Total Hip Arthroplasty for Crowe type IV Developmental Dysplasia

- Surgical Technique
- Long term Follow-up Study

L. Kerboull, M.D, Ph.D.

Introduction

- **M. Kerboull experience began in 1970.**
- **Despite Charnley strongly advised « not to attempt the operational reconstruction of a non reduced congenital dislocated hip »**
- **This challenging surgical procedure was supported by a thorough analysis of hip developmental dysplasia**

Personal family series
30 years of experience in THA on developmental dysplasia

M.K : 535 THA on developmental hip dysplasia, 352 Crowe III-IV, 1970 –2004

L.K : 245 THA on developmental hip dysplasia, 82 Crowe III-IV, 1991–2008

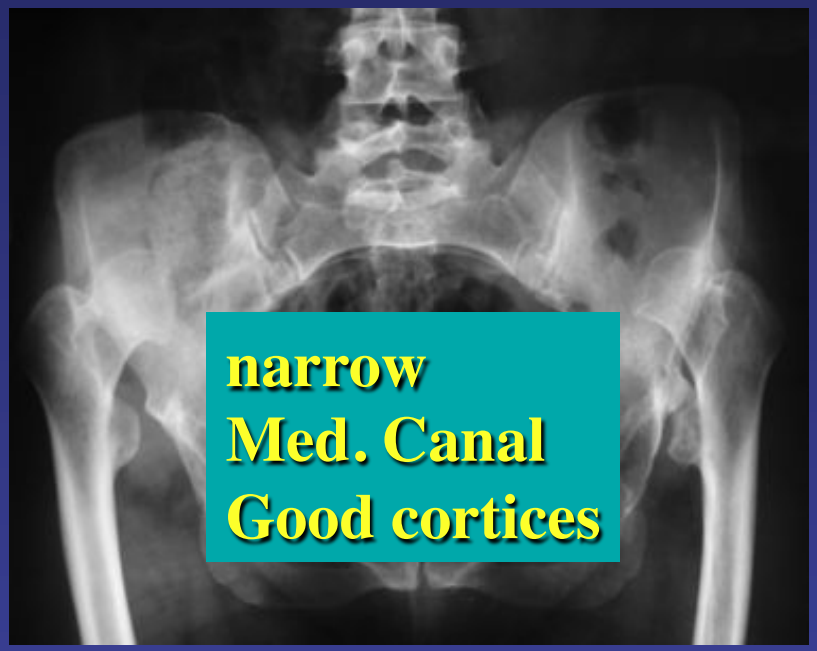
770 hips

- **Crowe type IV**

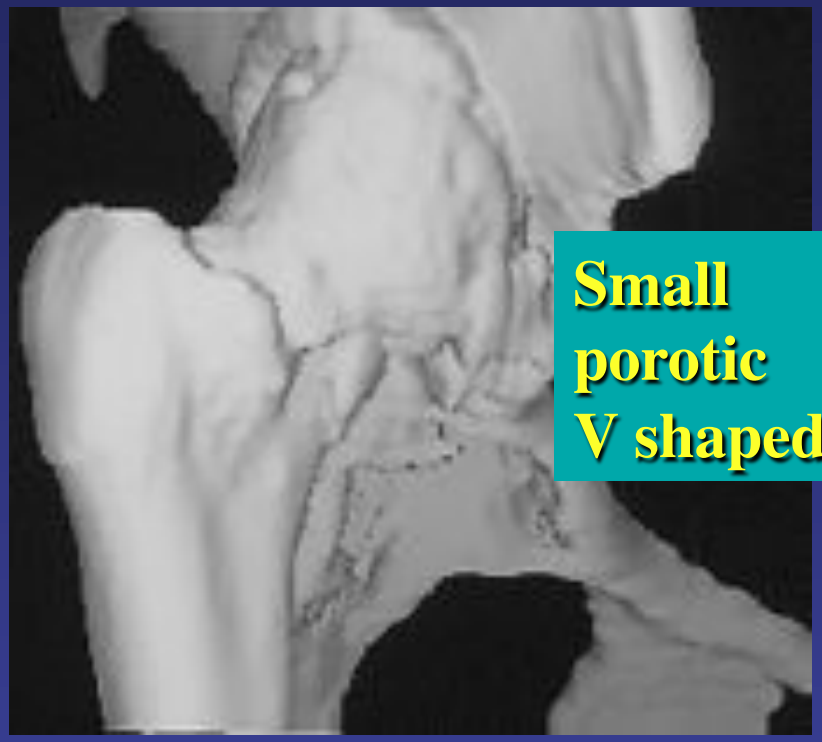
- **Eftekhar Type C or D**
- **Total Dislocation for Hartofilakidis or Harris**

