Société de Pneumologie d'Île-de-France SPIF

AUTOUR DU POUMON : NERFS, MUSCLES ET PAROI

Samedi 24 mars 2018 – Espace du centenaire : 189 rue de Bercy 75012 Paris

Indications opératoires des scolioses et autres déformations rachidiennes

Pr Marc-Antoine Rousseau

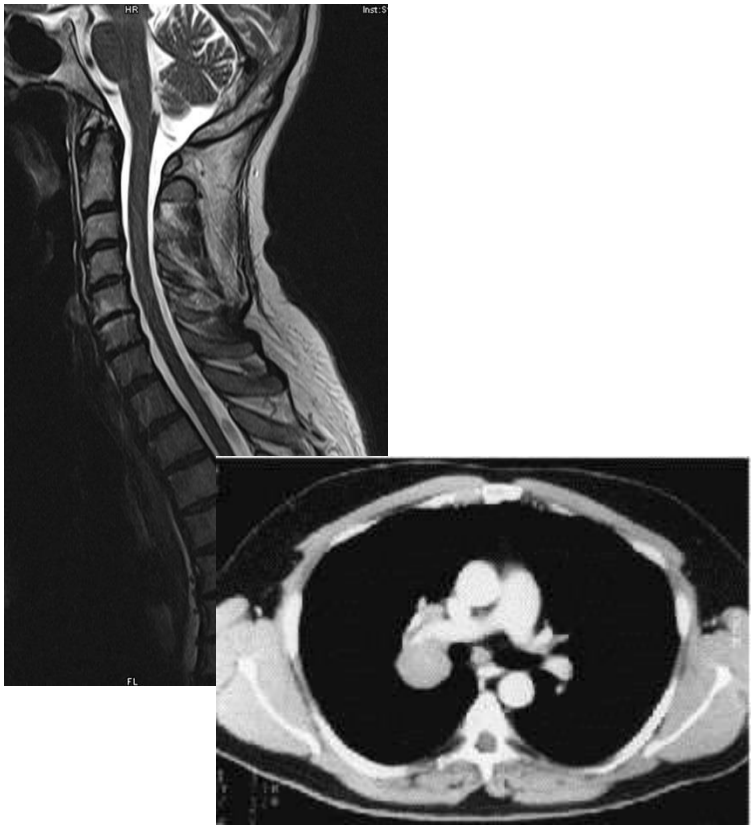
BICHAT BEAUJON ORTHOPÉDIE TRAUMATOLOGIE

ASSISTANCE PUBLIQUE HÔPITAUX DE PARIS

USPC Université Sorbonne Paris Cité

Rachis

CONTENU / CONTENANT



POSTURE / MOBILITE

Posture « normale »

lordose

cyphose

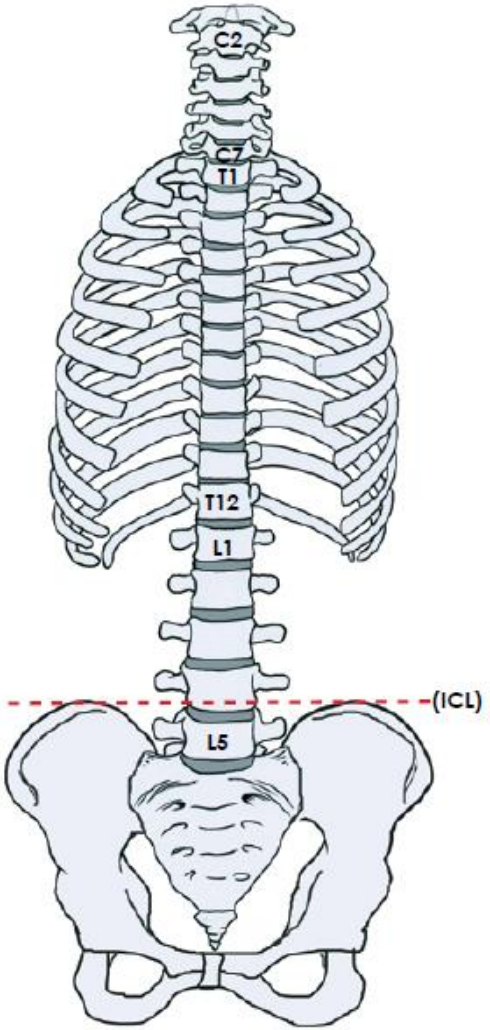
lordose

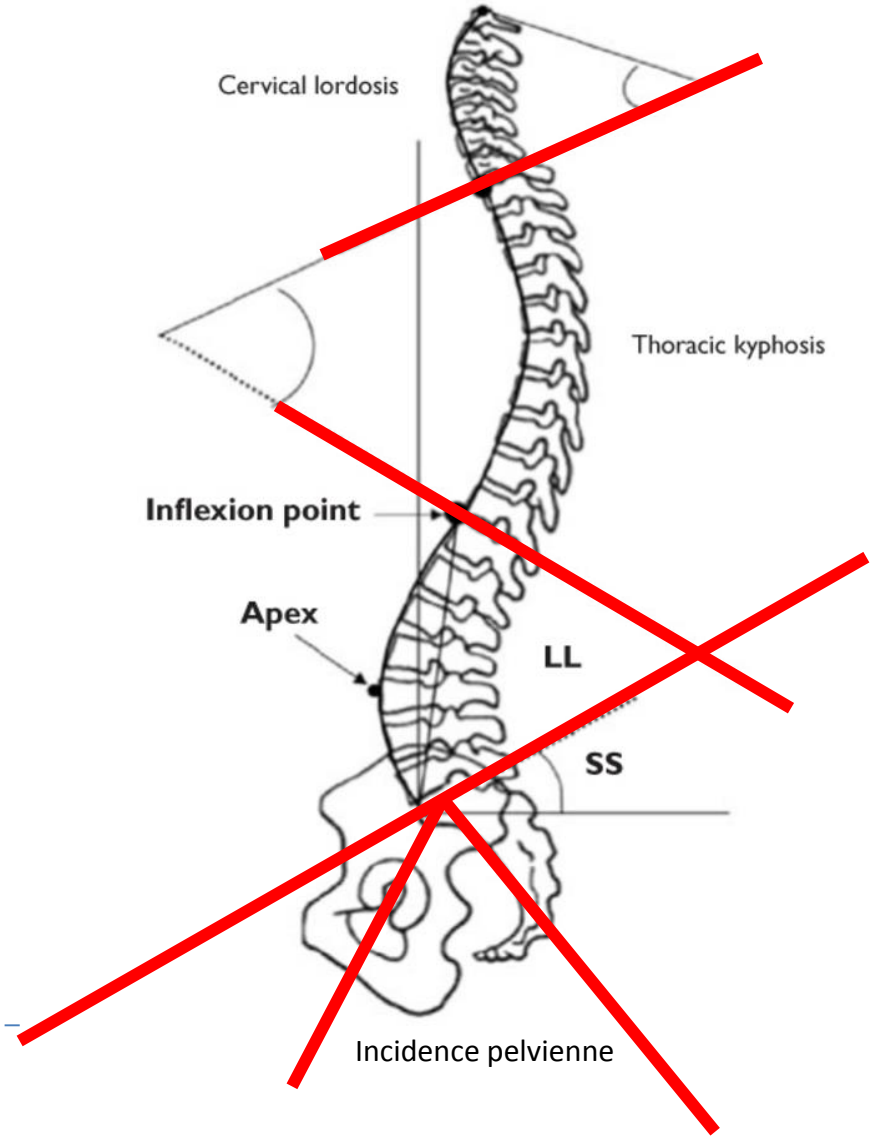
cervical

thoracique

lombaire

Relations entre les courbures





Équilibre sagittal

Déséquilibre sagittal

processus de vieillissement / évolution pathologique

Rétroversion du bassin

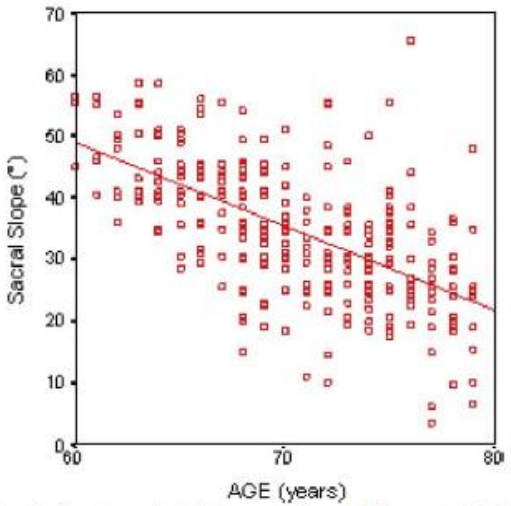
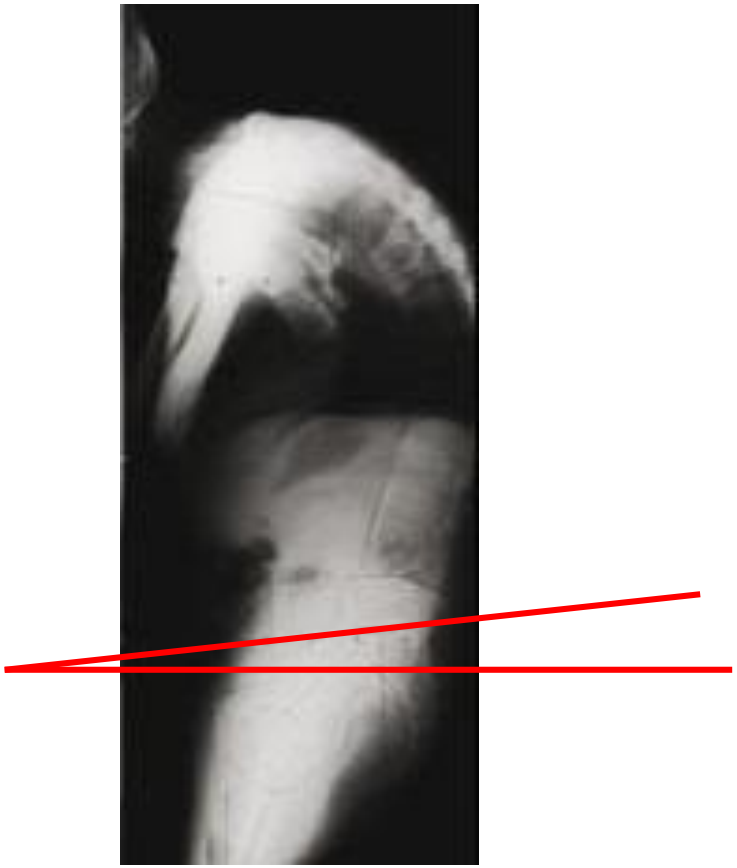
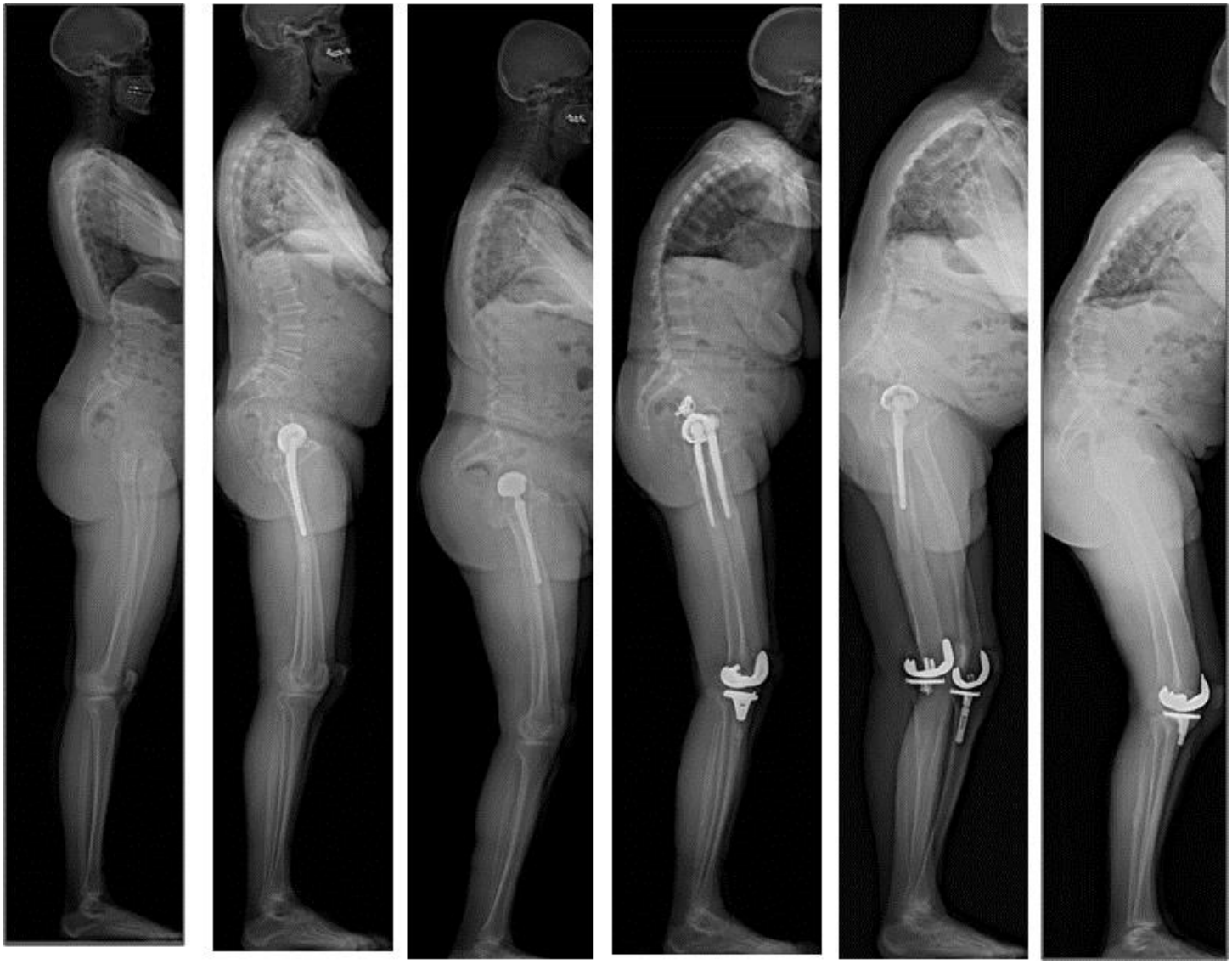


Fig. 3. Scatter plot between Sacral Slope and Age. Regression : Sacral Slope = 130 - 1.35 * Age (R^2 = 0.38, $P < .0001$).



[Optimization of total hip arthroplasty implantation: is the anterior pelvic plane concept valid?]

Rousseau MA, Lazennec JY, Boyer P, Mora N, Gorin M, Catonné Y. J Arthroplasty. 2009 Jan;24(1):22-6.

