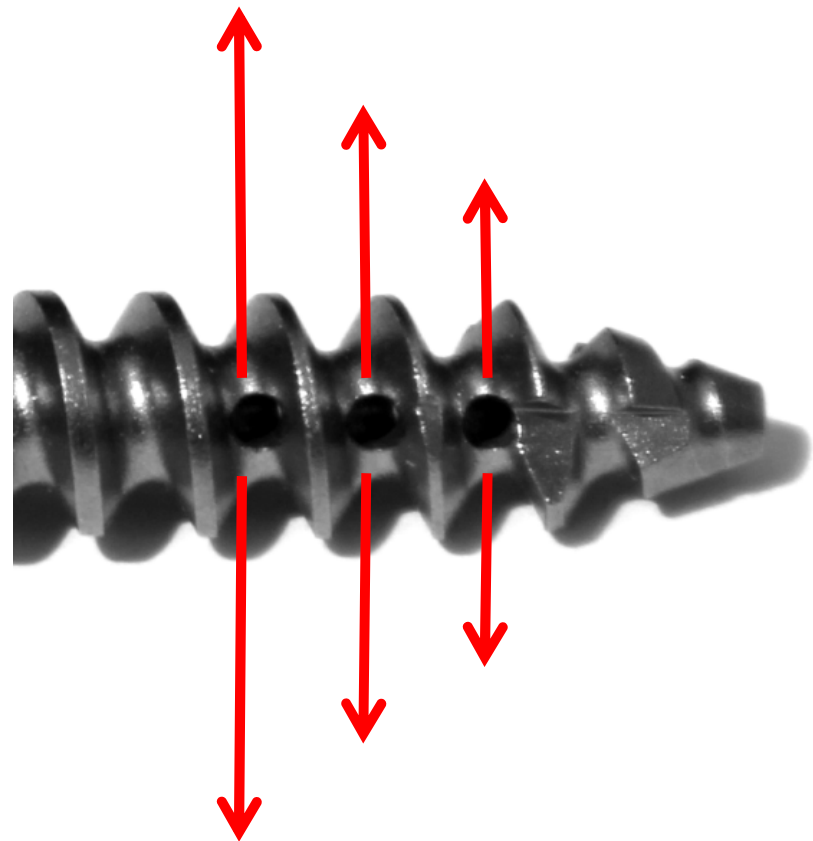
Extravasation par les premiers trous

Flux à travers le trou à la pointe rare,
attention au sacrum

Risque en chirurgie de reprise

Néo-corticale empêche le flux de
ciment à travers les trous!

Favoriser le vis à gros diamètre



Indication chez le patient polytraumatisé

La particularité du patient polytraumatisé

Stabilisation précoce diminue la durée de ventilation mécanique et le taux de complications pulmonaires

Raccourci la durée de séjour en réanimation et d'hospitalisation

SPINE Volume 35, Number 21S, pp S187-S192
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■ Early *Versus* Late Stabilization of the Spine in the Polytrauma Patient

John R. Dimar, MD,* Leah Y. Carreon, MD, MSc,* Joseph Riina, MD,†
David G. Schwartz, MD,† and Mitchel B. Harris, MD‡

The timing of spinal stabilization in polytrauma and in patients with spinal cord injury

Christian Schinkel and Alexander P. Anastasiadis

Current Opinion in Critical Care 2008, 14:685–689

Ostéosynthèse percutanée chez le polytraumatisé

Principe du fixateur interne en MIS permettant de réduire et de stabiliser le rachis

Possibilité de combiner avec un mini abord centré sur la zone de laminectomie



Percutaneous pedicle screw fixation in polytrauma patients

L. Scaramuzzo · F. C. Tamburrelli ·
E. Piervincenzi · V. Raggi · S. Cicconi ·
L. Proietti

Percutané n = 9 / Ouvert n = 12

Influence sur le timing de l'ostéosynthèse

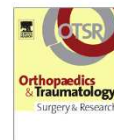
Timing surgical treatment pz of III e IV SAPS II score quartile	ICU- LOS	H- LOS	Mechanical ventilation need	Blood transfusion need
Early	24.6	39.6	24	356 cc
Delayed	43.6	95	44.6	895 cc
Significance $p < 0.05$	0.003	0.004	0.002	0.005

Orthopaedics & Traumatology: Surgery & Research 100 (2014) 449–454



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Original article

Early percutaneous fixation of spinal thoracolumbar fractures in polytrauma patients

H. Giorgi, B. Blondel, T. Adetchessi, H. Dufour, P. Tropiano, S. Fuentes*

Unité de Chirurgie rachidienne, Hôpital Timone, 264, rue Saint-Pierre, 13385 Marseille, France