Anatomic abnormalities in total hip dislocation

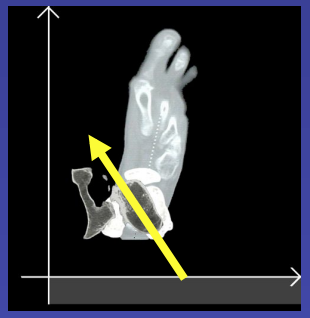
Distorted bone anatomy



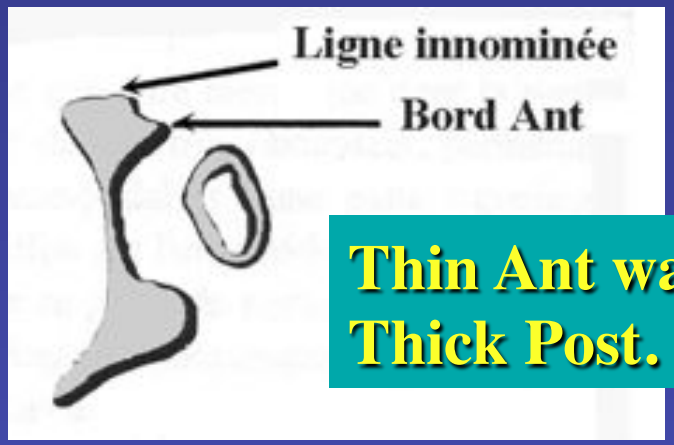
narrow
Med. Canal
Good cortices



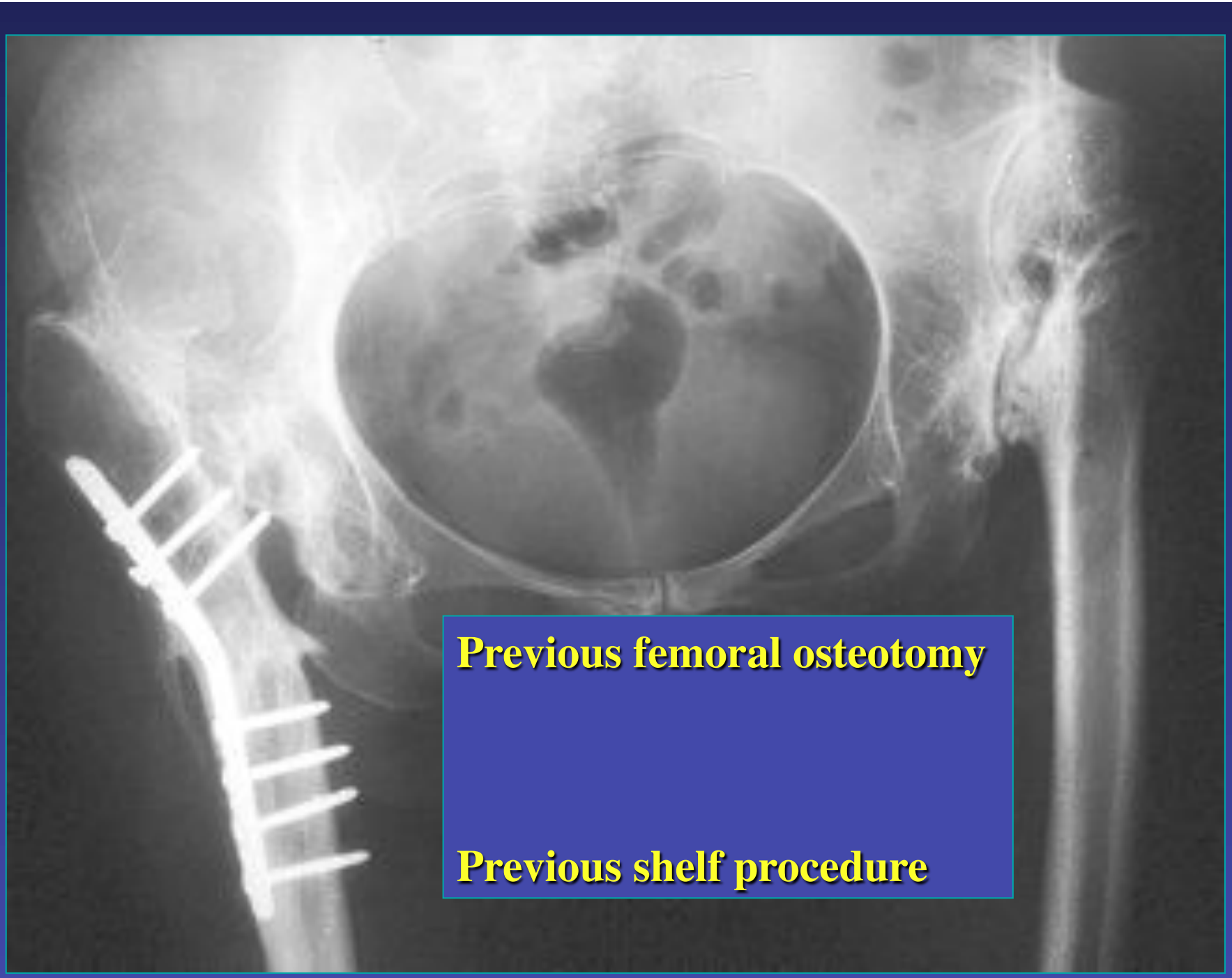
Small
porotic
V shaped



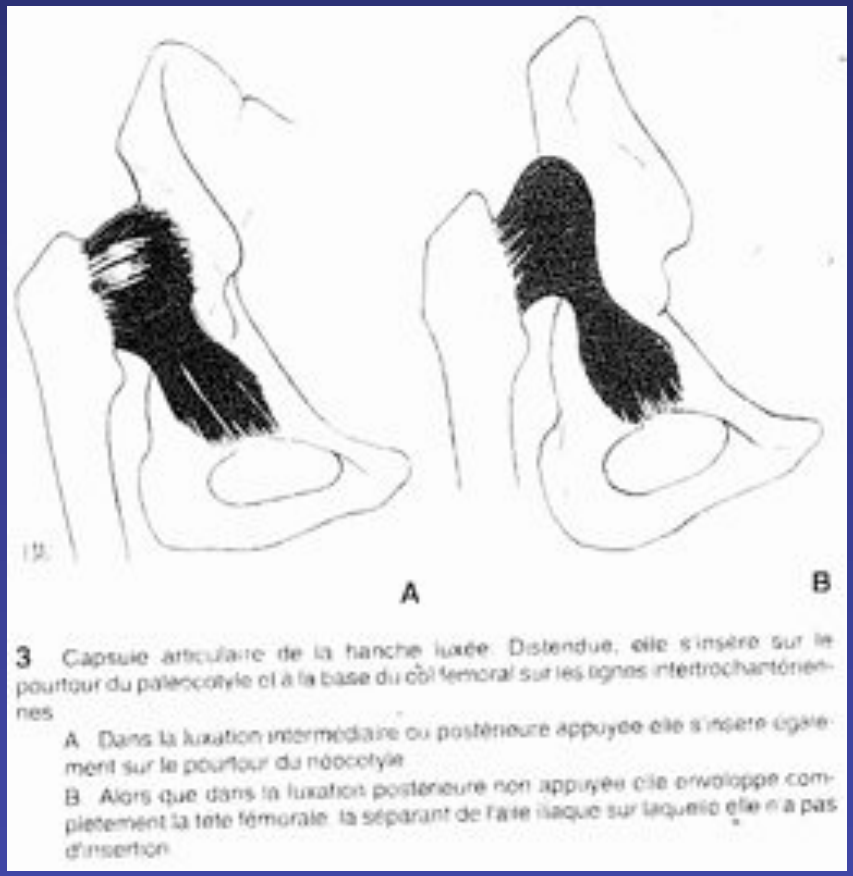
Excessive
antetorsion