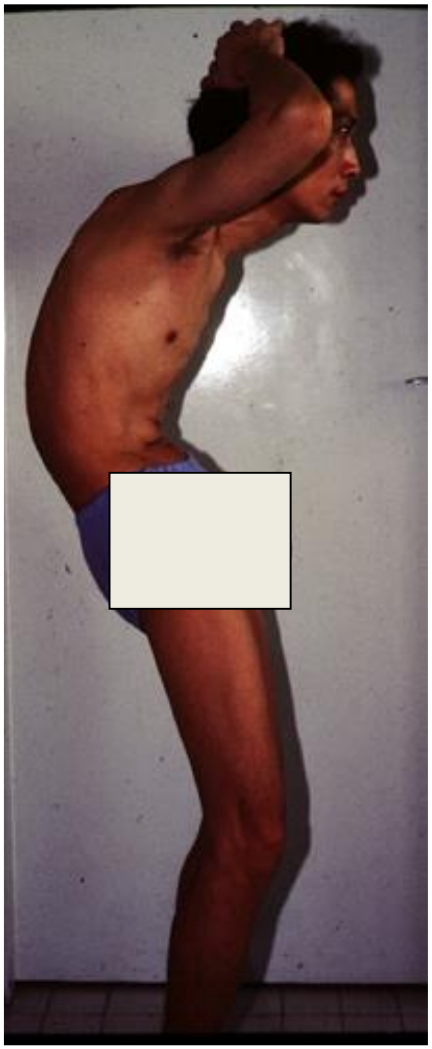


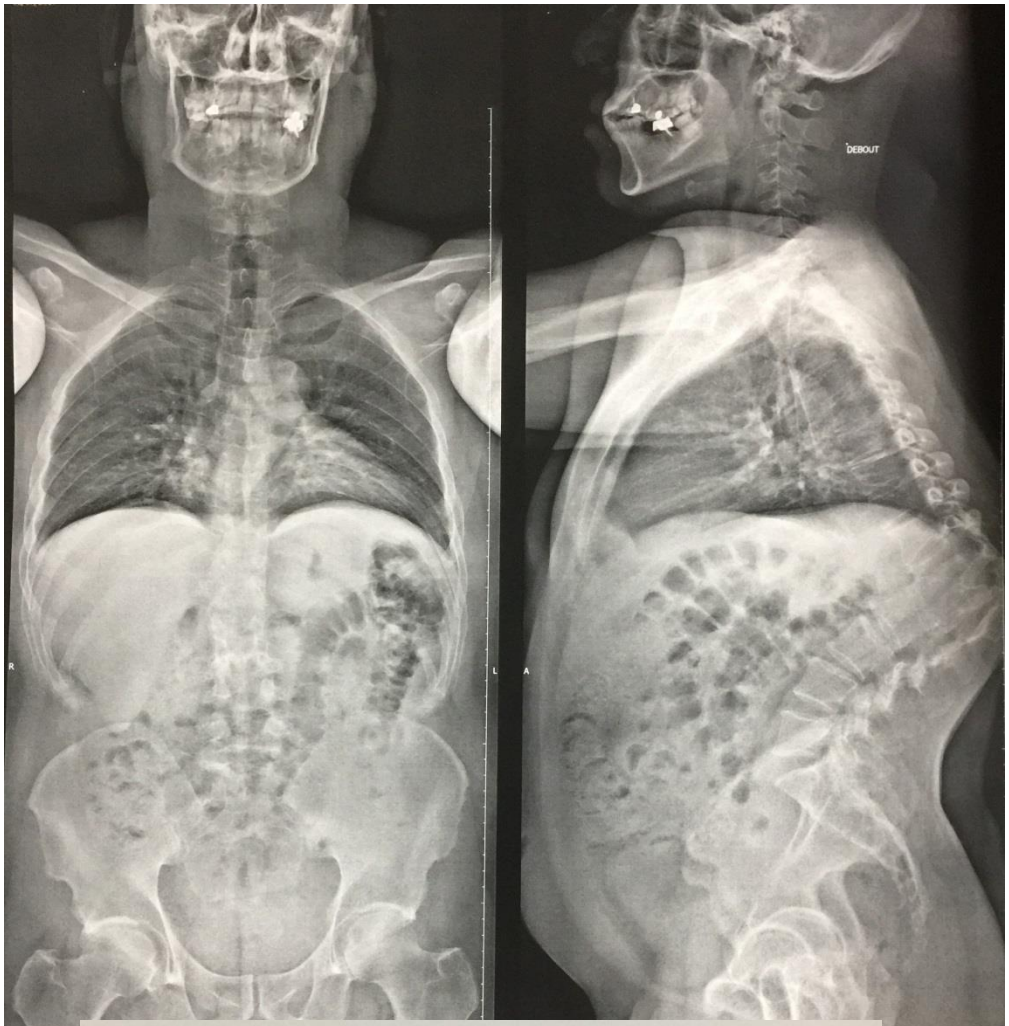
CAMPTOCORMIE

Retentissement musculaire

cyphoses rachidiennes

- Globale
  - Maladie de Scheuerman
  - Spondylarthrite ankylosante
- Locale
  - Fractures
  - Tumeur
  - Spondylite (Pott)





INDICATION

Bilan préopératoire.
Antécédents : déformation thoracique.
Tabac : 20 PA sevré.
Signes fonctionnels respiratoires : dyspnée d'effort.
Traitement : antalgiques.

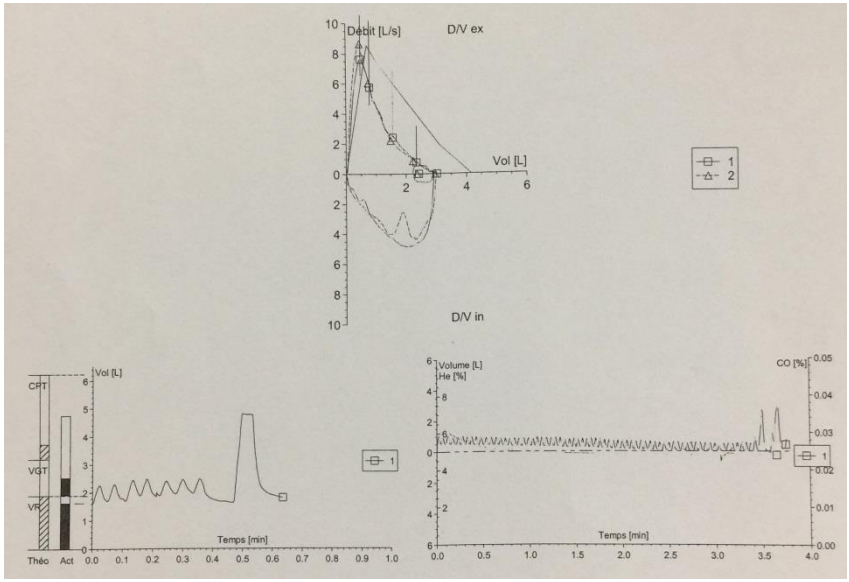
RESULTATS

On note une diminution de la capacité pulmonaire totale de 24 % et de la capacité vitale lente de 30 %. La courbe débit/volume est de type restrictif avec un VEMS bas à 70 % de la théorique non réversible sous Ventoline, mais le rapport de Tiffeneau est normal à 101 %. En revanche, il existe une diminution des débits expiratoires distaux partiellement réversible sous Ventoline.

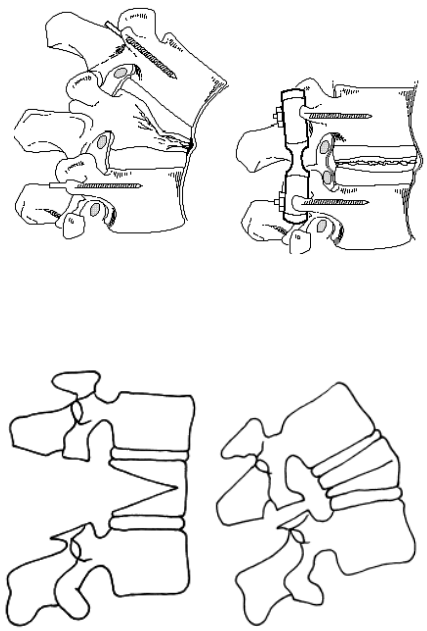
CONCLUSION

Examen de réalisation technique correcte.
Trouble ventilatoire restrictif amputant la capacité pulmonaire totale de 24 % assez à une obstruction distale partiellement réversible sous Ventoline.

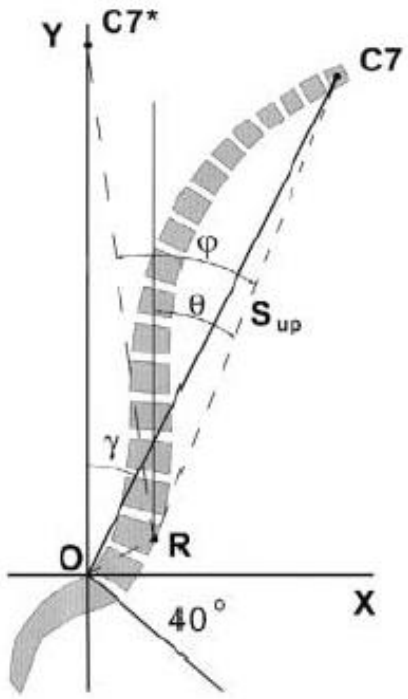
		Théo	Pré	%Pré/Théo	Post	%Post/Pré
Date			25/07/17		25/07/17	
Substance					VENTOLINE	
Dose					4	
CVF	[L]	4.16	3.02	73 %	2.96	-2 %
VEMS	[L]	3.44	2.42	70 %	2.35	-3 %
VEMS % CVF	[%]		80.21		79.40	-1 %
VEMS % CV IN	[%]	79.47	77.54	98 %	78.47	1 %
VEMS % CV EX	[%]	79.47	80.21	101 %	79.40	-1 %
DEP	[L/s]	8.55	7.63	89 %	8.66	14 %
DEM 75	[L/s]	7.40	5.75	78 %	6.04	5 %
DEM 50	[L/s]	4.65	2.43	52 %	2.22	-9 %
DEM 25	[L/s]	1.90	0.76	40 %	0.86	13 %
DEMM 25/75	[L/s]	4.09	1.98	48 %	1.85	-7 %
CVF IN	[L]	4.33	2.89	67 %	3.00	4 %
VIMS	[L]		2.84		2.89	2 %
DIM 50	[L/s]		4.20		4.03	-4 %
DEM 50 % DIM 50	[%]		57.73		55.01	-5 %
VIMS % CVF	[%]		98.41		96.63	-2 %
CV IN	[L]	4.33	3.13	72 %		
CV EX	[L]	4.33	3.02	70 %		
CI	[L]	3.03	2.83	93 %		
CRF-He	[L]	3.20	1.93	60 %		
VRE	[L]	1.30	0.30	23 %		
VR-He	[L]	1.90	1.63	85 %		
CPT-He	[L]	6.26	4.75	76 %		
VR % CPT-He	[%]	30.73	34.23	111 %		