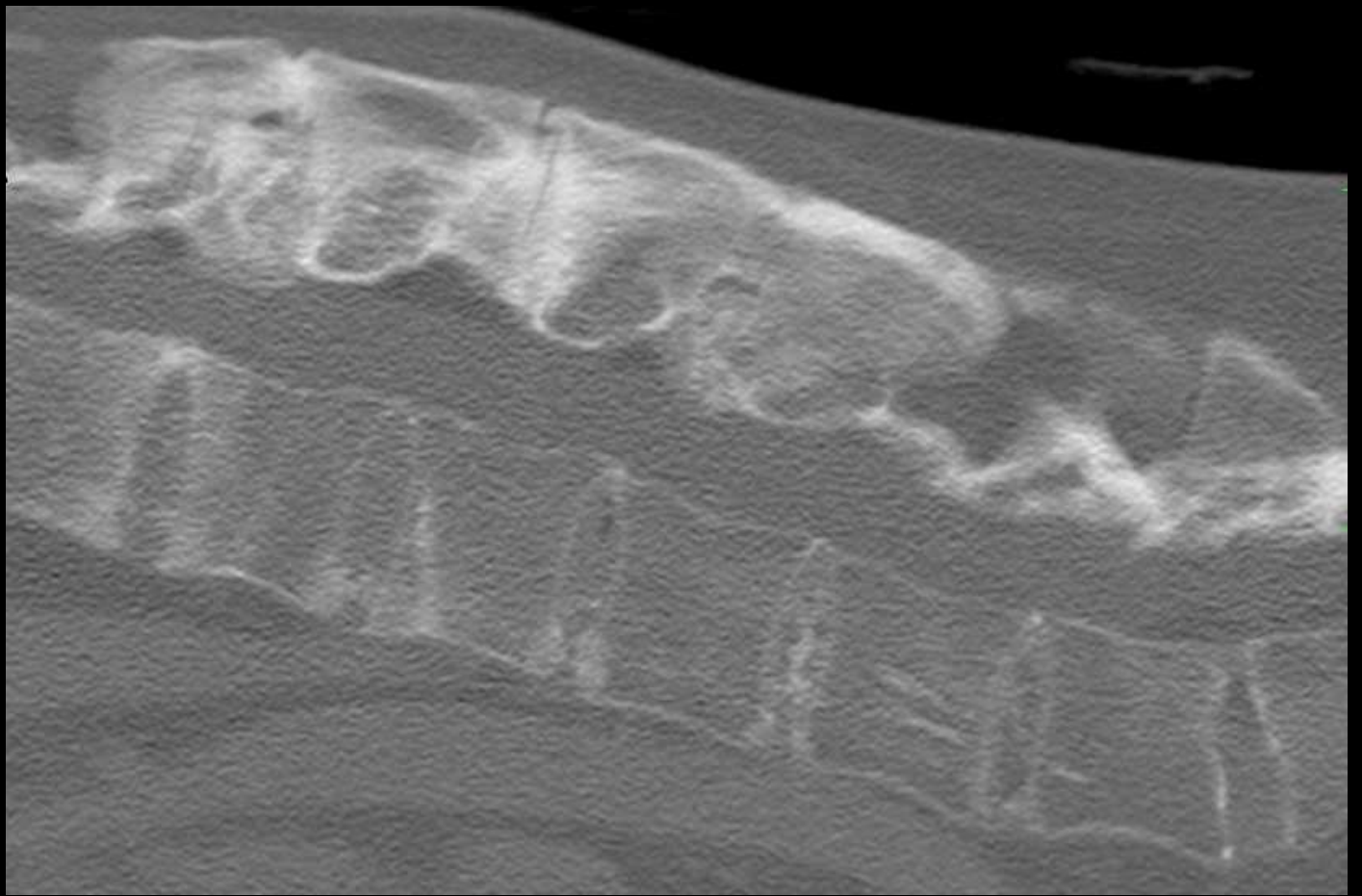
Percutané n = 10

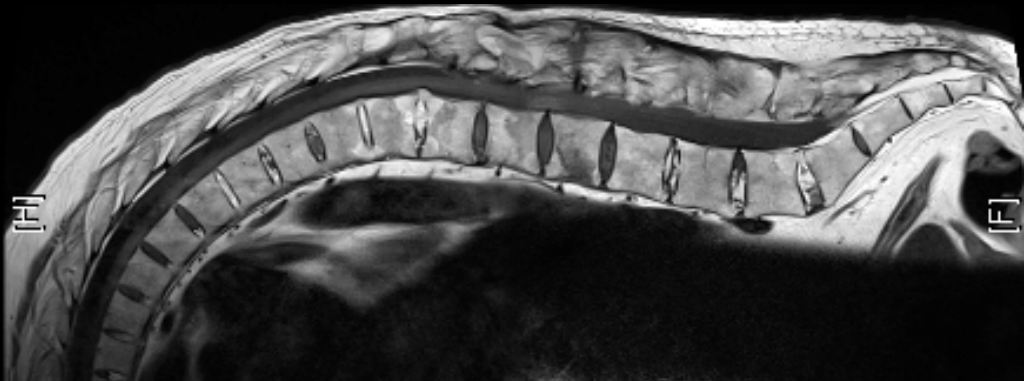