Thin Ant wall
Thick Post. wall


Previous femoral osteotomy
Previous shelf procedure

Soft tissues : articular capsule



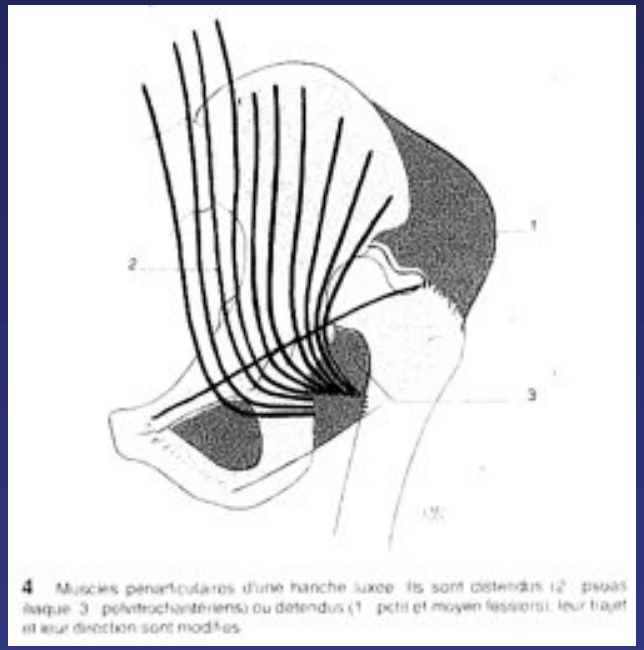
A B

3 Capsule articulaire de la hanche luxée. Distendue, elle s'insère sur le pourtour du paléocotyle et à la base du col fémoral sur les lignes intertrochantériennes.