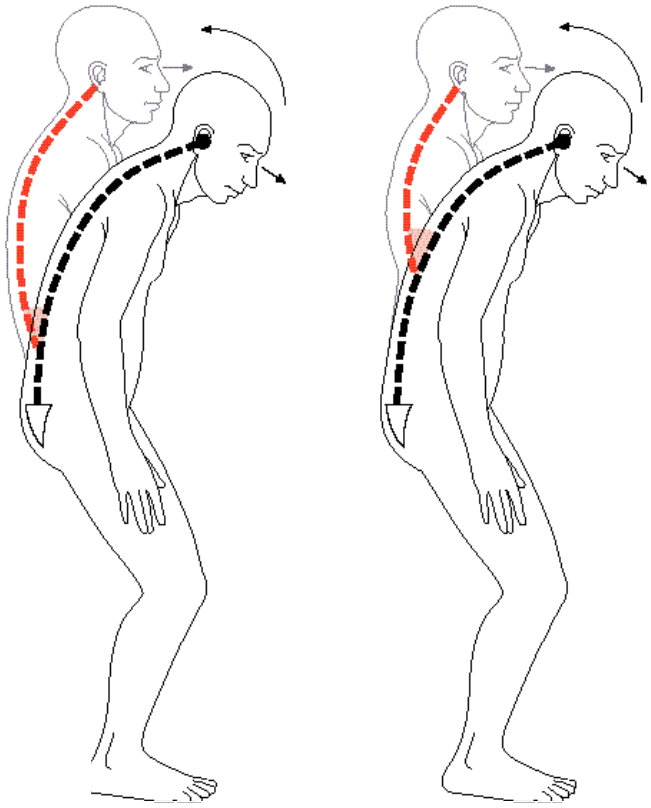
Ostéotomie vertébrale



Ostéotomie trans-pédiculaire
OTP

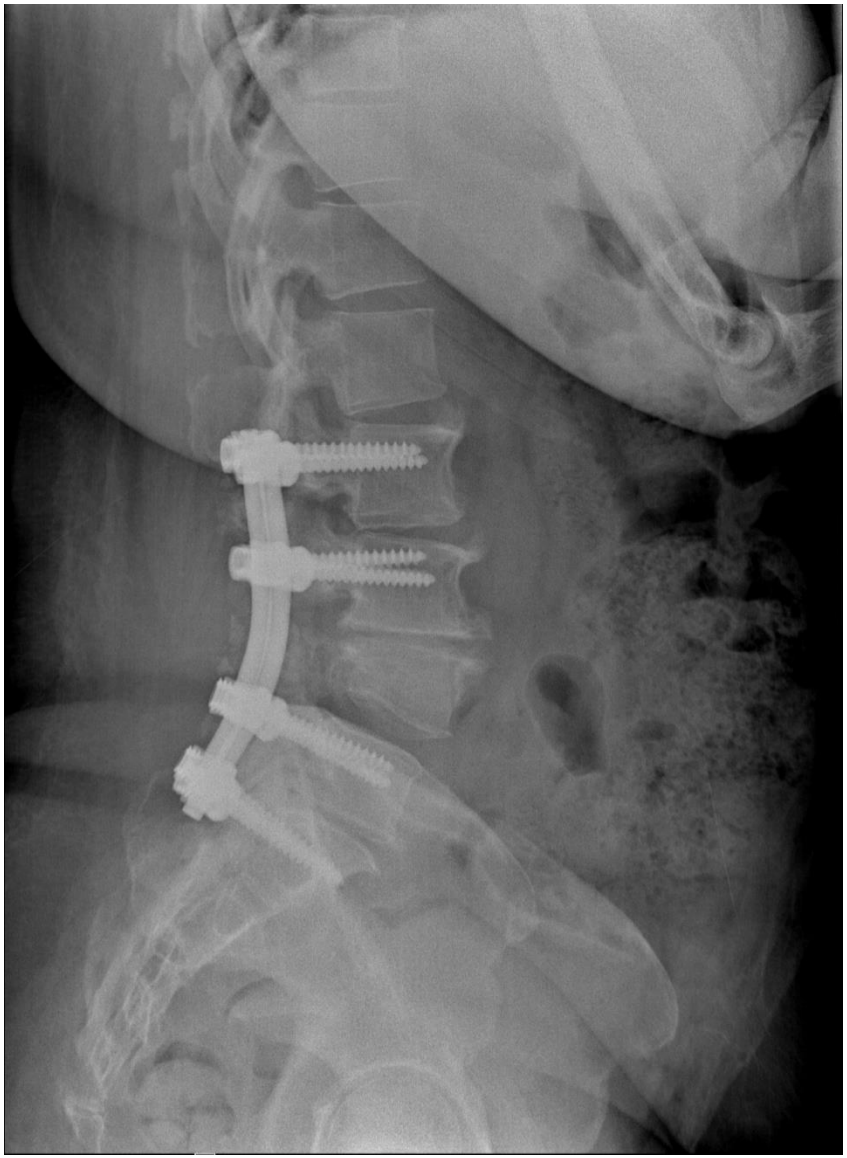


degré de correction

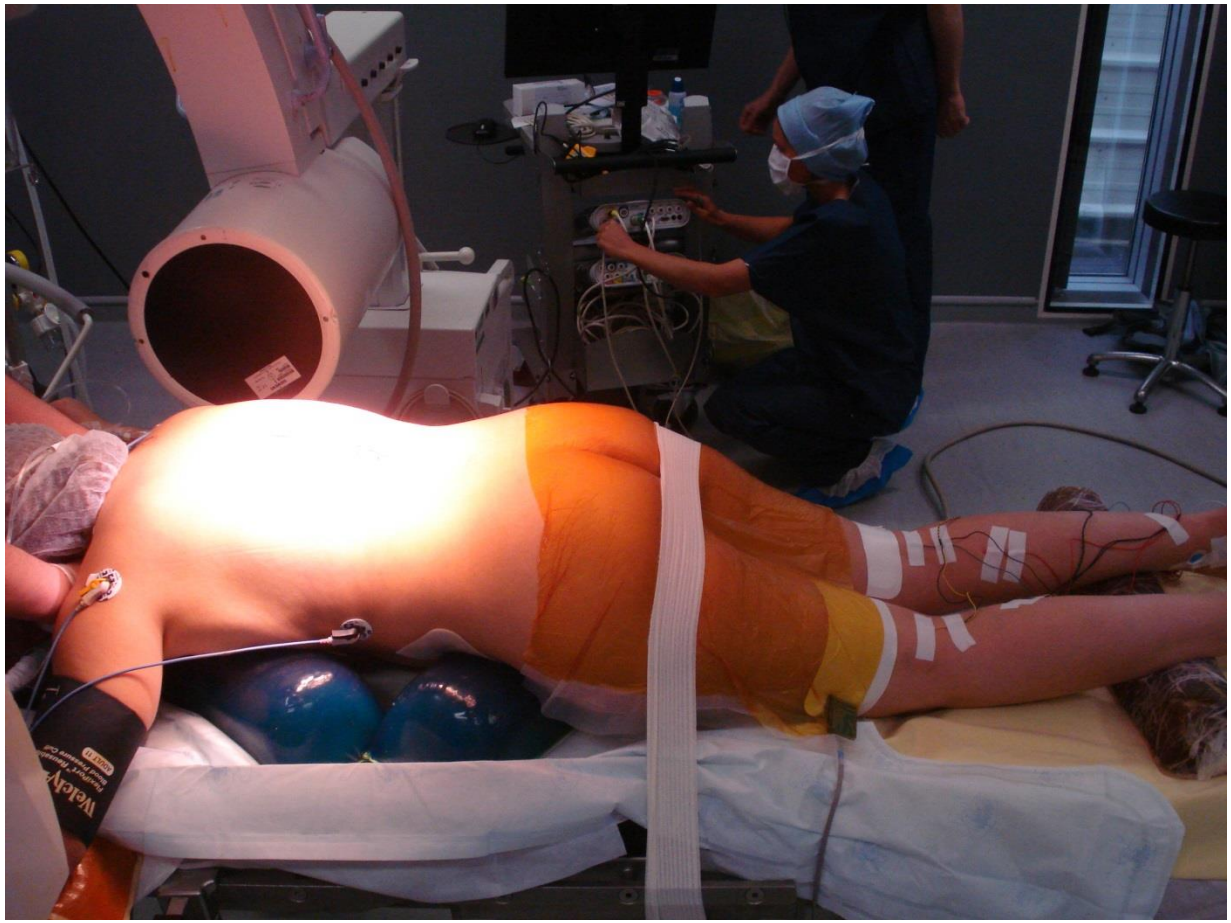


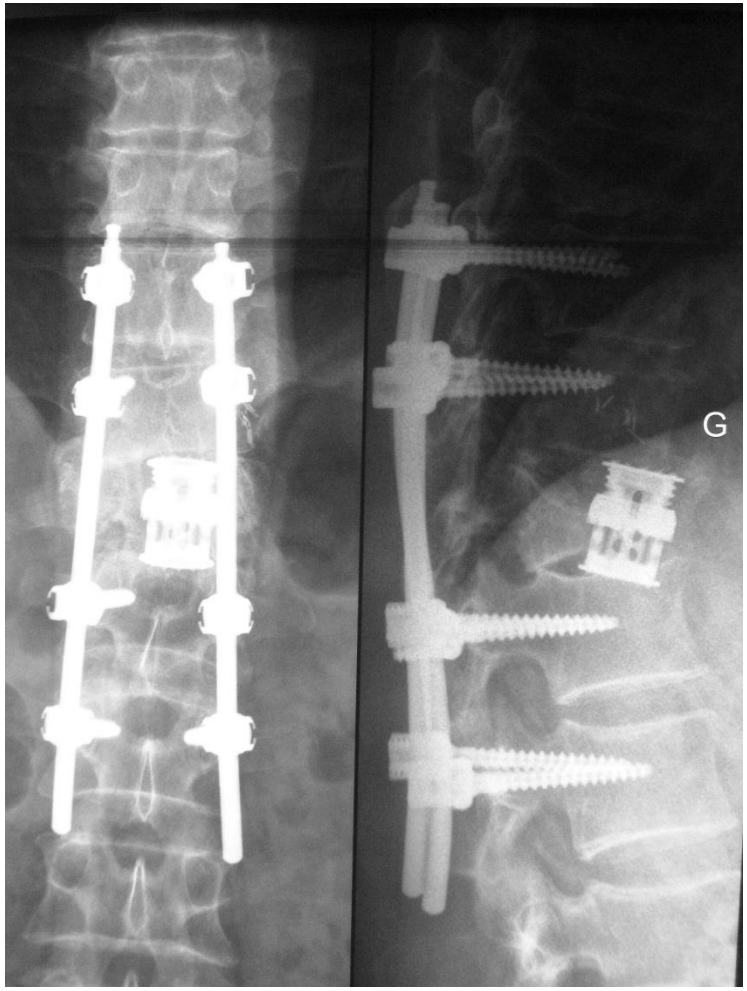
niveau

Sagittal rebalancing of the pelvis and the thoracic spine after pedicle subtraction osteotomy at the lumbar level.
Rousseau MA, Lazennec JY, Tassin JL, Fort D; Groupe d'Etude la Scoliose [French Scoliosis Study Group].
J Spinal Disord Tech. 2014 May;27(3):166-73.

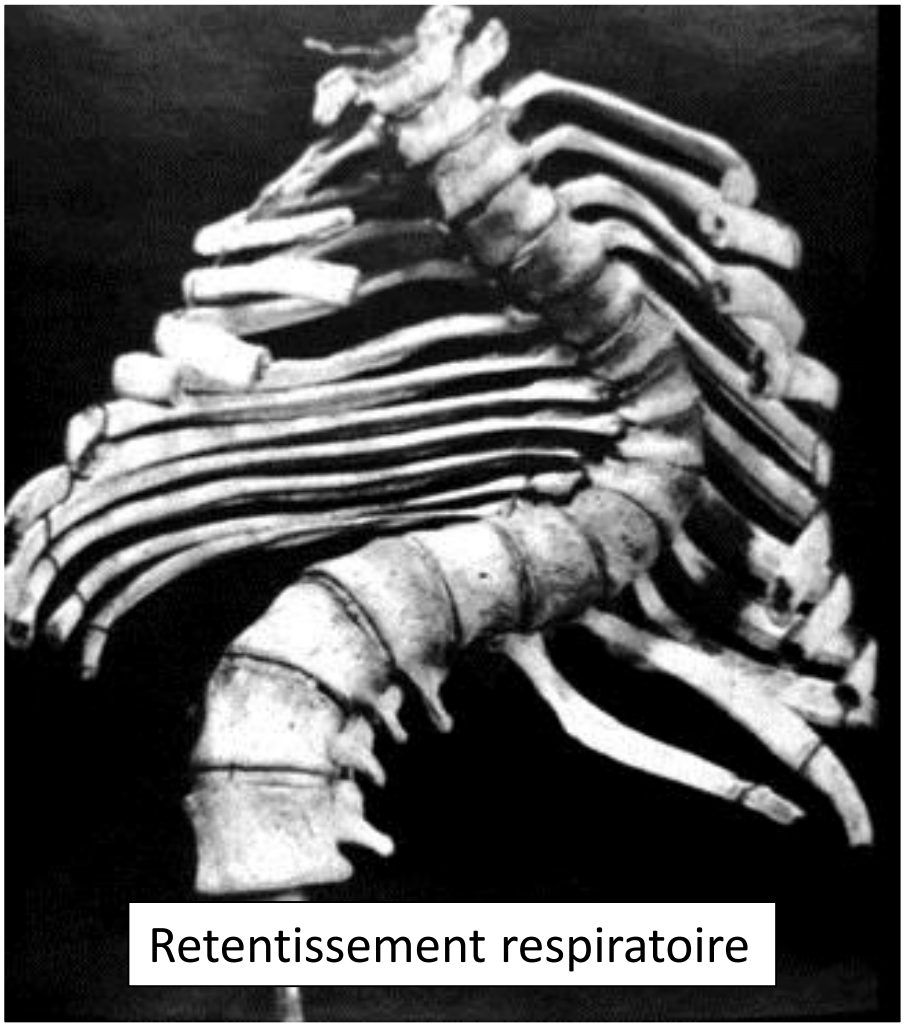
Potentiels Evoques peropératoire



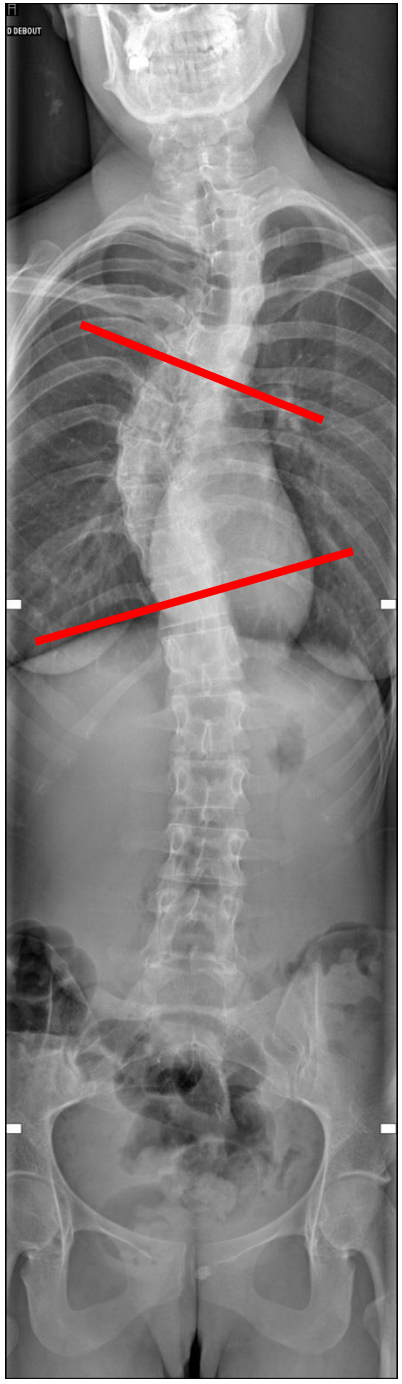

G

Déformation en 3D : la scoliose

Retentissement rachidien



Retentissement respiratoire



Pr MAL
Tel 01 40 87 52 74

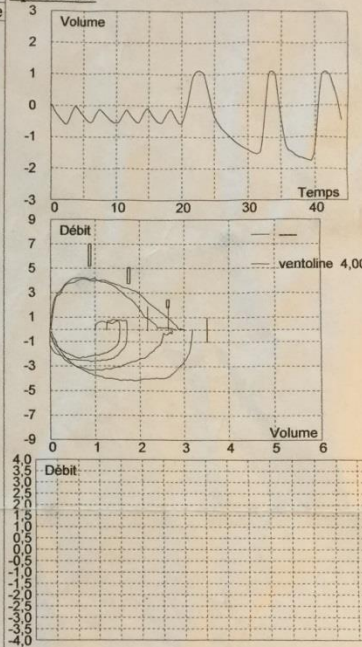
Numéro Identité : 104-2017
Date de naissance : 05/03/1991
Médecin Presc. : DR ATTOUCHE
Age : 26
Taille(cm) : 160
Poids(Kg) : 42
B.M.I. : 16,4

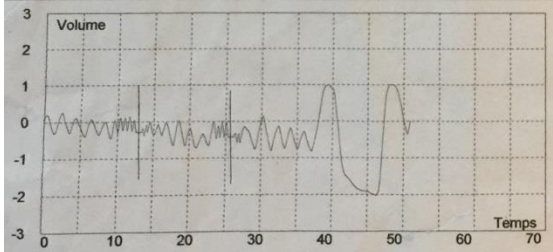
Spiro - Plethys

04/07/2017 10:56:03

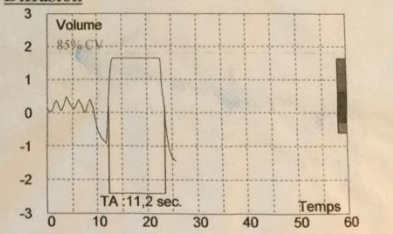
	Norme	Pré Mes.	Pré %Norme	Post Mes.	Post Dif. Pré%	Post %Norme
				ventoline 4,00		
CV(L)	3,55	2,84	80	---	---	---
VRI(L)	---	---	---	---	---	---
VRE(L)	---	1,17	---	---	---	---
CI(L)	---	1,70	---	---	---	---
CVF(L)	3,51	2,81	80	3,01	7	86
VEMs(L)	3,06	2,31	76	2,66	15	87
VEMs/CVF(%)	83,94	82,34	98	88,20	7	105
VEMs/CV(%)	83,94	81,30	97	---	---	---
DEP(L/S)	6,90	4,27	62	4,14	-3	60
DEM(L/S)	4,03	2,93	73	3,42	17	85
D25(L/S)	2,13	1,10	52	2,05	87	96
D50(L/S)	4,42	3,58	81	3,65	2	83
D75(L/S)	6,09	4,27	70	4,13	-3	68
VIMs(L)	---	0,27	---	2,88	955	---
RAW(cmH2O/L/S)	1,47	---	---	---	---	---
GAW(L/S*cmH2O)	0,68	---	---	---	---	---
SRAW(cmH2O*s)	4,34	---	---	---	---	---
FR (raw)(#/min)	---	---	---	---	---	---
VGT(L)	2,62	3,10	119	---	---	---
VR(L)	1,32	1,44	109	---	---	---
CPT(L)	4,77	4,48	94	---	---	---
CV (cpi)(L)	3,55	3,03	86	---	---	---
VR/CPT(%)	27,91	32,20	115	---	---	---
DLCO(mL/mmHg/Mi)	27,04	24,01	89	---	---	---
KCO(DLCO/L)	5,67	4,28	75	---	---	---
DLCO cor(mL/mmHg/Mi	27,04	24,01	89	---	---	---
KCO cor(DLCO/L)	5,67	4,28	75	---	---	---
VA(L)	4,77	5,61	118	---	---	---

Spiro lente





Diffusion



Commentaires

. Pas de trouble ventilatoire restrictif.
. DLCO normale
. Pas de trouble ventilatoire obstructif, cependant on observe une amélioration des débits sous B_2

Medi soft Exp'air 1.28.

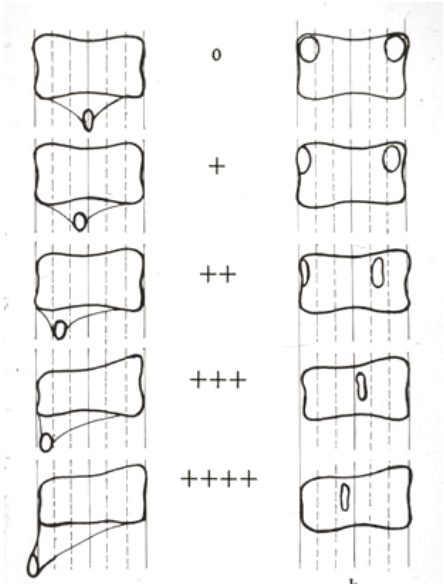
Dépister la scoliose

Cliniquement : **GIBBOSITE**

Diagnostic positif

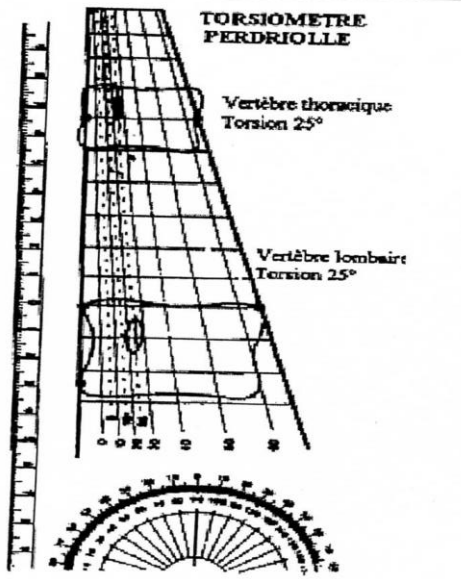
Définition : **ROTATION VERTEBRALE**

Cotrel Nash & Moe



en grades

Perdriolle



en degré

(persiste sur une radio allongé)

Attitude scoliotique

Pas de rotation

Inégalité de longueur des membres inférieurs

Caractériser la scoliose

Type de courbure	apex
Cervicale	C1 – C6
Cervico-thoracique	C7 – T1
Thoracique	T2 – T11
Thoraco-lombaire	T12 – L1
Lombaire	L2 – L4
Lombo-sacrée	L5 – S1