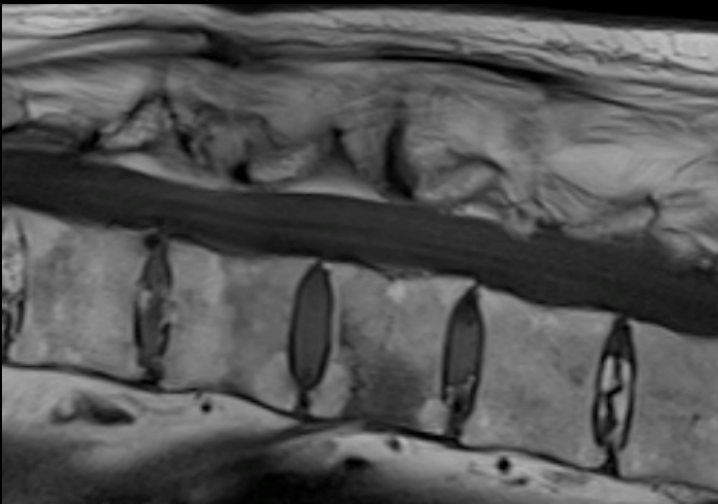
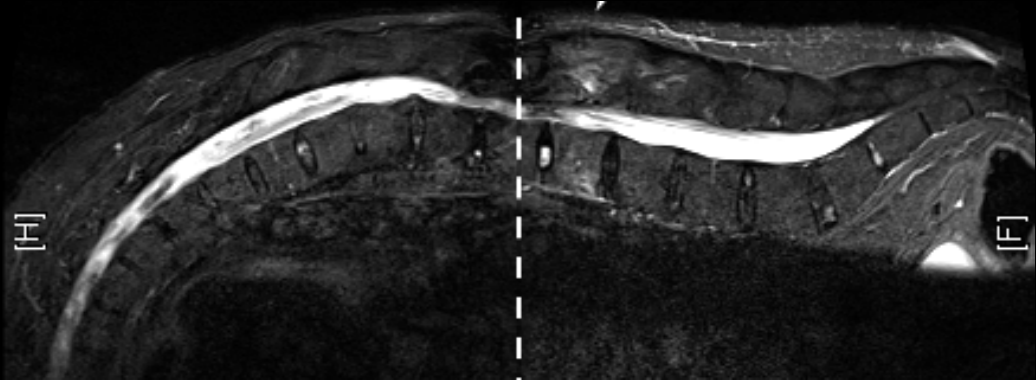
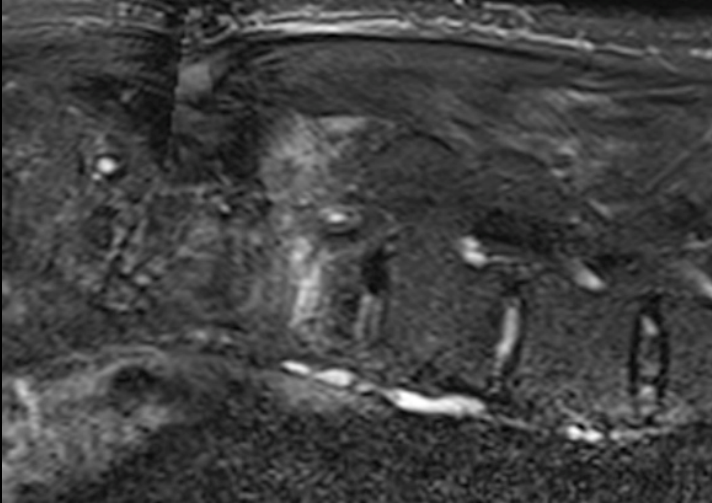
Damage control