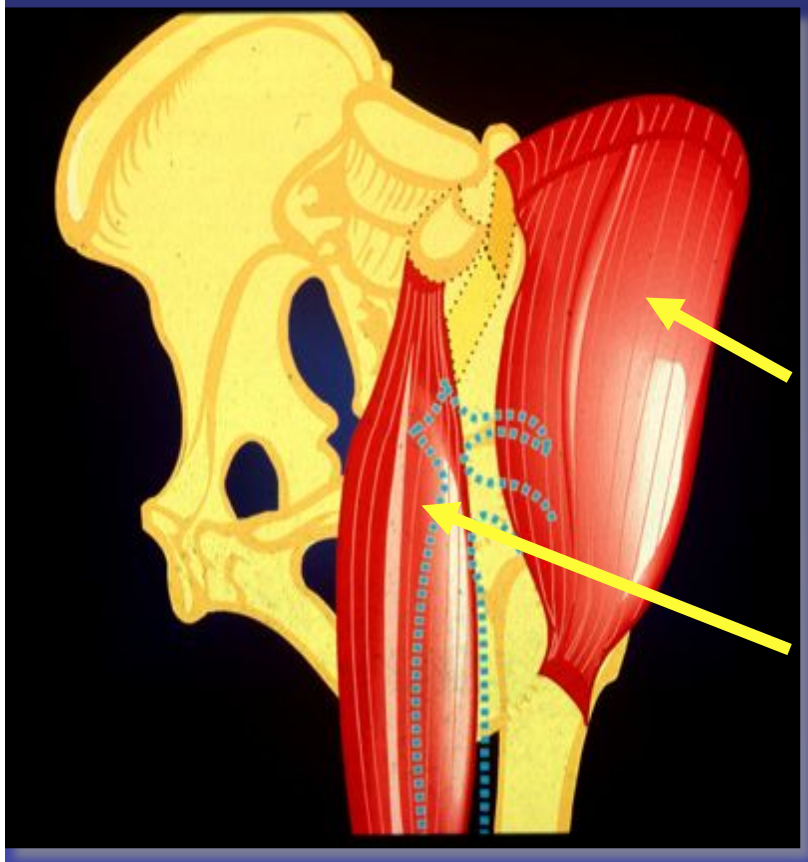
A Dans la luxation intermédiaire ou postérieure appuyée elle s'insère également sur le pourtour du néocotyle.

B Alors que dans la luxation postérieure non appuyée elle enveloppe complètement la tête fémorale, la séparant de l'aile iliaque sur laquelle elle n'a pas d'insertion.

Soft tissues: muscles



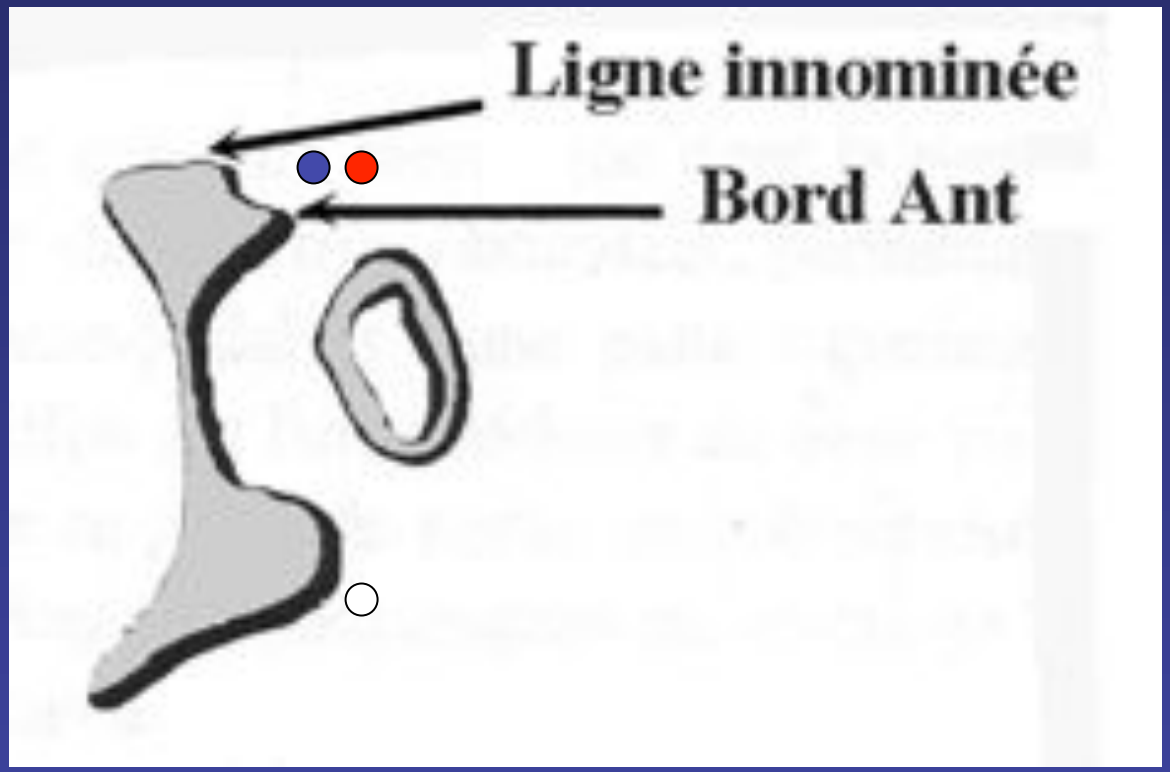
4 Muscles périarticulaires d'une hanche luxée. Ils sont distendus (2 : psoas iliaque, 3 : pelvitrochantériens) ou détendus (1 : petit et moyen fessiers). Leur trajet et leur direction sont modifiés.