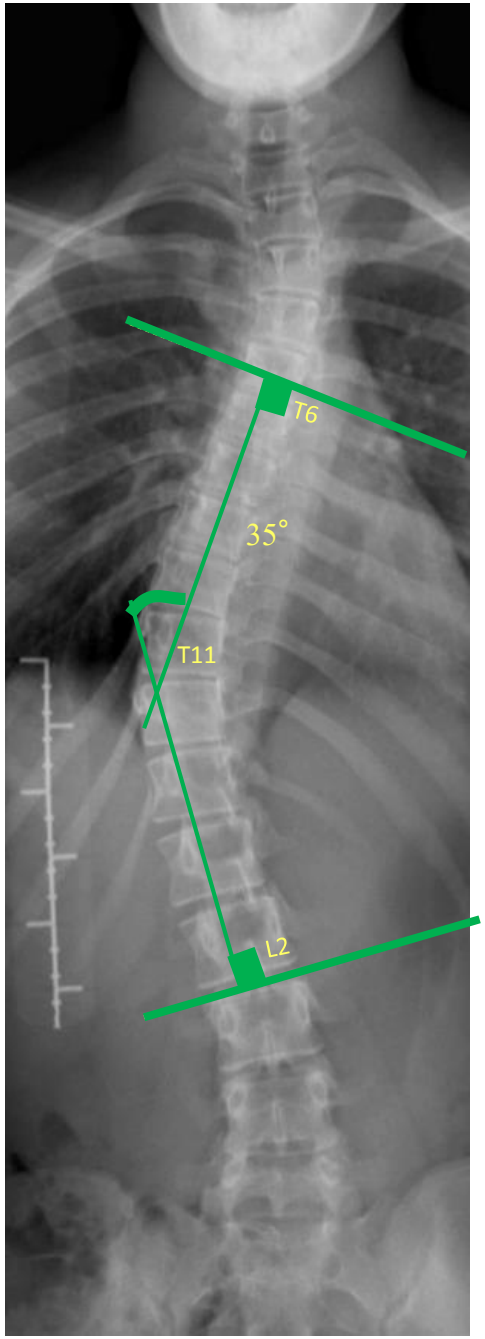
siège / coté

Caractériser la scoliose

Angle de **COBB**

Offset frontal

Angle ilio-lombaire



Télérachis / EOS

Caractériser la scoliose

Face **ET** Profil

Cyphose rotatoire

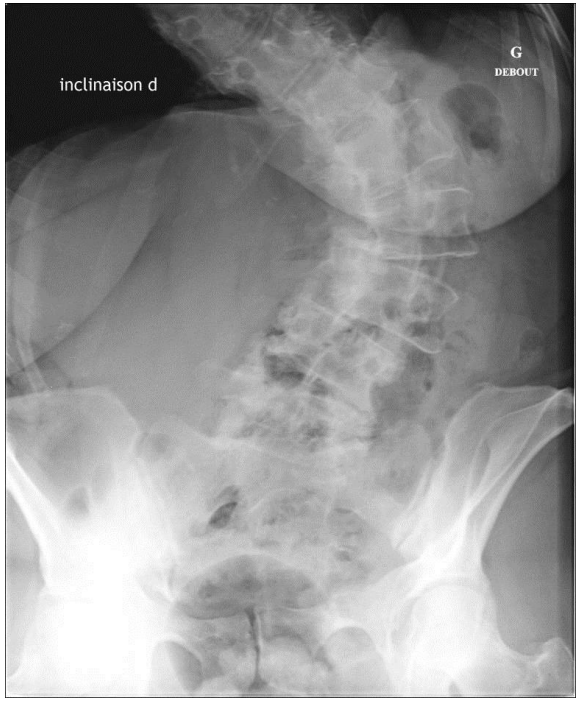
Cyphose jonctionnelle

Caractériser la scoliose

Bilan de <u>réductibilité</u>

clinique

radiologique



The Lenke Classification:
Technique for Analysis and Classification of AIS

Bending measurements in parentheses on x-ray images

TYPE 1 MT

TYPE 2 DT

TYPE 3 DM

TYPE 4 TM

TYPE 5 TL/L

TYPE 6 TL/L-MT

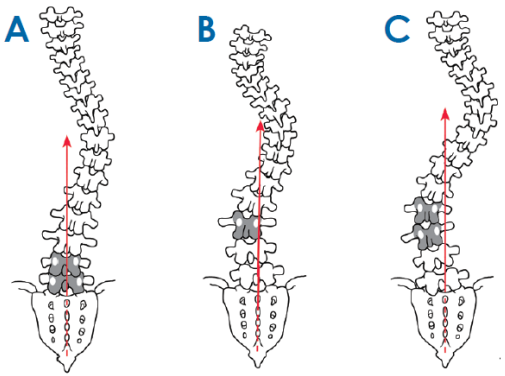
Type	Proximal Thoracic	Main Thoracic	Thoracolumbar/Lumbar	Curve Type
1	Non-Structural	Structural (Major*)	Non-Structural	Main Thoracic (MT)
2	Structural	Structural (Major*)	Non-Structural	Double Thoracic (DT)
3	Non-Structural	Structural (Major*)	Structural	Double Major (DM)
4	Structural	Structural (Major*)	Structural (Major*)	Triple Major (TM) §
5	Non-Structural	Non-Structural	Structural (Major*)	Thoracolumbar/Lumbar (TL/L)
6	Non-Structural	Structural	Structural (Major*)	Thoracolumbar/Lumbar-Main Thoracic (TL/L – MT)
Minor Curve Structural Criteria	Side Bending Cobb ≥ 25° T2-T5 Kyphosis ≥ +20°	Side Bending Cobb ≥ 25° T10-L2 Kyphosis ≥ +20°	Side Bending Cobb ≥ 25° T10-L2 Kyphosis ≥ +20°	

*Major = Largest Cobb measurement – always structural.
Minor = All other curves – may be structural or non-structural.

	Coronal S.B.	Sagittal
PT	≥ 25°	≥ +20° (T2-T5)
MT	≥ 25°	≥ +20° (T10-L2)
TL/L	≥ 25°	≥ +20° (T10-L2)

Minor Curve Structural Criteria

Lumbar Modifier (A,B,C)

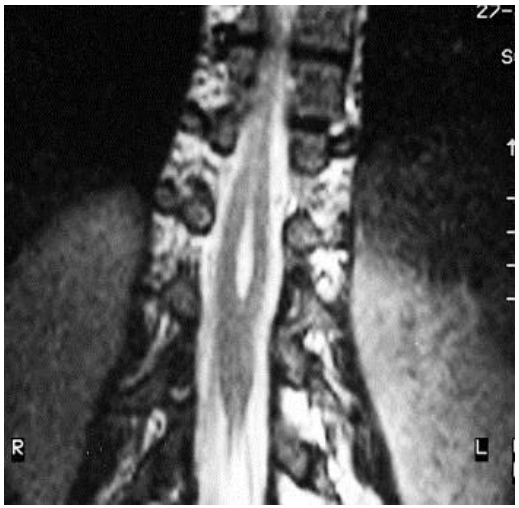


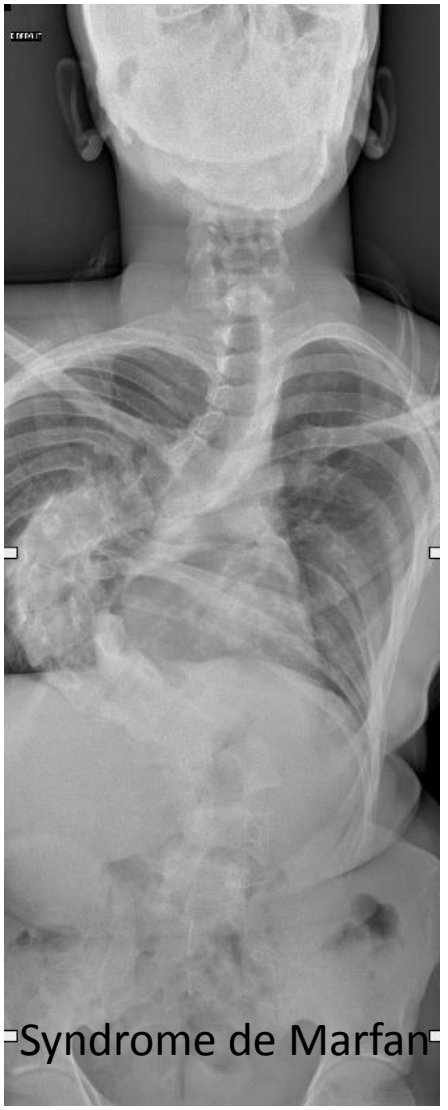
Sagittal Thoracic Modifier (–, N, +)

Thoracic Sagittal Profile T5-T12	
– (Hypo)	< +10°
N (Normal)	+10° - +40°
+ (Hyper)	>+40°

Caractériser la scoliose

- Scoliose secondaire
  - Malformation
  - Neuropathie
  - Myopathie





Syndrome de Marfan

Caractériser la scoliose

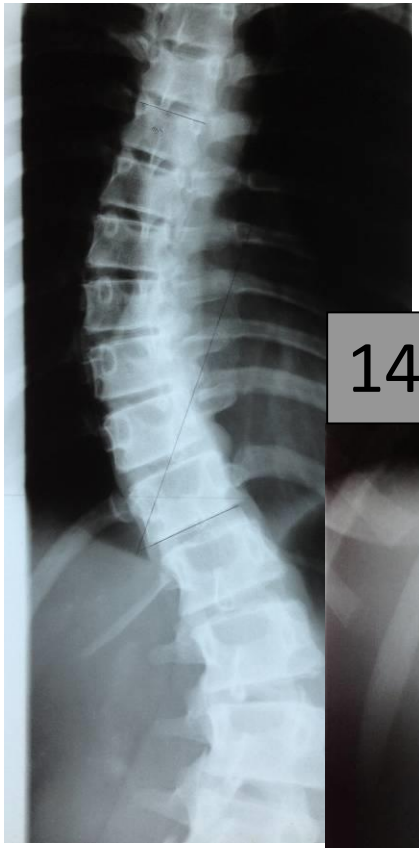
- Scoliose idiopathique de l'adulte (SIA)

évolution de la scoliose idiopathique de l'enfant et l'adolescent

Calssification de Cotrel	Age de découverte
Infantile	< 3 ans
Juvénile 1	3 – 7 ans
Juvénile 2	7 – 11 ans
Juvénile 3	11 ans - PR
Adolescence	> PR

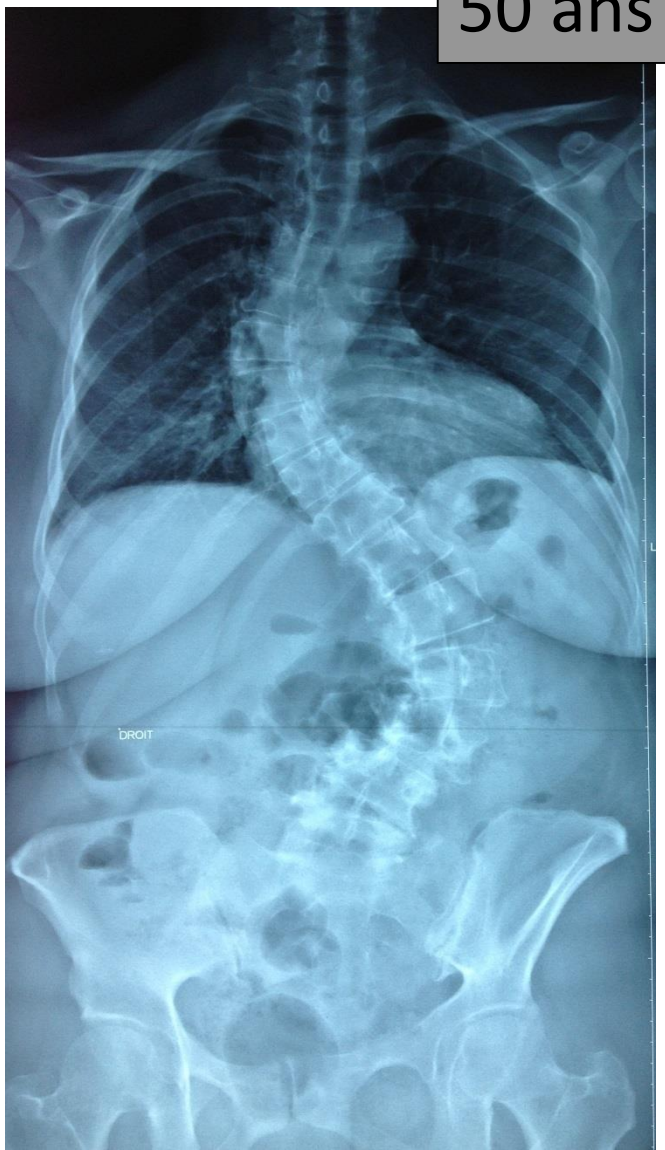
- Scoliose dégénérative (de novo)

Origine : adolescence



14 ans

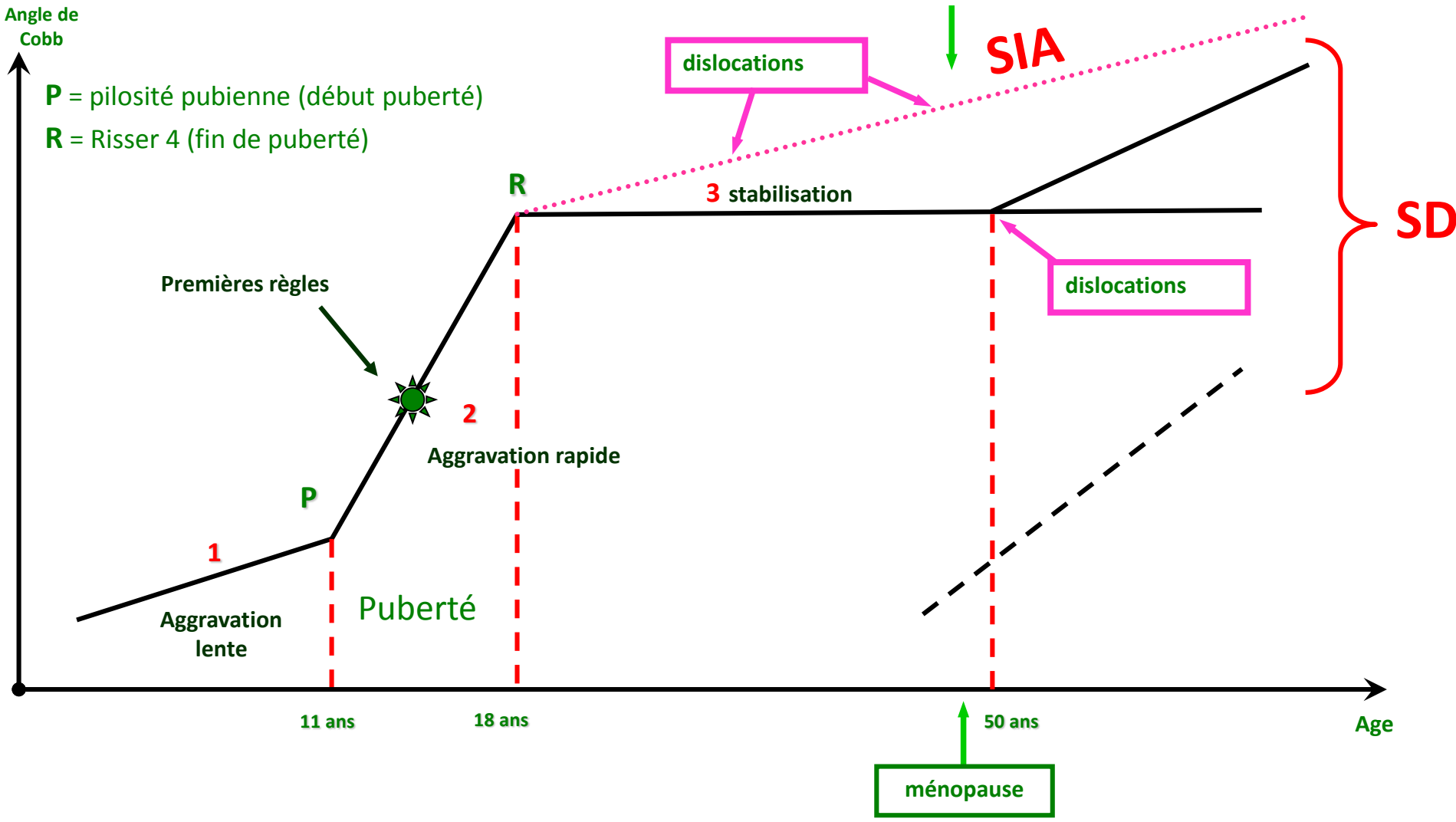
50 ans



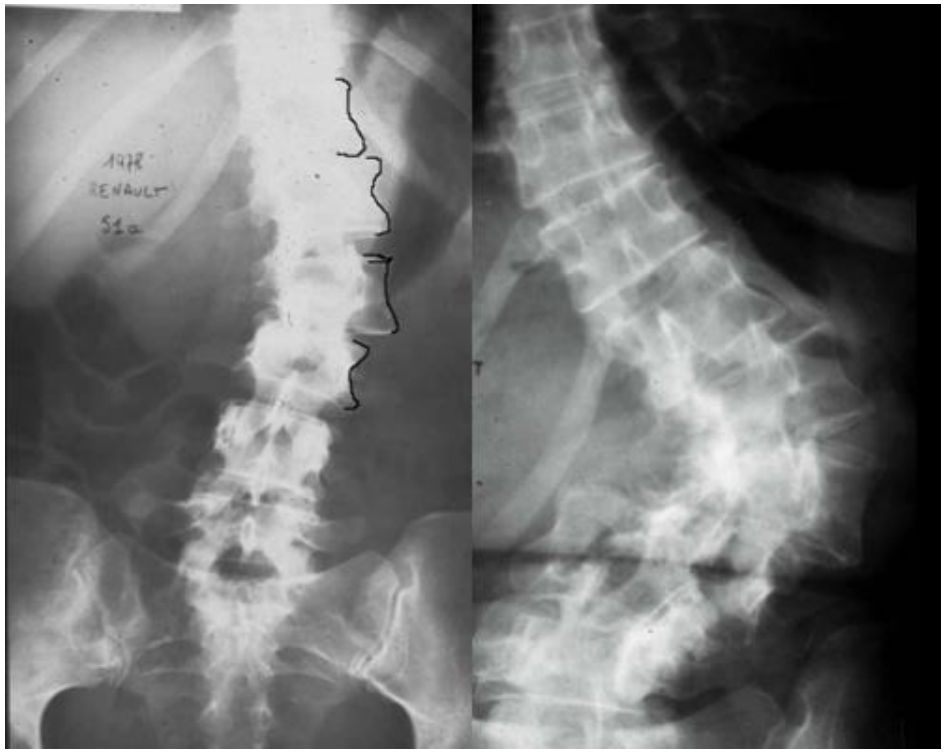
Origine :de novo

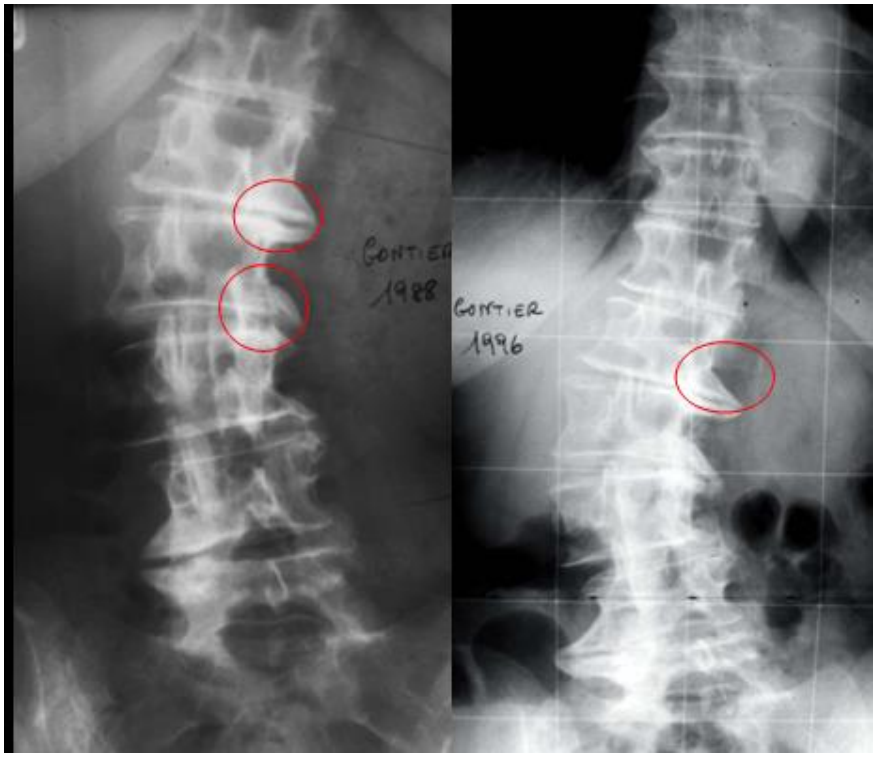
Courbe évolutive à l'adolescence G.DUVAL-BEAUPERE