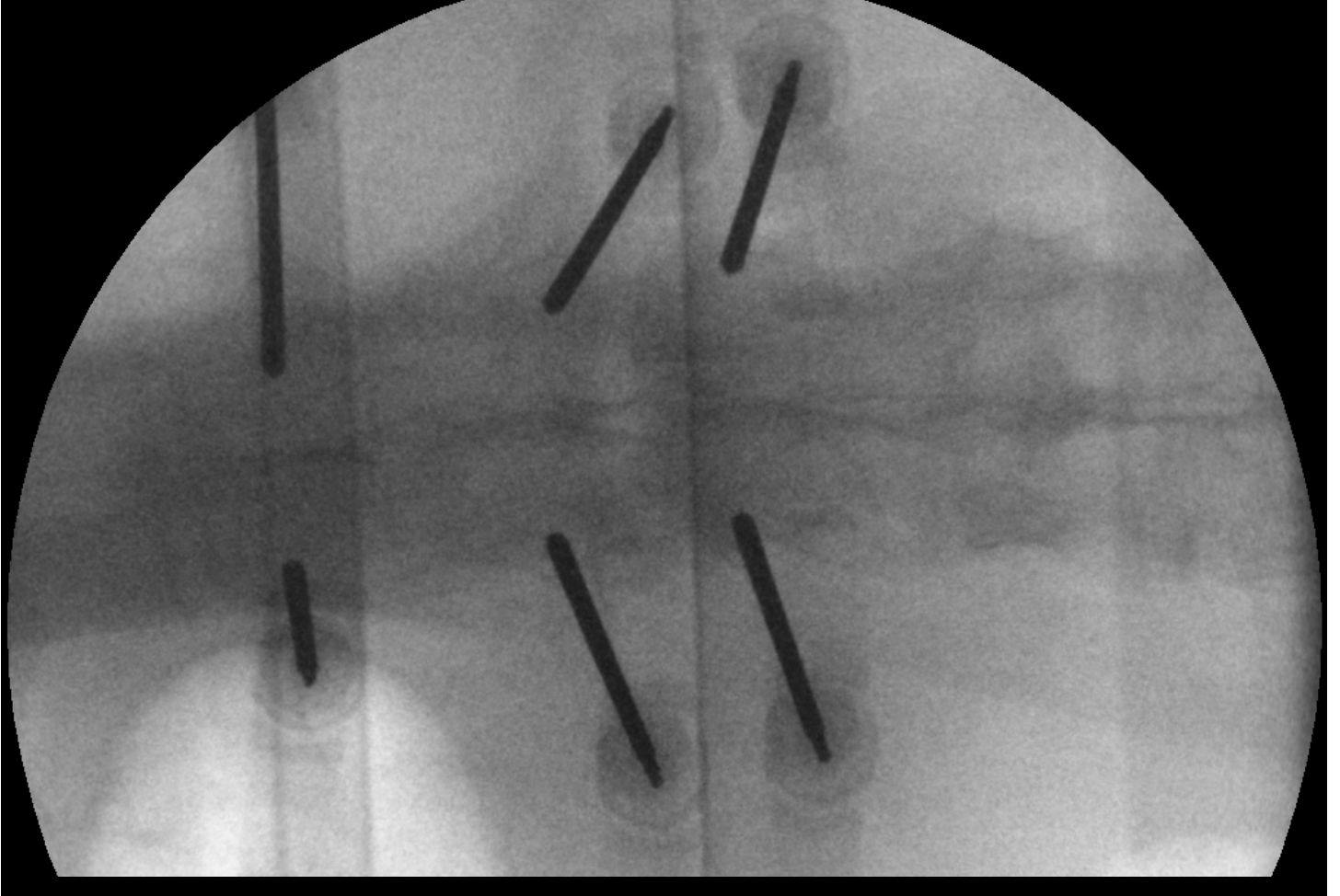