Abductors : relaxed with wrong orientation

Rect.Fem. Psoas , ADD : elongated

Neuro-vascular elements



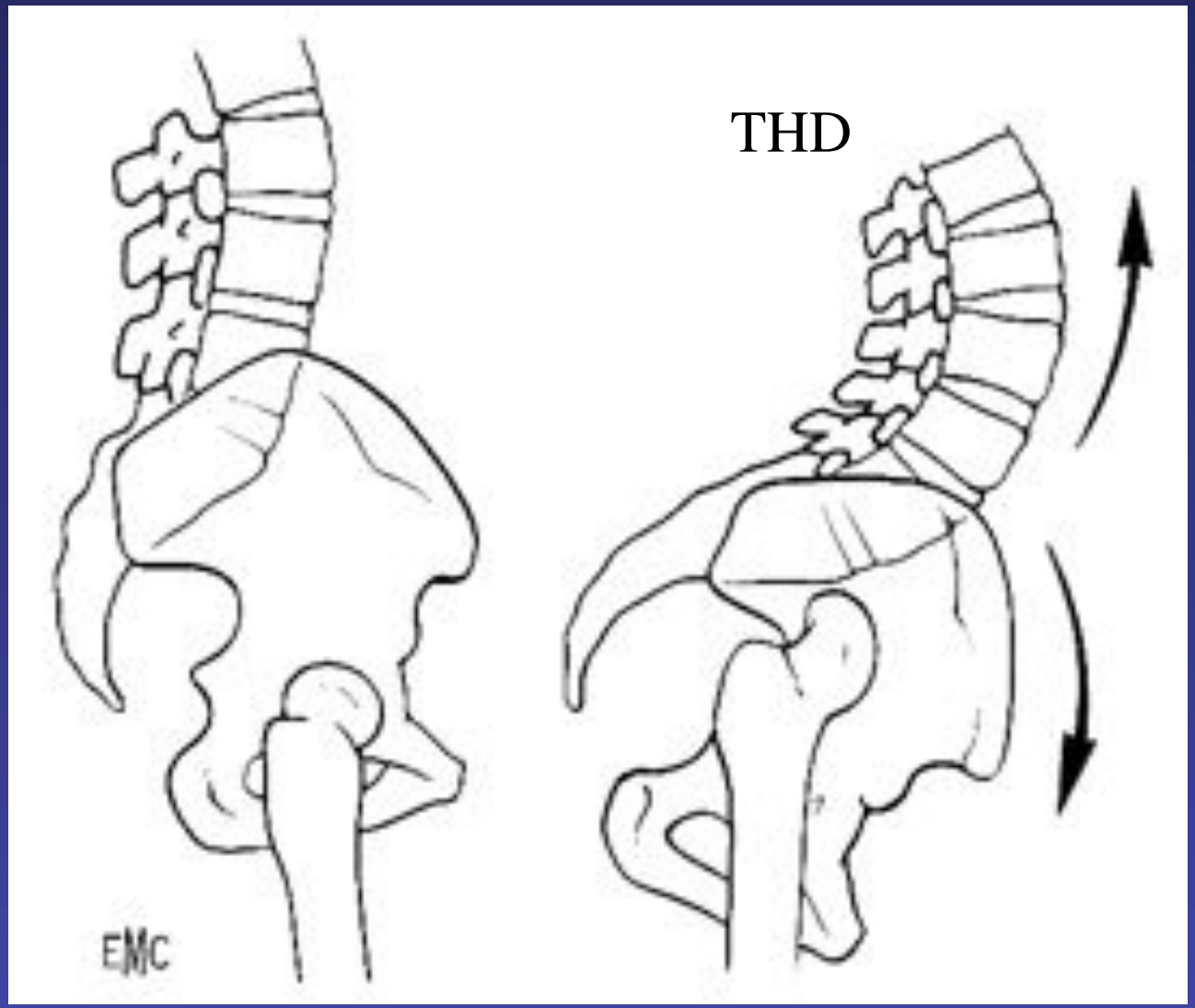