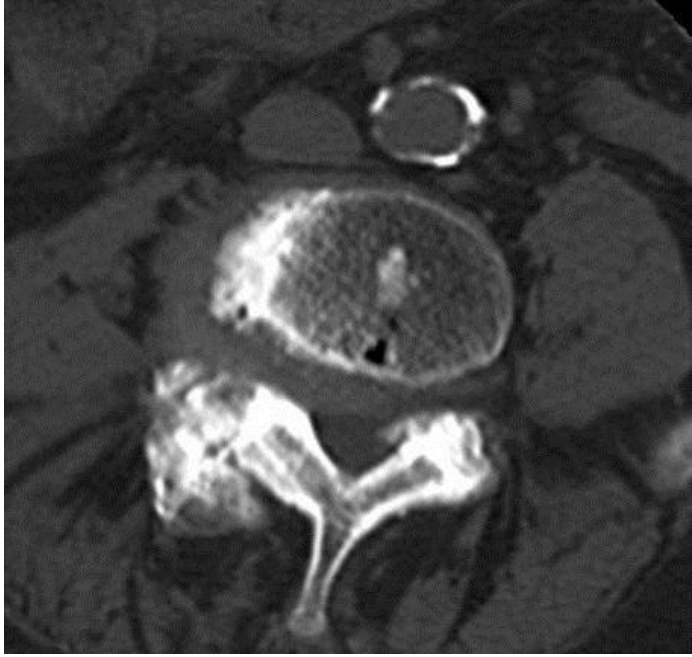
Courbe évolutive à l'âge adulte C.MARTY

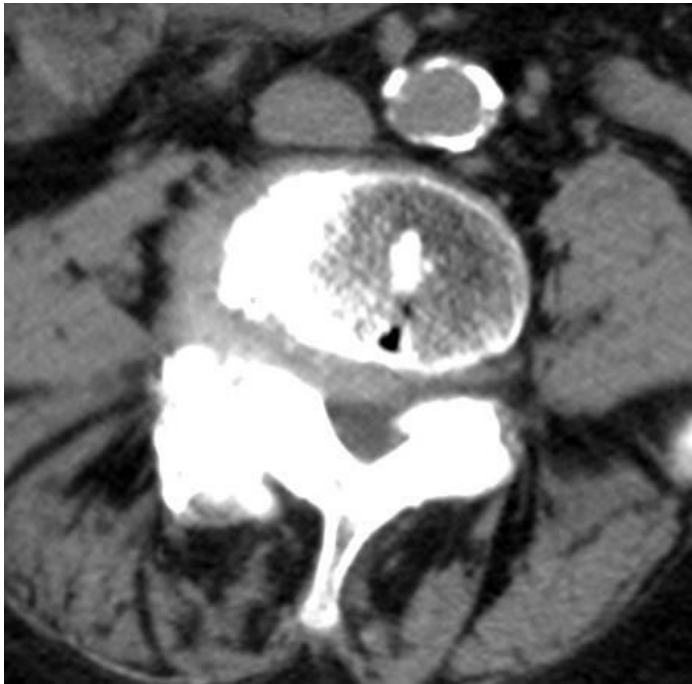


Arthrose









Décompensation avec la sénescence

- Dégénérescence
  - Ligaments
  - Muscles
  - Os
  - Poids

Dislocation rotatoire

Fermeture de l’angle ilio-lombaire

Déséquilibre

Clinique : signes fonctionnels

- Lombalgie
  - Discopathies
  - Articulaires postérieures
  - Déséquilibre frontal
- fatigabilité « mécanique » des MI
  - Déséquilibre sagittal
- Radiculopathie / claudication neurogène
  - Sténose dégénérative
  - Étirements / pincements « mécaniques »

Oswestry Disability Index

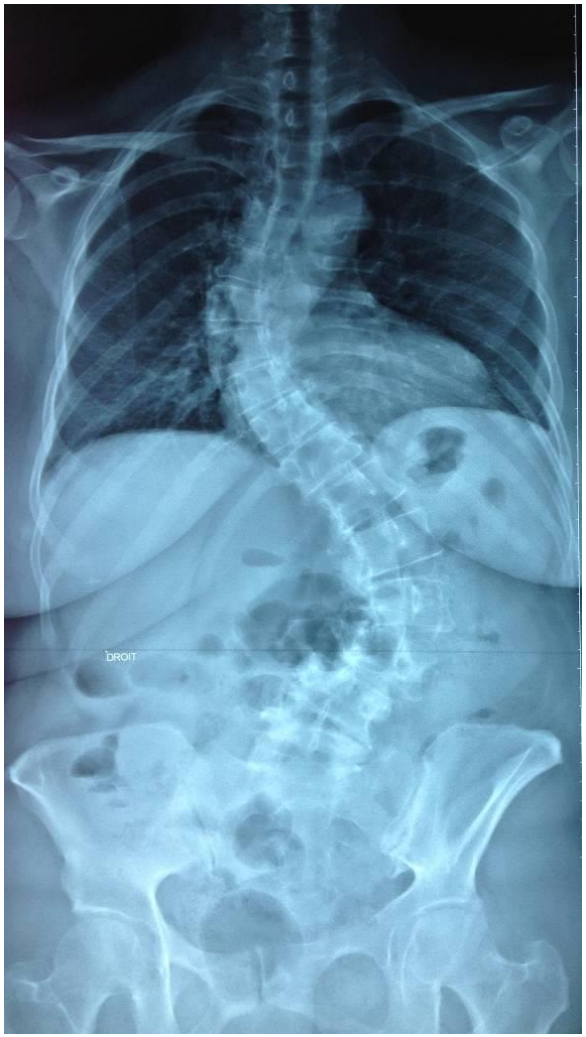
- Intensité de la douleur
- Indépendance (toilette, habillage)
- Soulever une charge
- Marcher
- Position assise
- Station debout
- Sommeil
- Activité sexuelle
- Vie sociale
- Voyage et sorties

« **ODI** » : auto-questionnaire
/ 100 points
0 = normal

Clinique : signes physiques

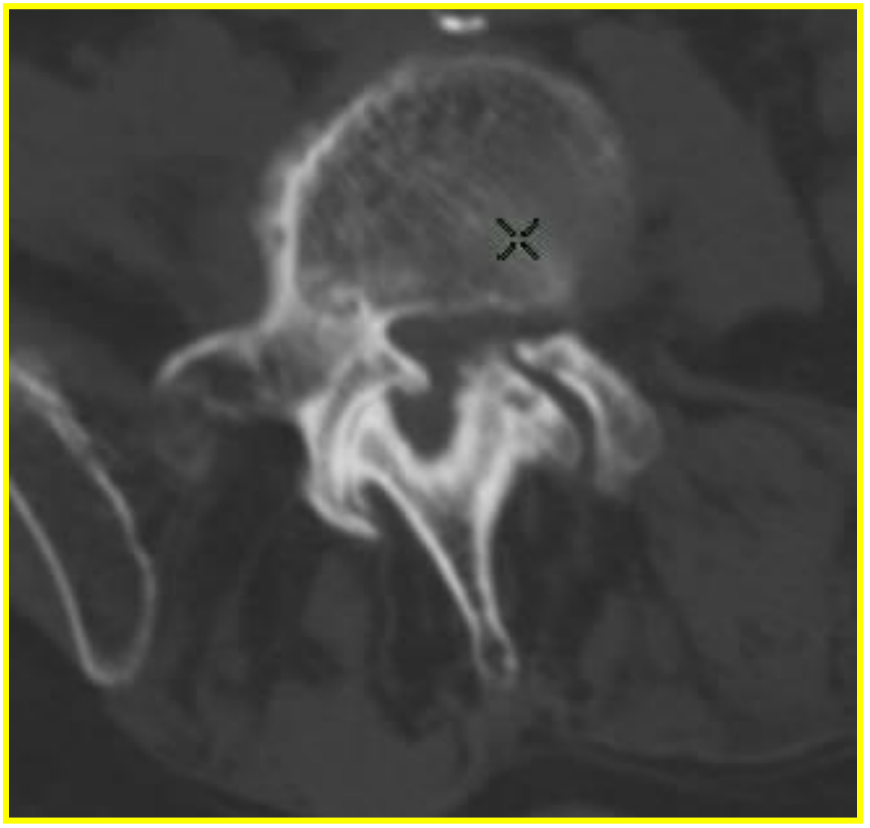
Imagerie

- Radiographies standards
  - Statique de face
  - Statique de profil
- Radiographies dynamiques
  - Réductibilité
- IRM
  - Disques
  - Canal spinal
- Scanner
  - Ossifications
- Sacoradiculographie

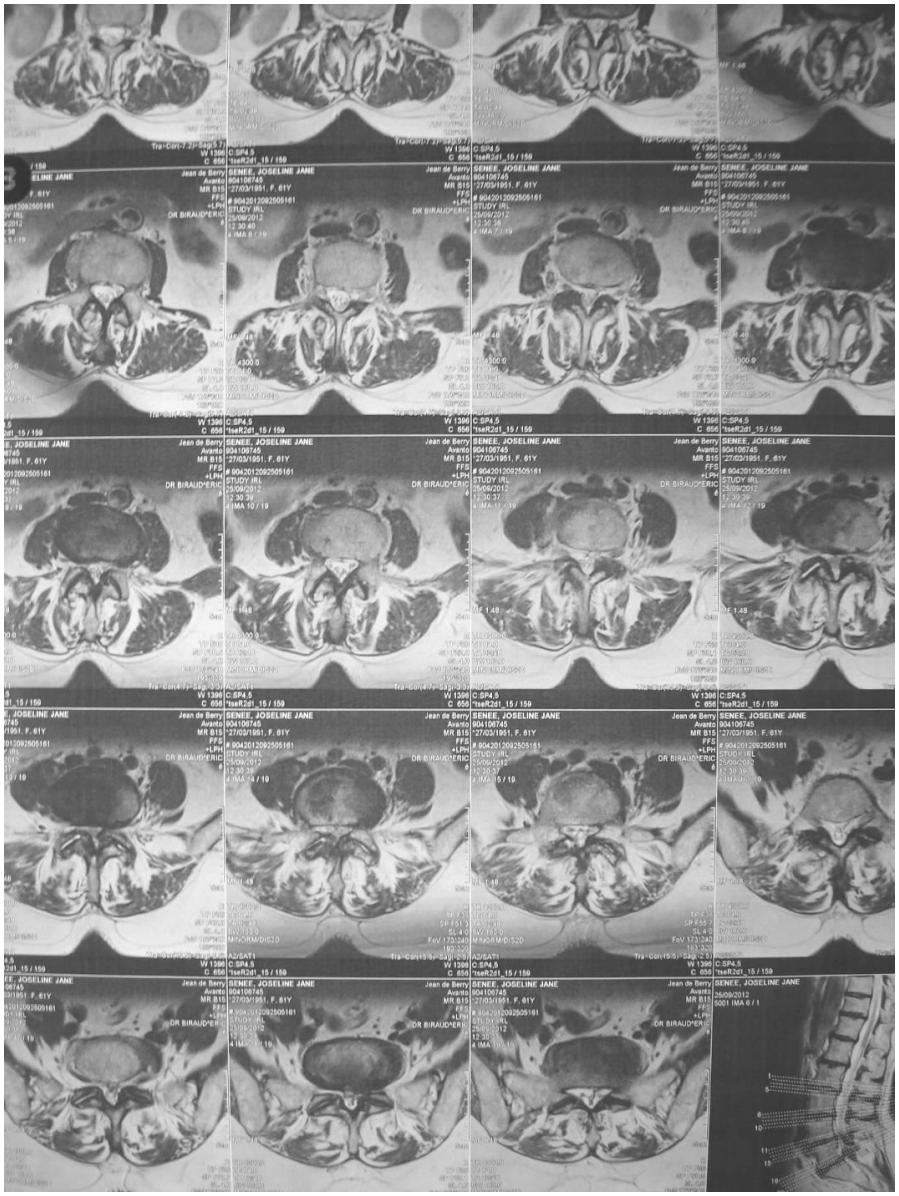


Bilan dislocation rotatoire

- Imagerie en coupe : scanner / IRM



Canal spinal



disques

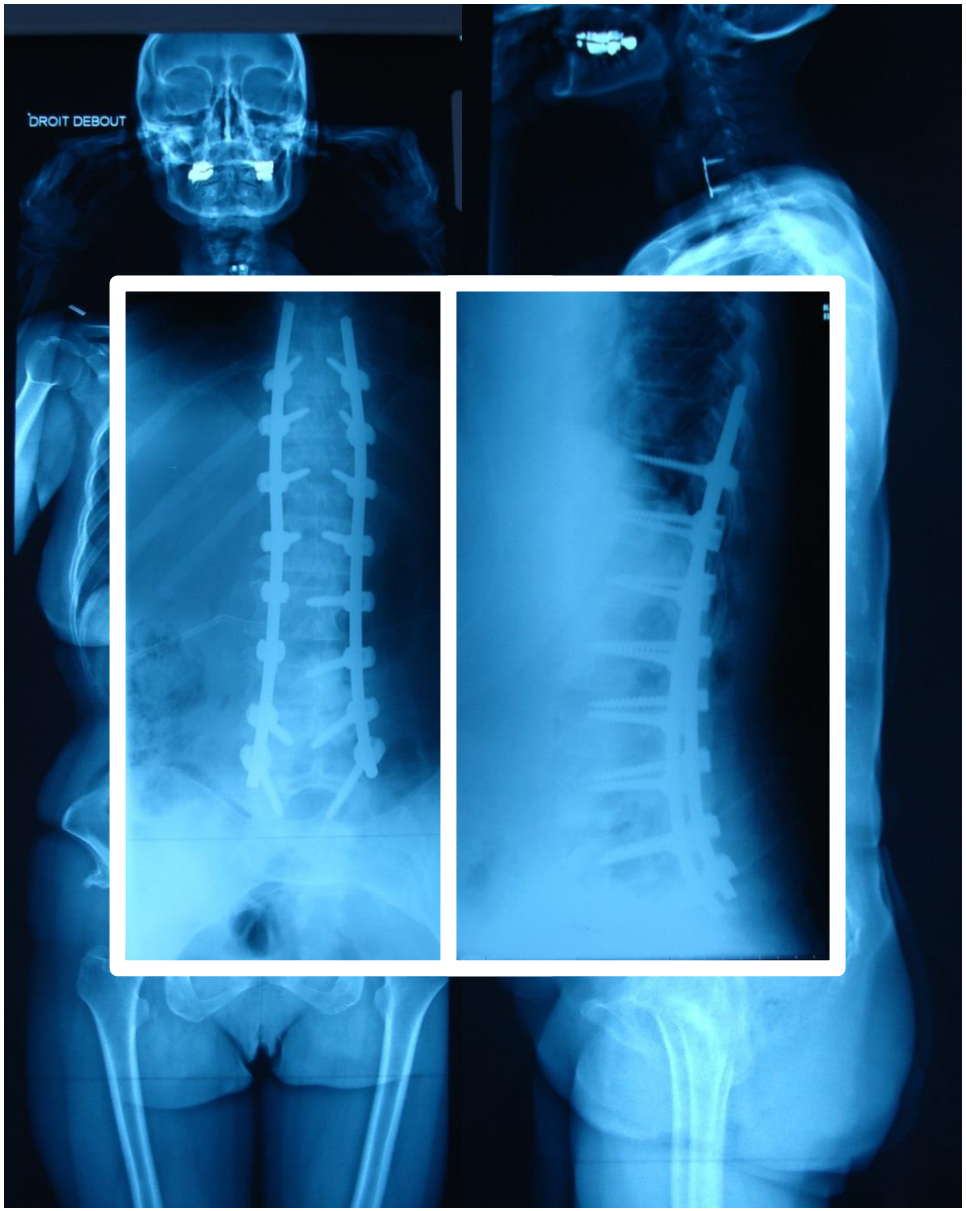
Options thérapeutiques

- Syndrome rachidien
  - kinésithérapie
    - Musculation extenseurs
    - Musculation abdominaux
  - Médicaments antalgiques
  - Ceintures
  - Chirurgie de stabilisation