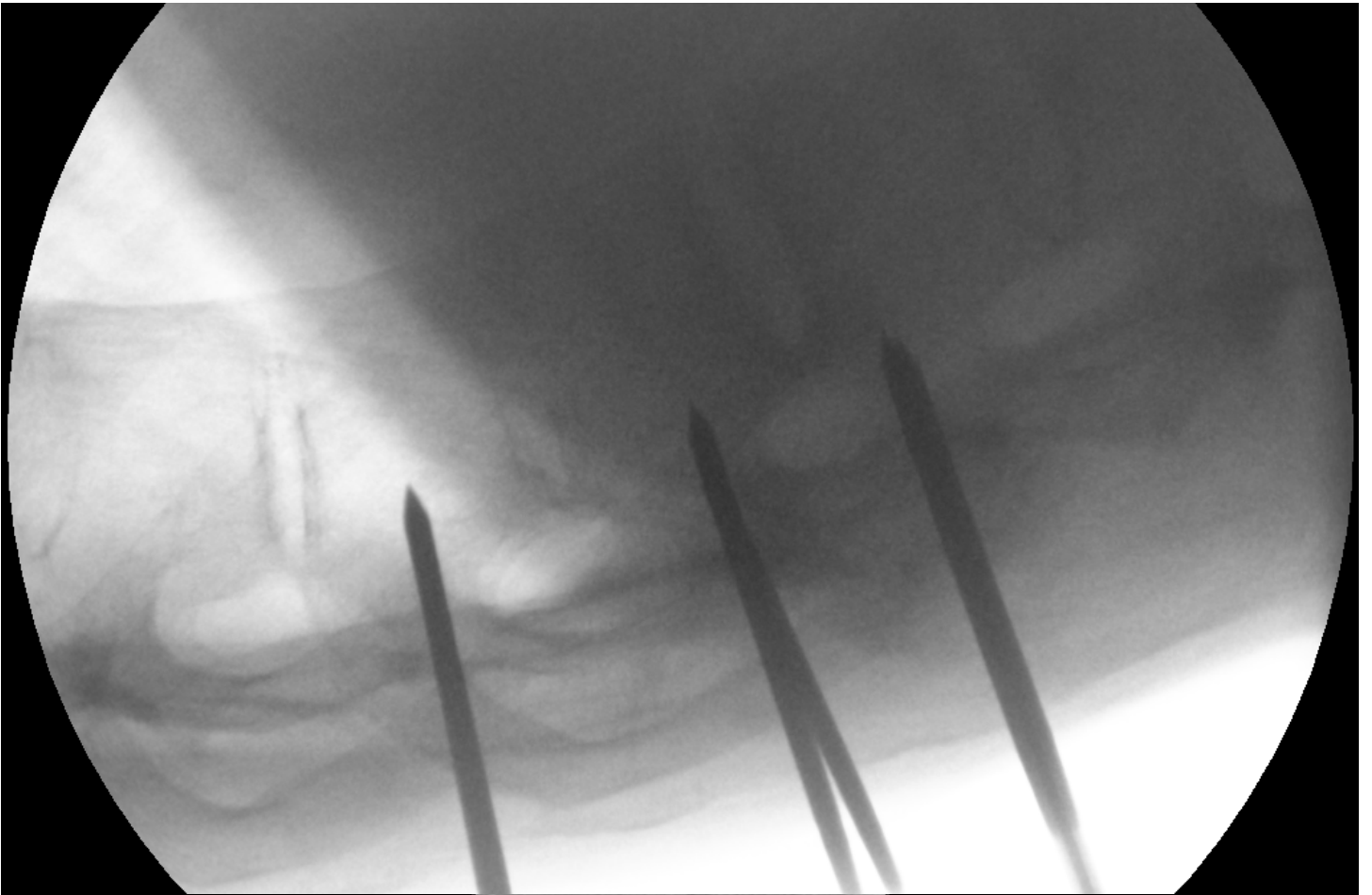
Greffe antérieure secondaire