Course and location may be altered

CDH : static body balance

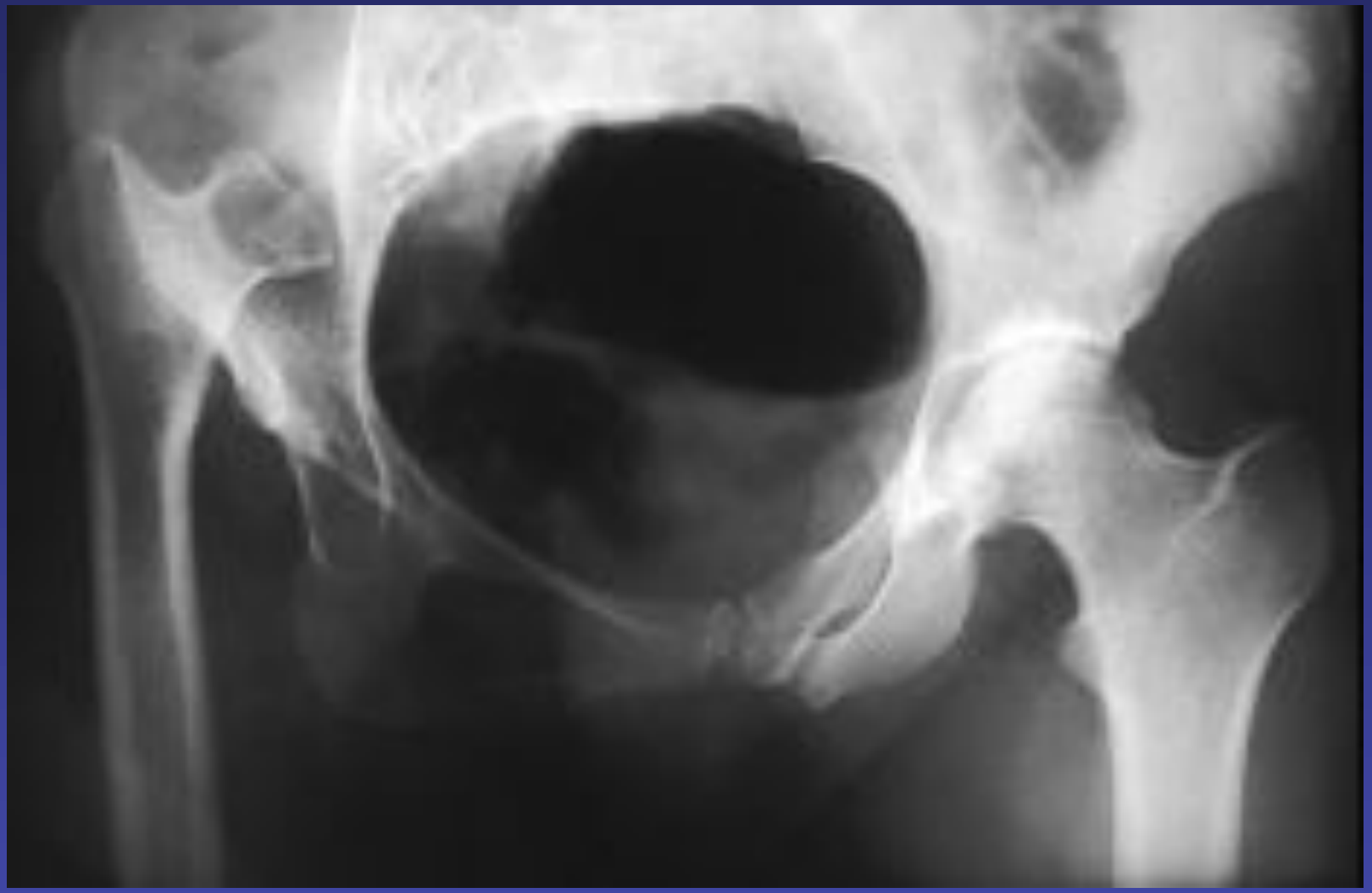
- **Pelvic ring**
- **Spine**
- **Knee**