- Radiculalgies
  - Infiltrations
    - Hiatus, épidurale, articulaires postérieure
  - Médicaments antalgiques, anti-inflammatoires
  - Manipulations / étirements
  - Chirurgie
    - Décompression + fixation

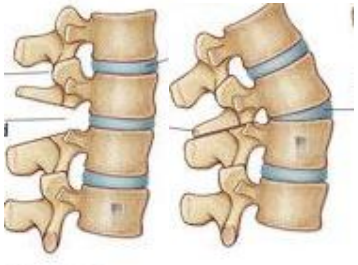
Abord postérieur

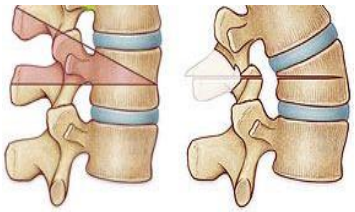
- Fixation
  - Pédiculaire
  - Crochets
  - Extension iliaque
  - Cage intersomatiques postérieure
- Laminectomie
- Ostéotomies

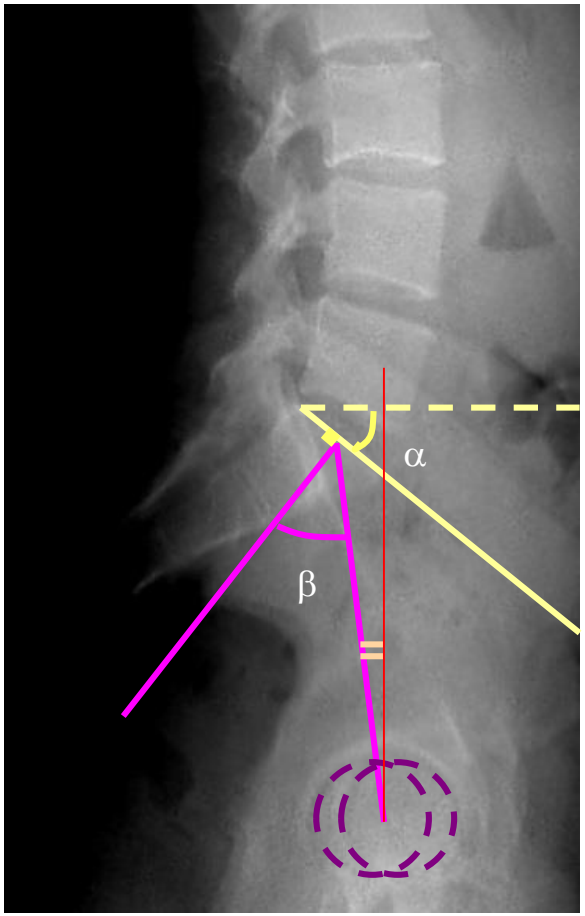


Restauration de la Lordose lombaire

- Dérotation
  - Cobb / lordose lombaire
- Ostéotomies
  - Smith Petersen
  - Ostéotomie transpédiculaire



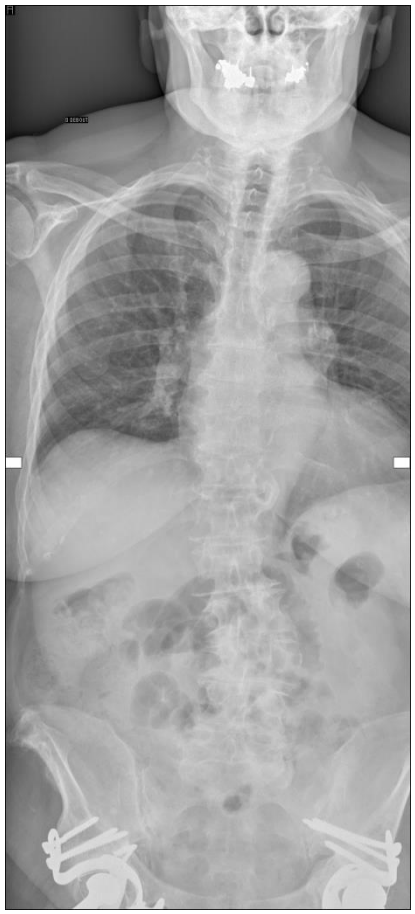


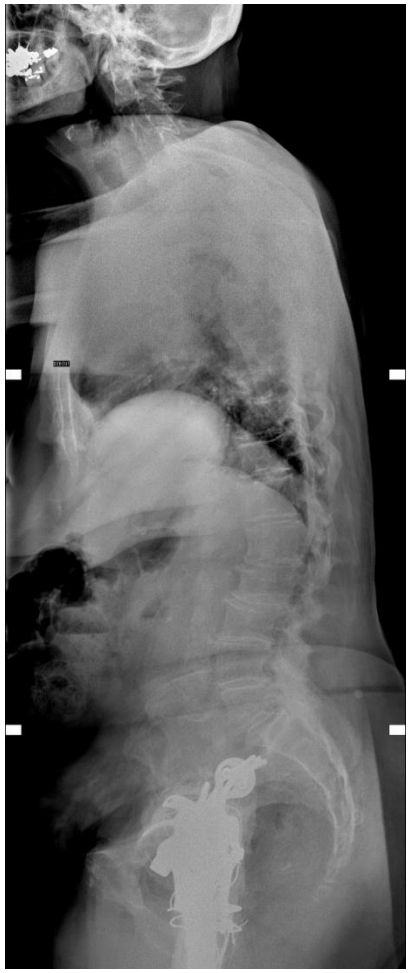


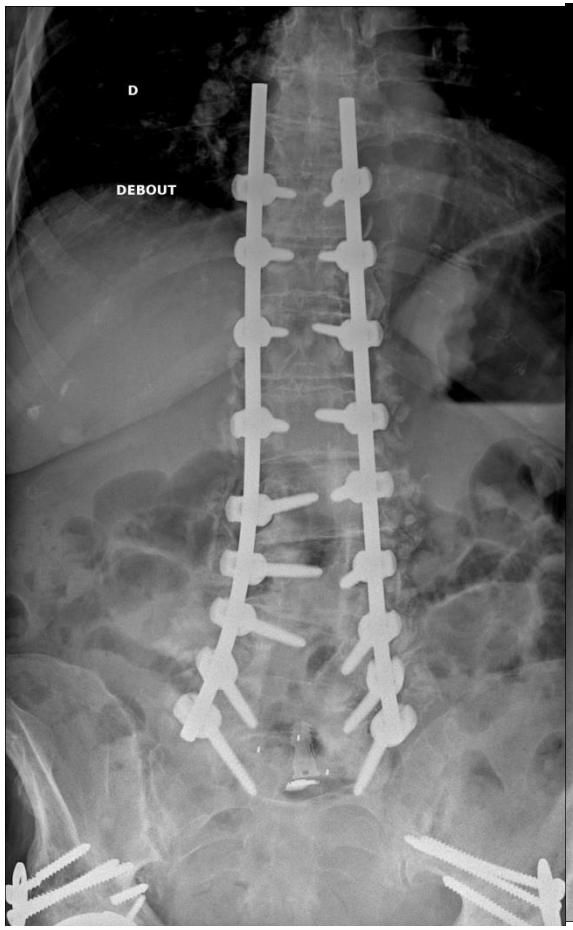
Double abord

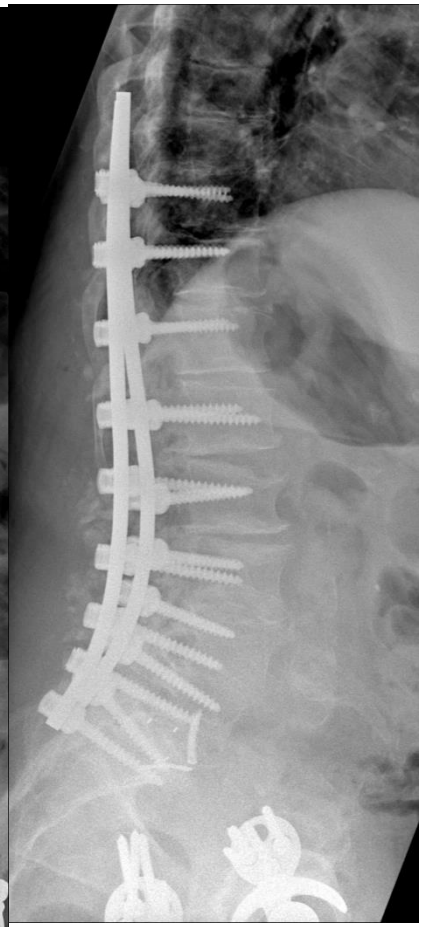
montage postérieur premier + recalibrage

Fixation intersomatique L5/S1

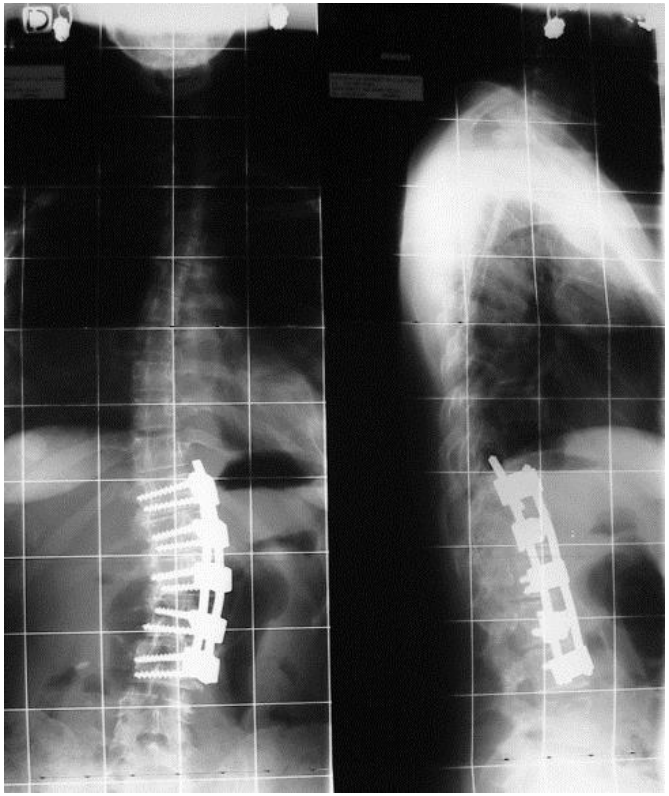








Abord antérieur isolé



Intervention de DWYER

Chirurgie ?

bénéfice

morbidité

- Opératoire
- Convalescence

TERRAIN

Infections in the operated spine: update on risk management and therapeutic strategies.
Lazennec JY, Fourniols E, Lenoir T, Aubry A, Pissonnier ML, Issartel B, Rousseau MA ; French Spine Surgery Society.
Orthop Traumatol Surg Res. 2011 Oct;97(6 Suppl):S107-16.

Arthrodèse pour scoliose de l'adulte

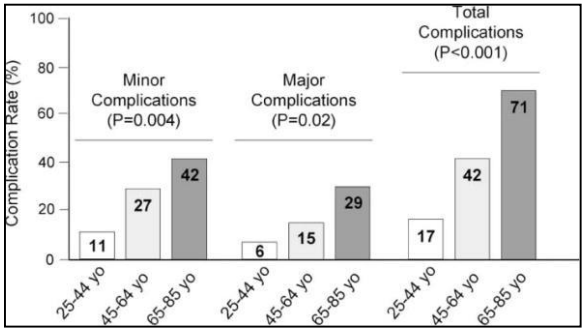
Prospectif (2ans) 160 patients : bénéfice du traitement chirurgical vs médical

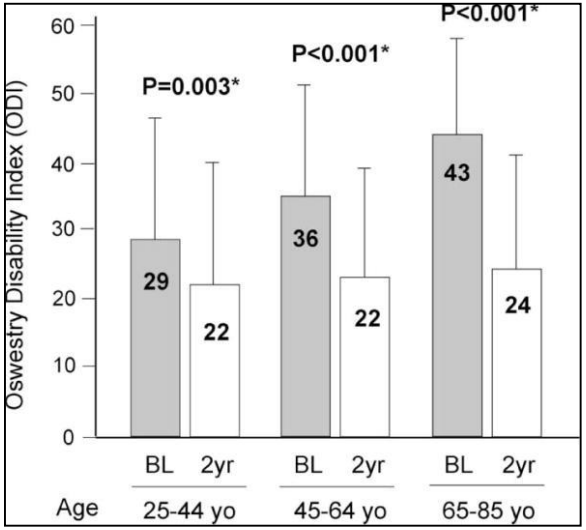
Group	N	Mean	Standard Deviation	*P*
Baseline back pain				
Nonoperative	70	5.34	2.15	0.007
Operative	80	6.28	2.04	
2-yr back pain				
Nonoperative	70	5.72	2.39	0.00
Operative	80	2.36	2.24	

Group	N	Mean	Standard Deviation	*P*
Baseline leg pain				
Nonoperative	62	3.68	2.70	0.68
Operative	79	3.89	3.12	
2-yr leg pain				
Nonoperative	62	3.47	3.02	0.0002
Operative	79	1.72	2.44	

Bridwell KH et al. (2009) Does treatment (nonoperative and operative) improve the two-year quality of life in patients with adult symptomatic lumbar scoliosis: a prospective multicenter evidence-based medicine study. Spine (Phila Pa 1976) 34:2171–2178.

Rétrospectif : 206 / 453 patients à 2 ans





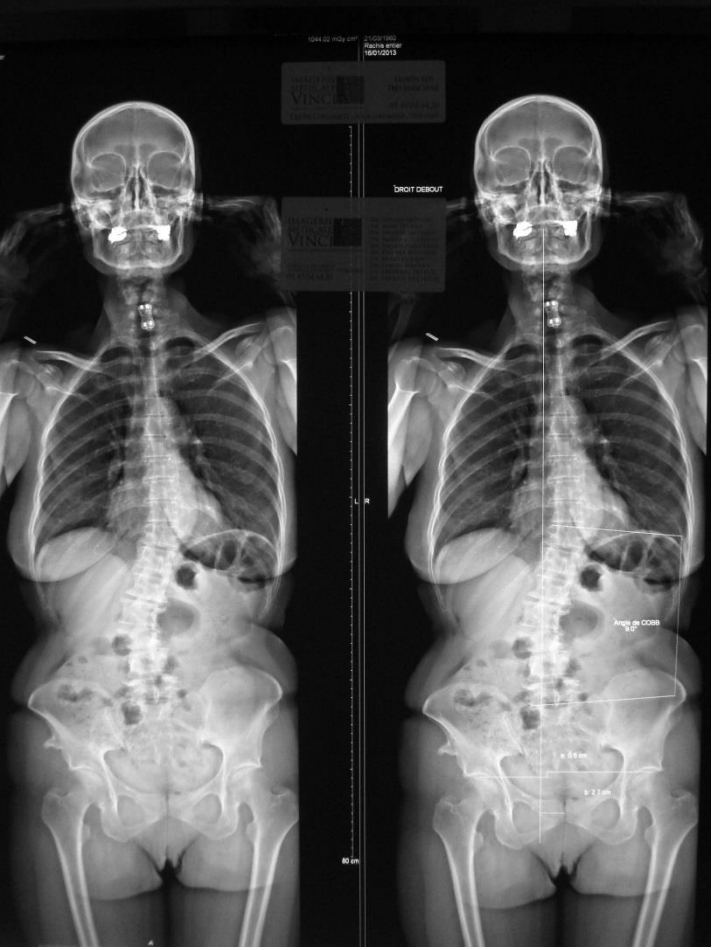
	Patient Age (Yrs)		
	25–44	45–64	65–85
n (%)	47 (23)	121 (59)	38 (18)
Operative data available (%)	44 (94)	119 (98)	37 (97)
Anterior procedure (%)	12 (27)	69 (57)	17 (46)
Mean levels (SD, range)	5 (2, 2–7)	4 (2, 1–8)	5 (2, 2–11)
Posterior procedure (%)	40 (91)	118 (98)	35 (95)
Mean levels (SD, range)	10 (3, 3–18)	11 (4, 2–18)	10 (5, 2–18)
Decompression (%)*	5 (11)	33 (28)	17 (46)
Osteotomy (%)†			
Anterior	1 (2)	0 (0)	1 (3)
Pedicle subtraction	1 (2)	5 (4)	1 (3)
Smith-Peterson‡	3 (6)	19 (16)	10 (26)
Vertebral column	0 (0)	2 (2)	0 (0)
Other	0 (0)	2 (2)	0 (0)
Pelvic fixation (%)§	7 (16)	58 (49)	16 (43)
Mean operating room time, h (SD, range)¶	7.0 (3.0, 2.0–17.5)	9.0 (2.9, 3.0–17.0)	8.3 (2.8, 3.0–14.3)
Mean estimated blood loss, mL (SD, range)	1016 (903, 75–4500)	1570 (1166, 16–5000)	1858 (1481, 50–6750)
Mean hospital stay, d (SD, range)**	8.2 (3.3, 3–16)	10.2 (5.1, 4–45)	11.1 (6.8, 2–36)

Smith JS et al. (2011) Risk-benefit assessment of surgery for adult scoliosis: analysis based on patient age. Spine (Phila Pa 1976) 36:817–824.