Fracture sur spondylarthrite ankylosante





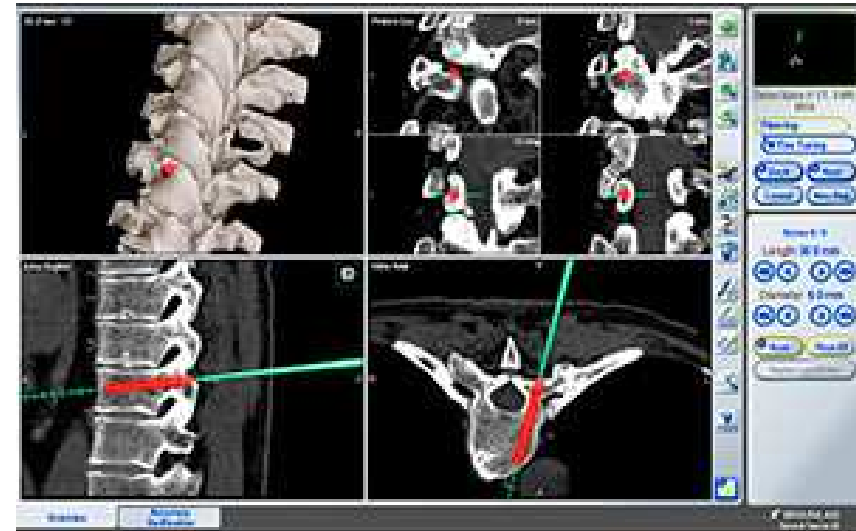


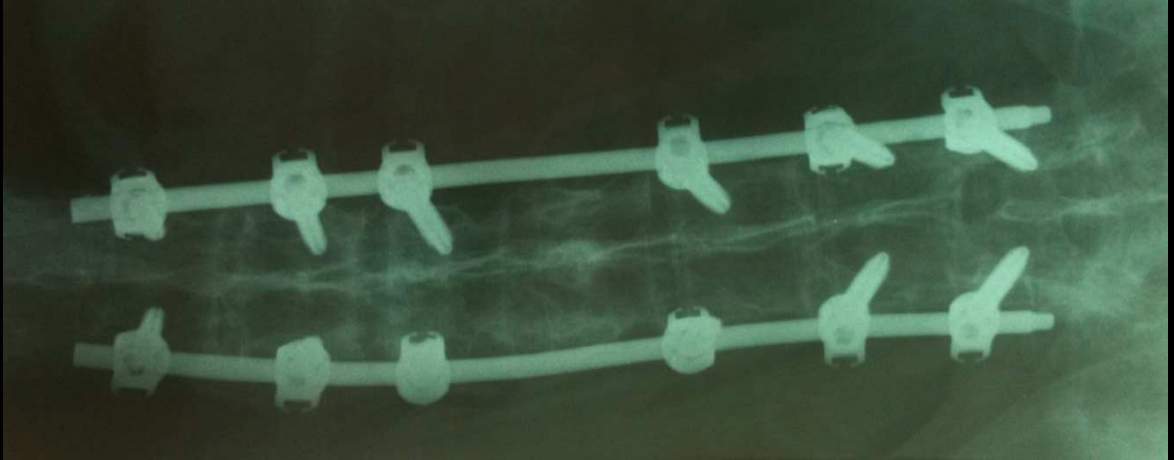
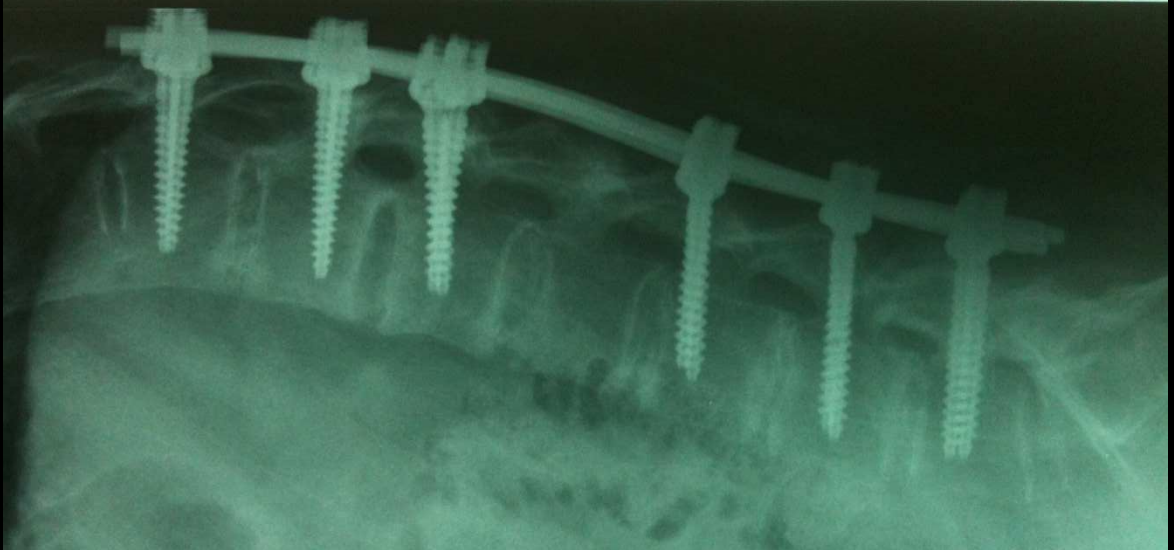
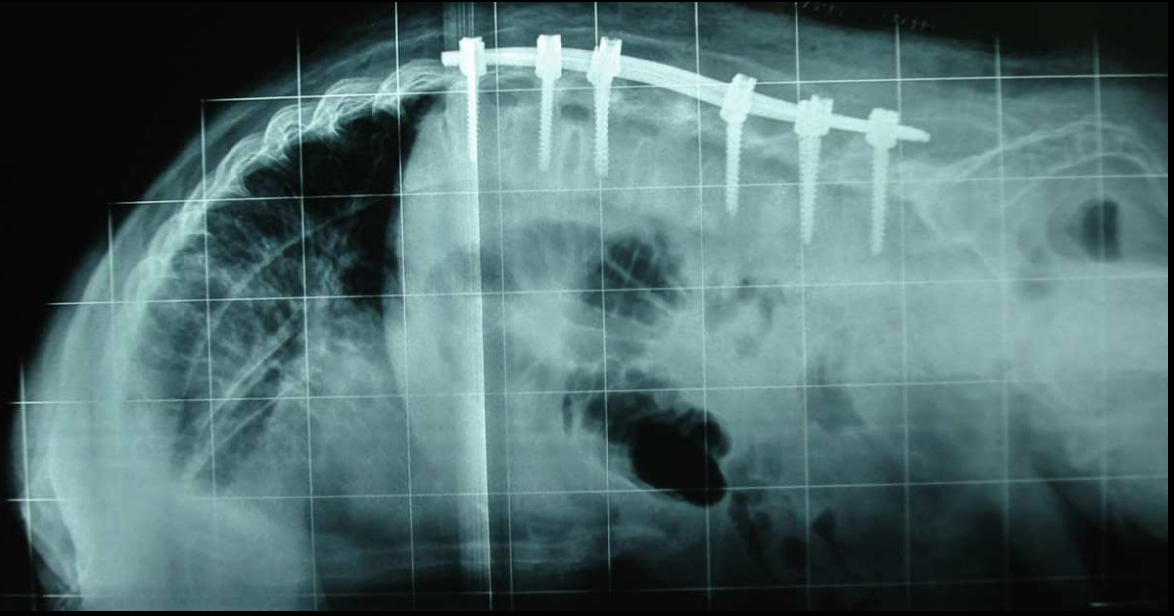


Scanner per-opératoire et navigation

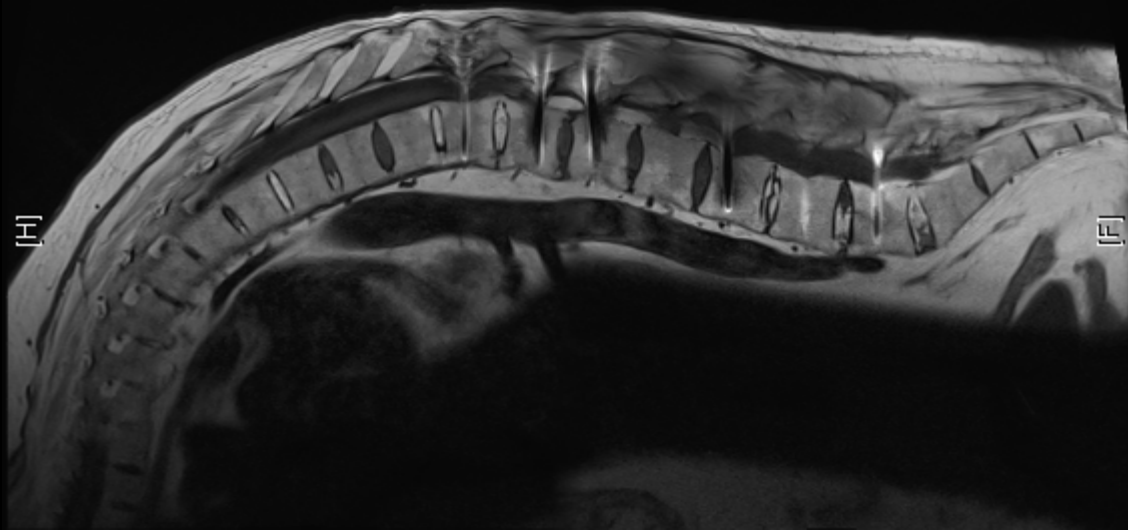
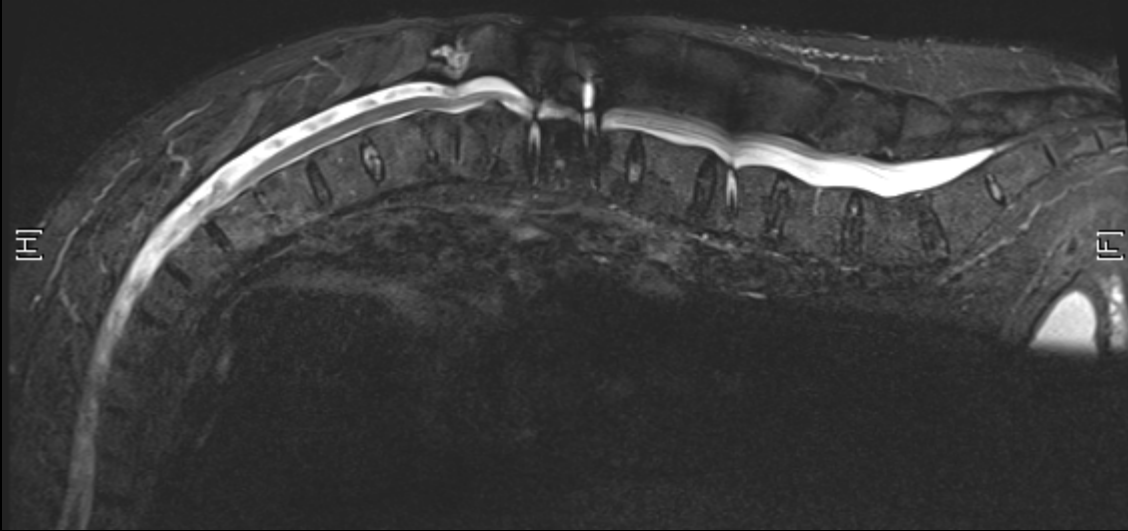
Précision de l'instrumentation