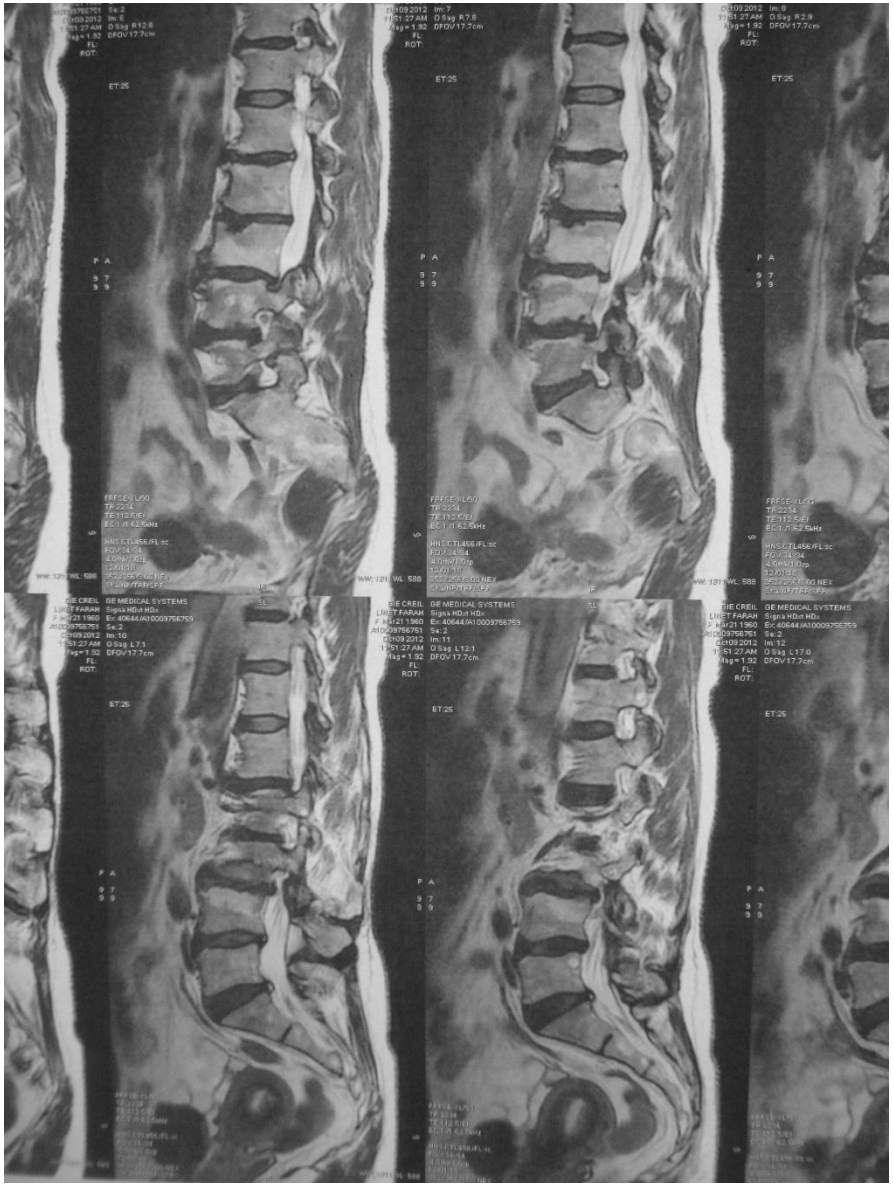
Etendue du montage : limites de l'arthrodèse ?

- Toute la courbure vraie
- En fonction de la correction attendue

- Des choix « par la négative »
  - Pas d'arrêt sur les vertèbres en rotation (sommet)
  - Pas d'arrêt sur le sommet d'une cyphose
  - Pas d'arrêt à la jonction thoraco-lombaire
  - Eviter l'arrêt sur une discopathie

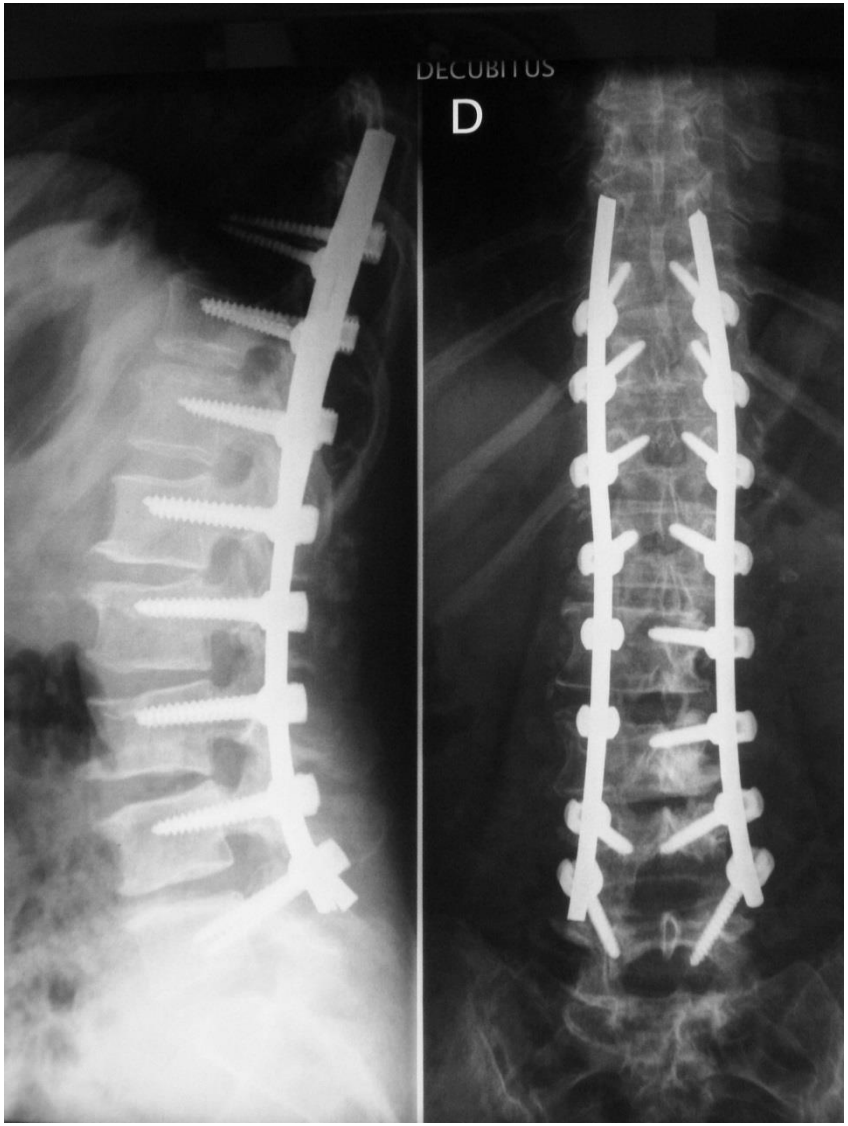


53 y. old
Female
Dege scoliosis
Backpain
No radicular pain



MRI :

Absence of L5 S1 DDD



TL fixation
No canal
Posterior graft

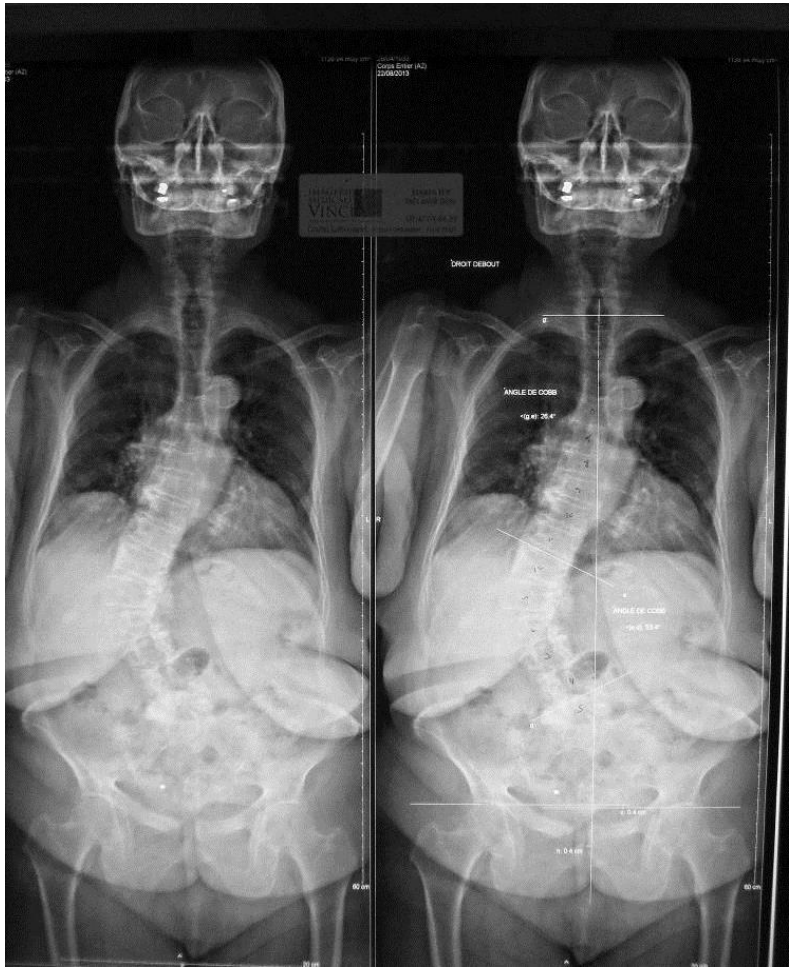
XIA 3
Vitallium
Monoaxial 5.5 - 40

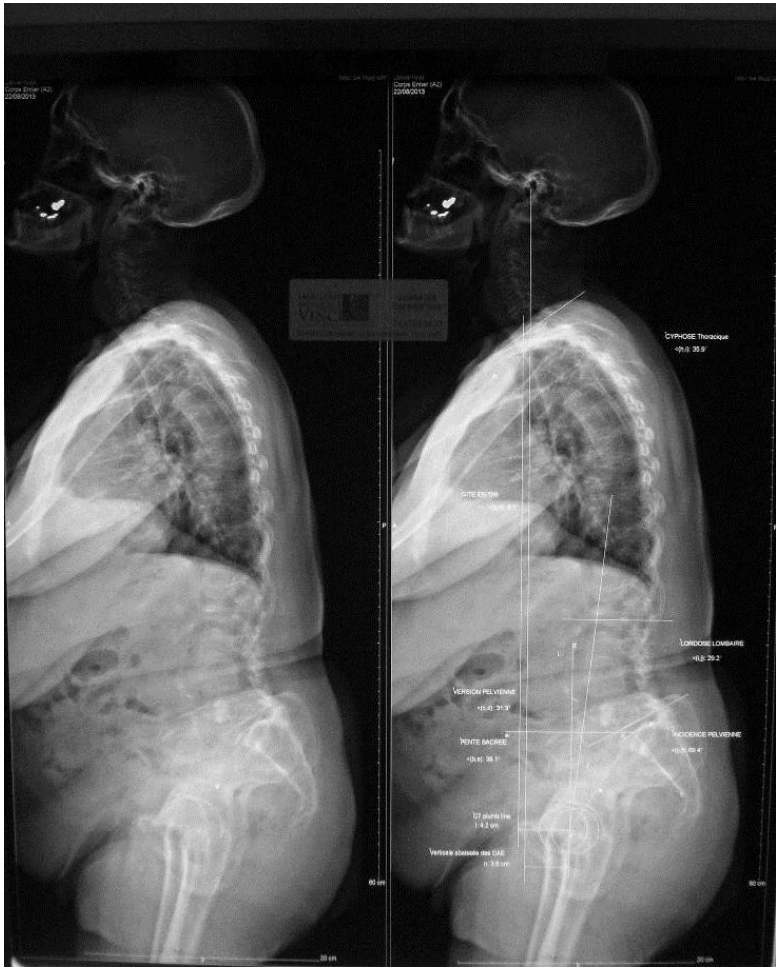
Enjeu de la charnière L5 – S1

- Importance physiologique
- Difficulté de fixation primaire

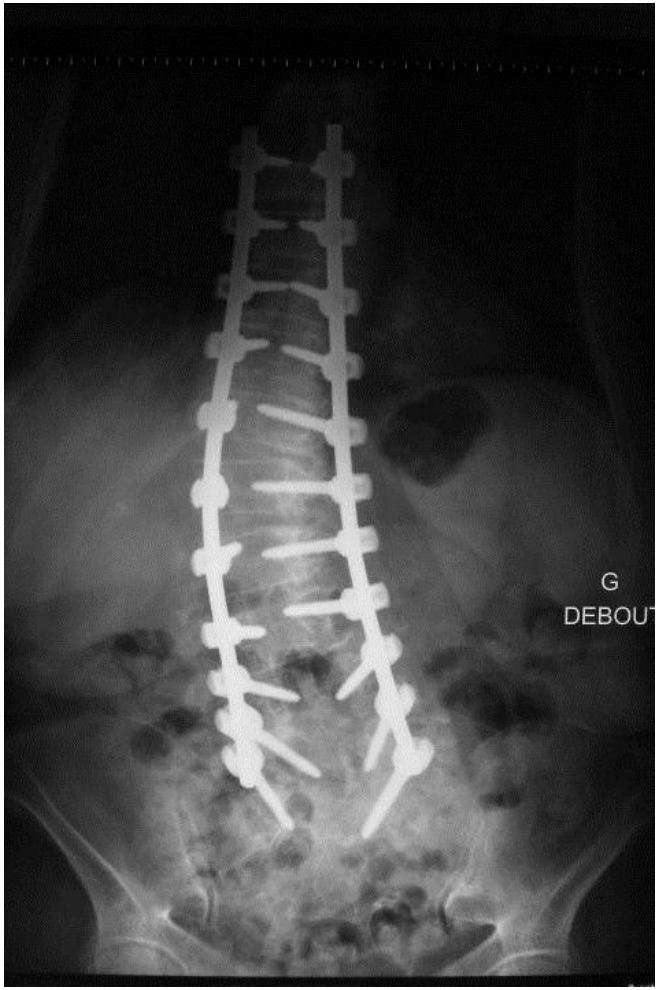
Source de reprise

Outcomes in adult scoliosis patients who undergo spinal fusion stopping at L5 compared with extension to the sacrum.
Sardar ZM, Ouellet JA, Fischer DJ, Skelly AC.
Evid Based Spine Care J. 2013 Oct;4(2):96-104.