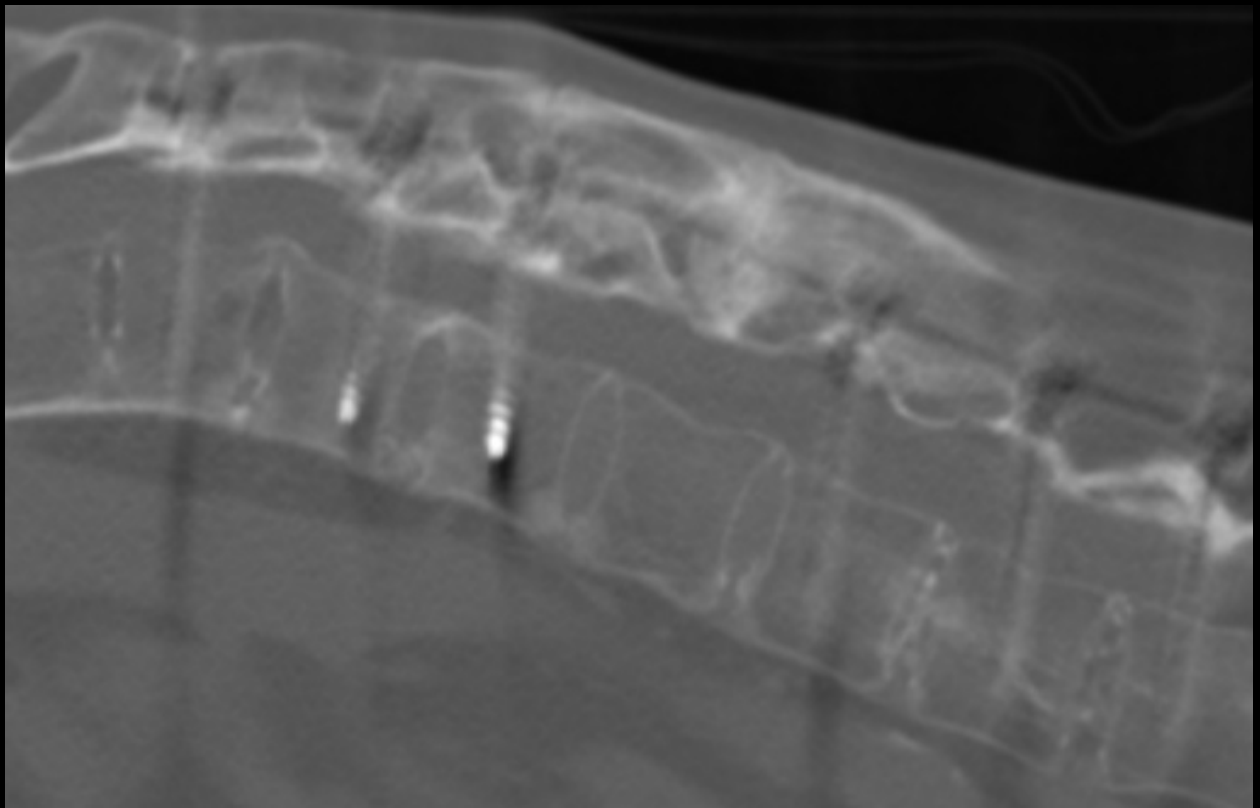
Absence d'irradiation IBODE et chirurgien











Conclusions

Ostéosynthèse percutanée adaptée à la majeure partie des fractures thoracolumbaires instables

Qualité de réduction et stabilisation identique aux techniques à ciel ouvert

Avantage de la faible morbidité et de la préservation musculaire

Réflexion sur la colonne antérieure: ciment ou greffe

Irradiation pour les techniques sous amplificateur de brillance

Utilisation actuelle de la navigation chirurgicale