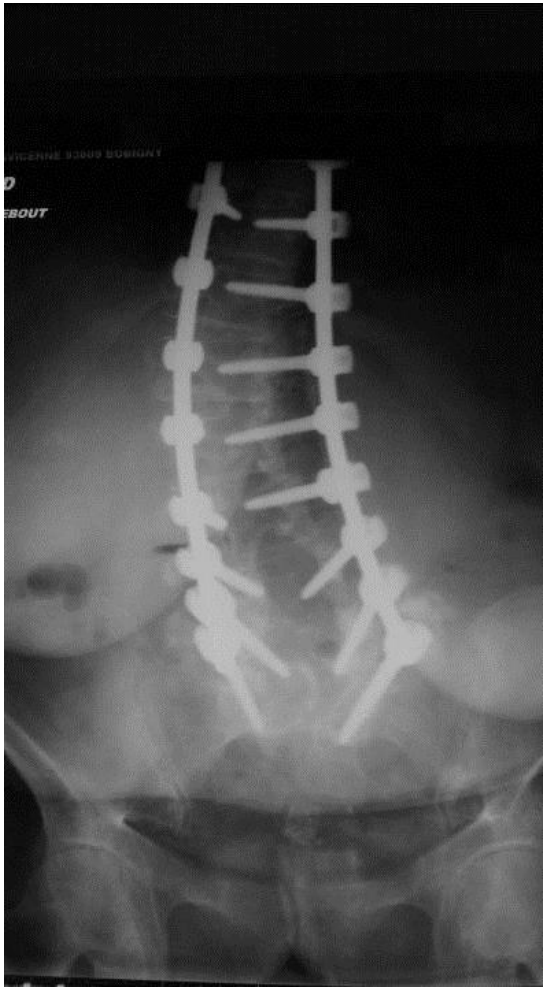




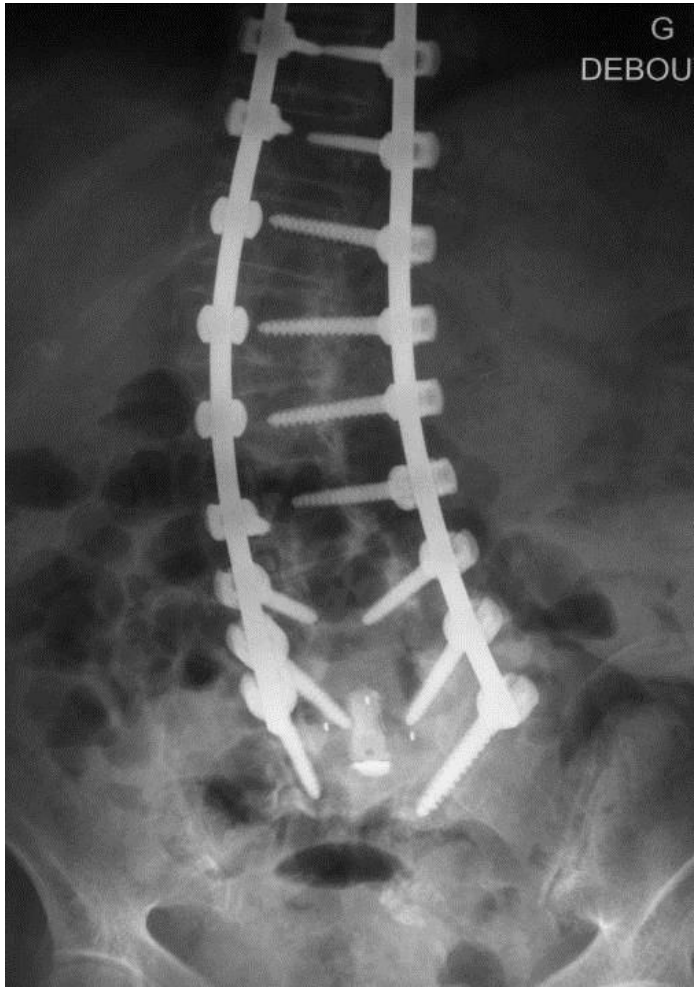
81 y. old, in good shape
Dege scoliosis
Claudication
Back pain



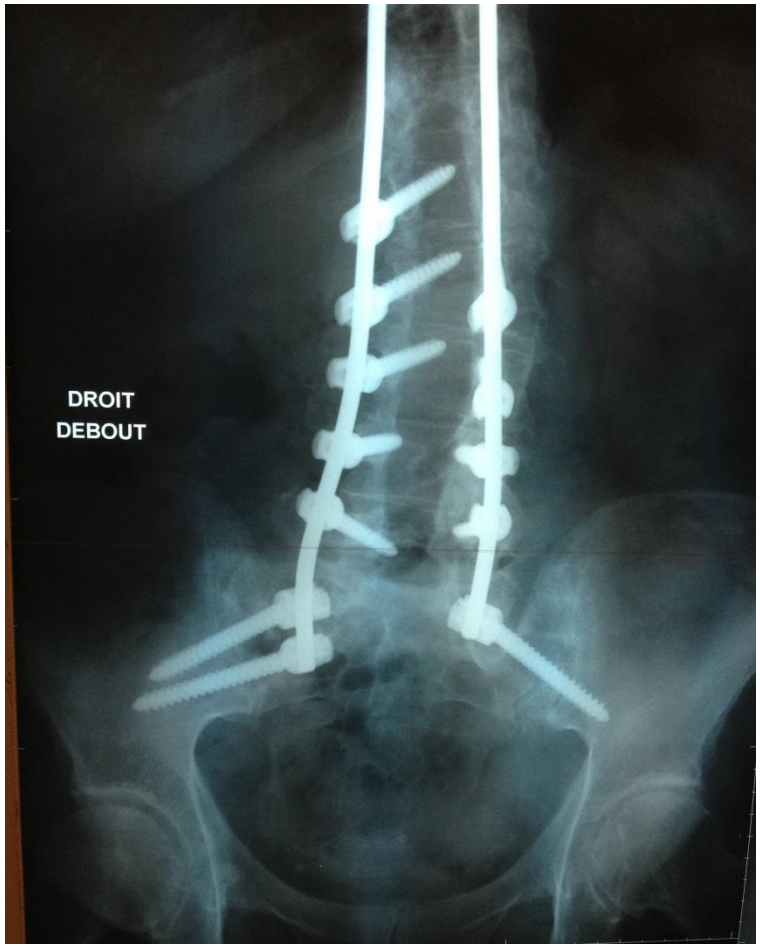
TLS fixation
Lower Laminectomy

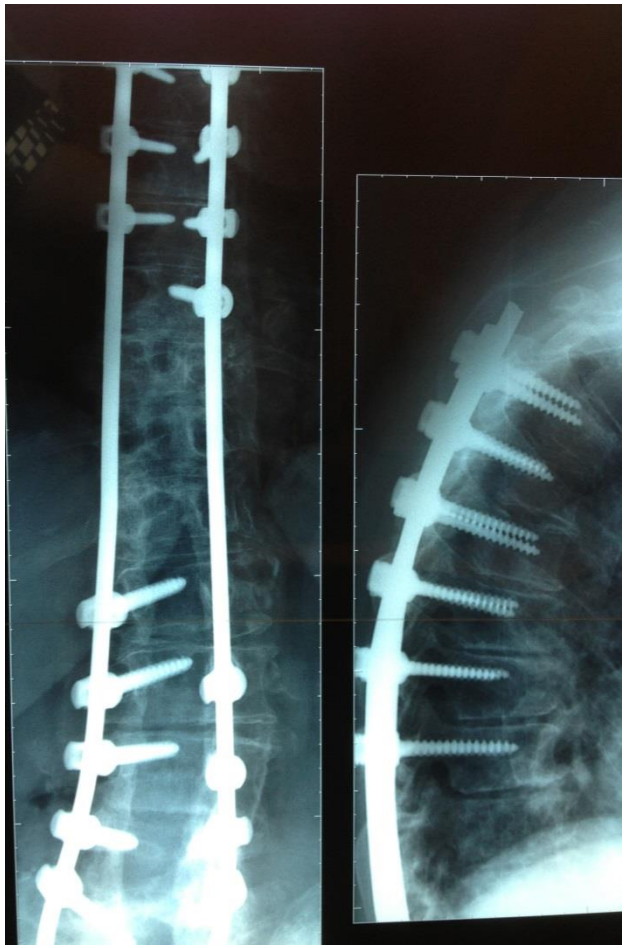


6 mo. Post-op
Bilateral S1 loosening
Sciatica again

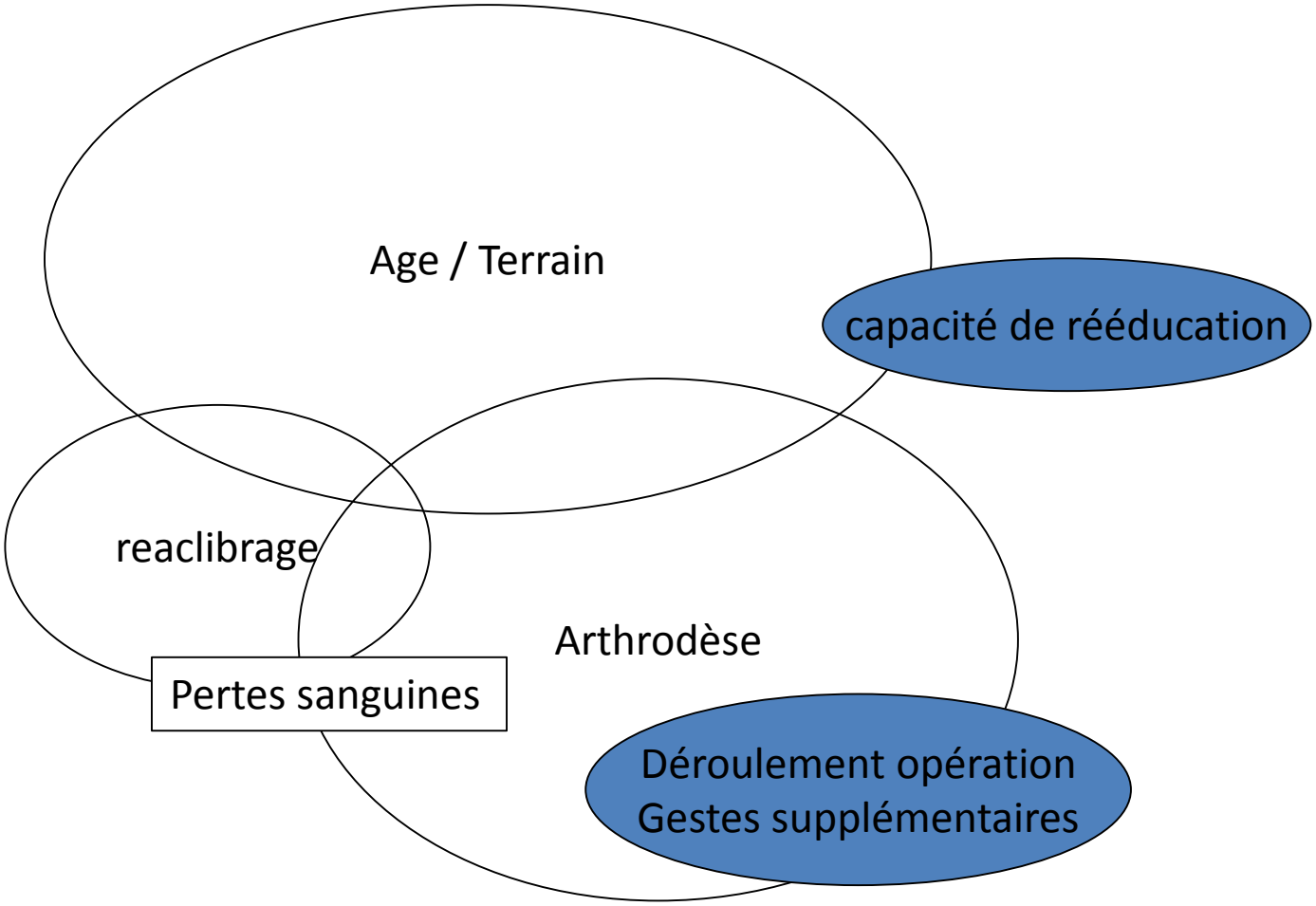


Secondary ALIF


DROIT
DEBOUT



SIA = Morbidité spécifique



Complication, N (%)	Patient Age* (yrs)		
	All (n = 4980)	≤60 (n = 2920)	>60 (n = 2060)
Dural tear	142 (2.9%)	77	65
Wound infection			
Superficial	46 (0.9%)	28	37
Deep	73 (1.5%)	43	46
Implant complication	80 (1.6%)	50	30
Acute neurological	49 (1.0%)	31	18
Delayed neurological	41 (0.5%)	22	19
Epidural hematoma	12 (0.2%)	8	4
Wound hematoma	22 (0.4%)	12	10
Cardiac	7 (0.1%)	1	6
Pulmonary embolus	12 (0.2%)	7	5
Pulmonary (not PE)	31 (0.5%)	21	10
DVT	9 (0.2%)	4	5
Death	17 (0.3%)	9	8
Sepsis	6 (0.1%)	3	3
Visual acuity change	3 (0.06%)	2	1
Other complication	119 (2.4%)	65	54
Total number patients with complications	521 (10.5%)	295 (10.1%)	226 (11.0%)
Total complications†	669 (13.4%)	384 (13.2%)	321 (15.6%)

Clinical Category	No. of Cases	No. Complications (%)	*P*
Degenerative scoliosis	2555	281 (11.0)	0.20
Idiopathic	2425	240 (9.9)	
No osteotomy	3887	376 (9.7)	0.0006
Osteotomy	1093	145 (13.3)	
No revision	3973	392 (9.9)	0.006
Revision	1007	129 (12.8)	
Anterior only	611	53 (8.7)	0.03*
Posterior only	3154	325 (10.3)	
Anterior and posterior	804	102 (12.7)	
Unspecified	409	40 (9.85)	

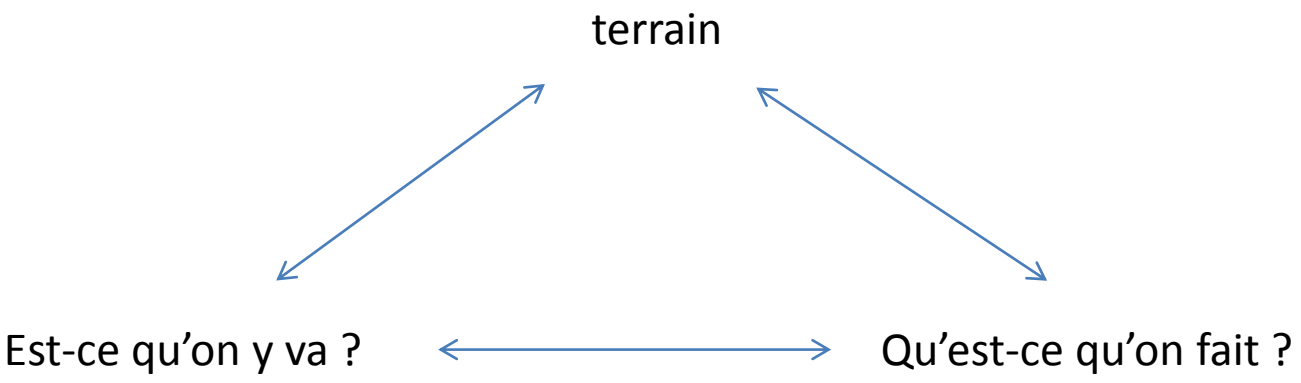
*Complication rate was significantly higher in anterior and posterior group when compared to the combination of anterior only and posterior only groups.

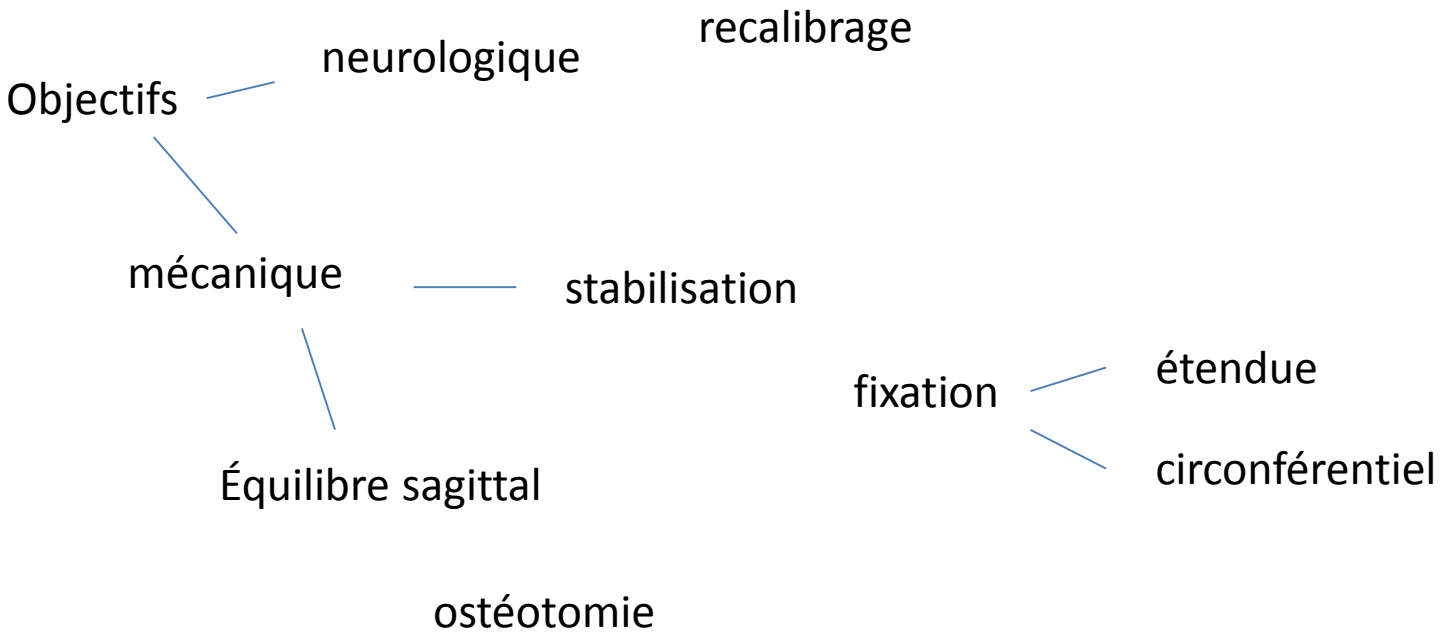
Sansur CA1 et al. Scoliosis research society morbidity and mortality of adult scoliosis surgery. Spine (Phila Pa 1976). 2011 Apr 20;36(9):E593-7.

SIA = cumul de points techniques

- Pour la décompression
  - Repères modifiés

- Pour la fixation
  - Montages longs (+/- cages)
  - Visées pédiculaires atypiques
  - Manque de réductibilité frontale
  - Déséquilibre sagittal : ostéotomies
  - Qualité osseuse


terrain
Est-ce qu'on y va ?
Qu'est-ce qu'on fait ?


recalibrage
neurologique
Objectifs
mécanique
stabilisation
fixation
étendue
circonférentiel
Équilibre sagittal
ostéotomie

Lecture proposée :

PMC FREE Full text

HSS J. 2011 Oct;7(3):257-64. Epub 2011 Jun 11.
Degenerative scoliosis**: a review.** Kotwal S, Pumberger M, Hughes A, Girardi F.