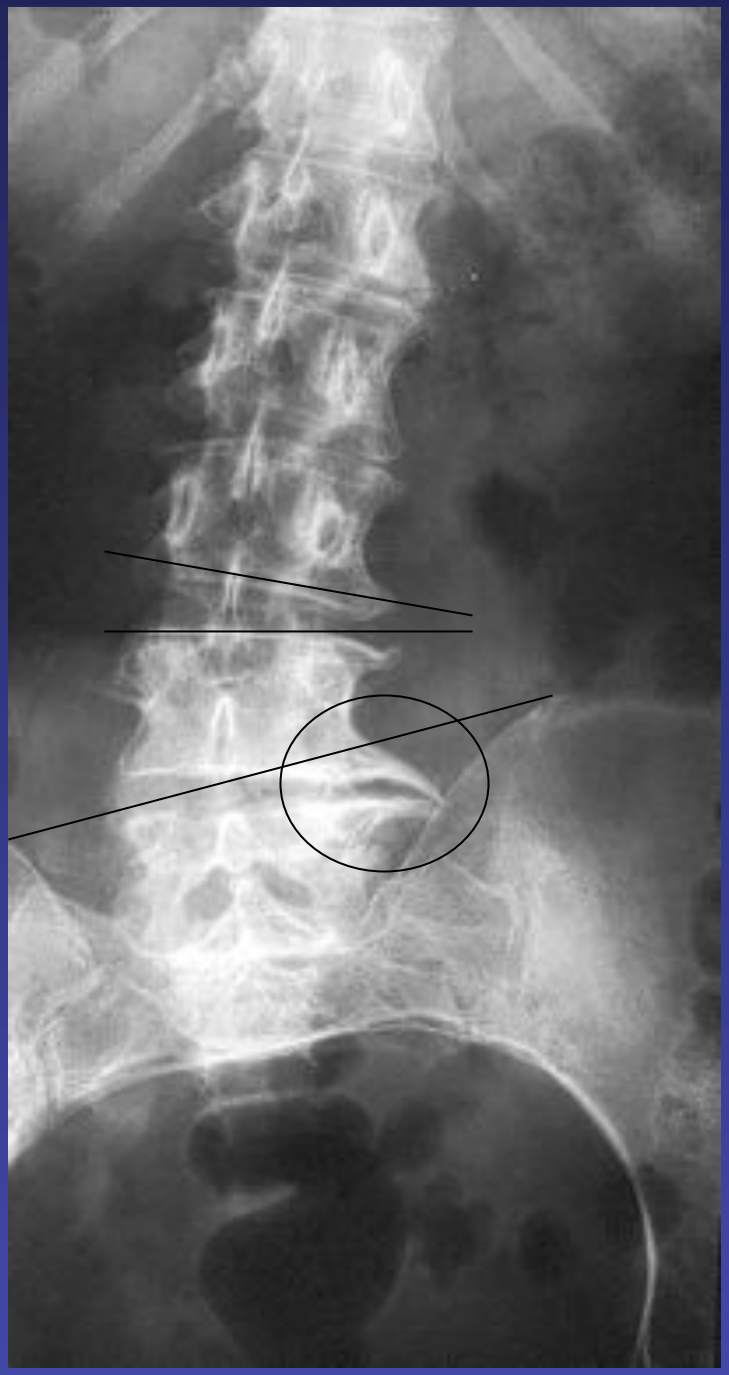
M.Kerboull Conf. Ens. SOFCOT 1990

Anterior tilt of the pelvic ring and hyperlordosis



lateral and rotational tilt of the pelvic ring

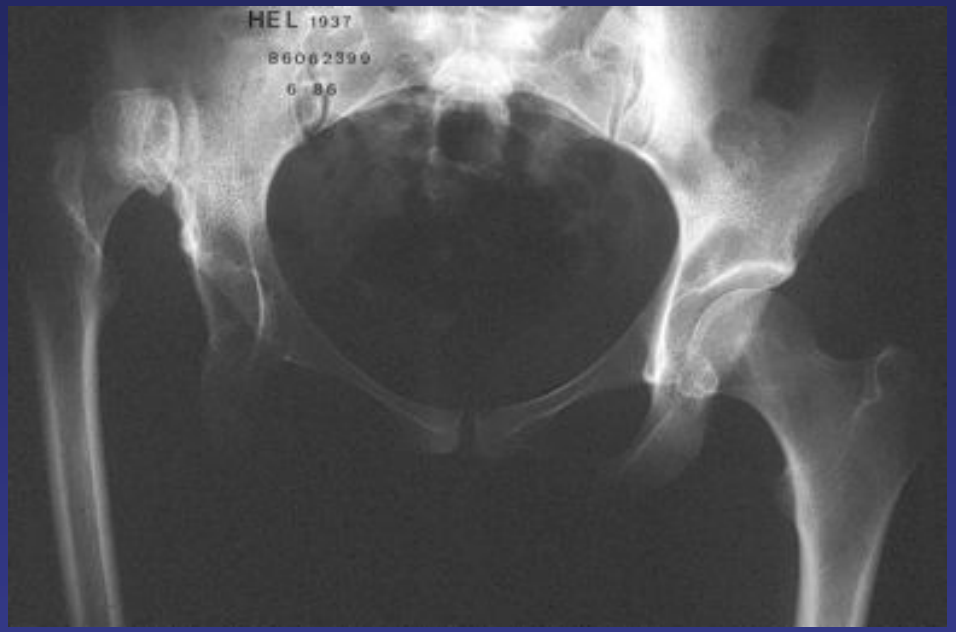




lumbar spine compensatory curvature will induce secondary painful arthrosis

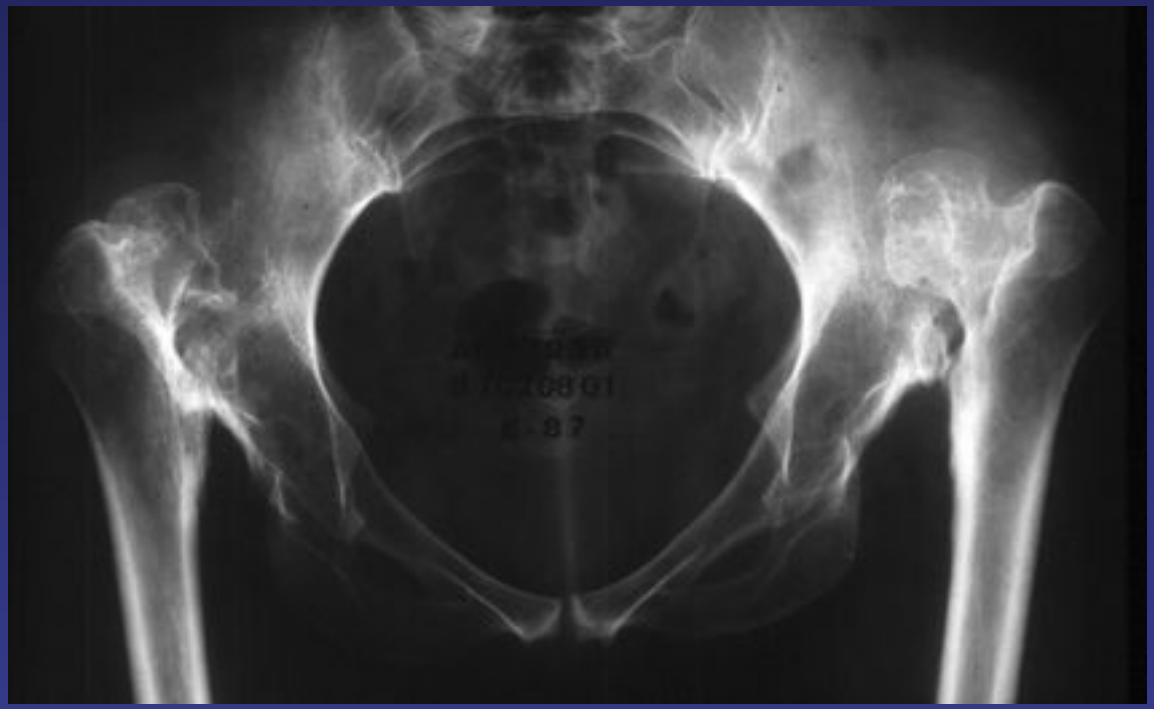
Valgus deformity of the knee

Different anatomical situations

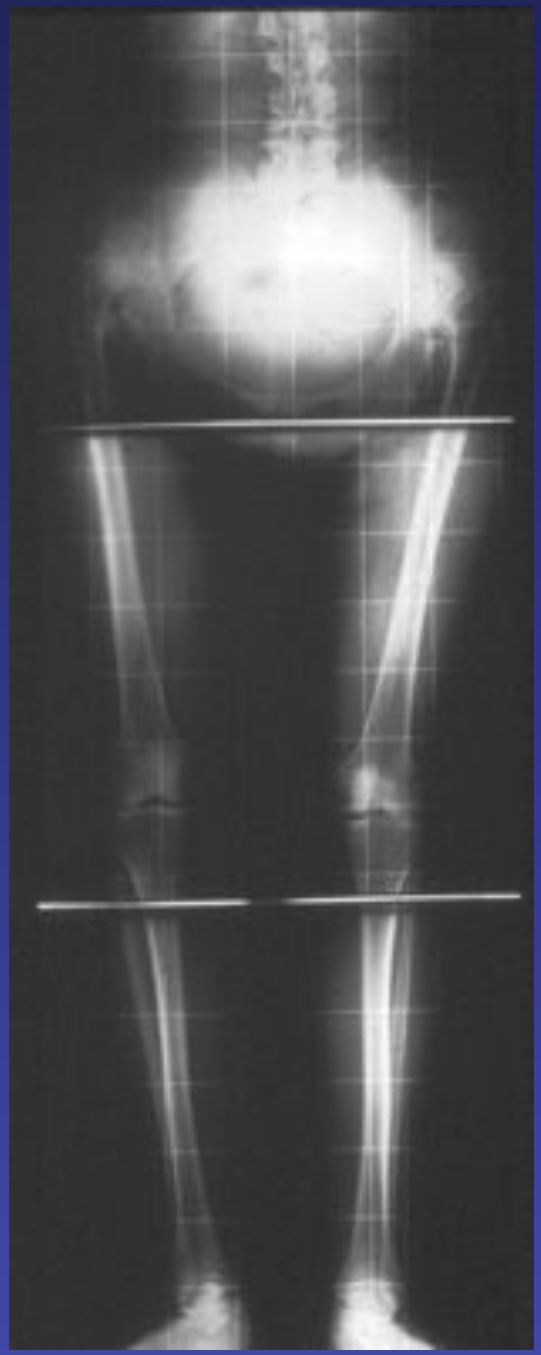


unilateral THD with normal or dysplastic opposite hip

shortening = leg length discrepancy
no AP pelvic tilt, mild lateral tilt
no modification of the lumbar spine



bilateral symetric THD
relatively rare
no leg length discrepancy
AP pelvic tilt and hyperlordosis
no lateral curve of the lumbar spine



bilateral non symetric THD
more frequent
leg length discrepancy
lateral pelvic tilt
lateral curve of the lumbar spine

Surgical goals

- **Pain free, stable and mobile hip**
- **Equalization of leg length**
- **Reduction of low back and knee pain through the improvement of static body balance**

Surgical Technique

Encyclopédie Médico-Chirurgicale 44-665-B

EMC, 44-665-B, 1996, Elsiever Paris

Arthroplastie totale de hanche sur luxation congénitale

M Kerboull

L'arthroplastie totale de hanche sur luxation congénitale revêt un caractère particulier en raison du terrain sur lequel elle est réalisée.

Qu'il s'agisse de luxation non traitée et invétérée ou des séquelles à l'âge adulte d'une luxation traitée dans l'enfance, il existe toujours, à des degrés divers, une hypoplasie ou une dysplasie iliaque et fémorale, un retentissement fonctionnel et anatomique sur le rachis et le genou et une inégalité de longueur des membres inférieurs.

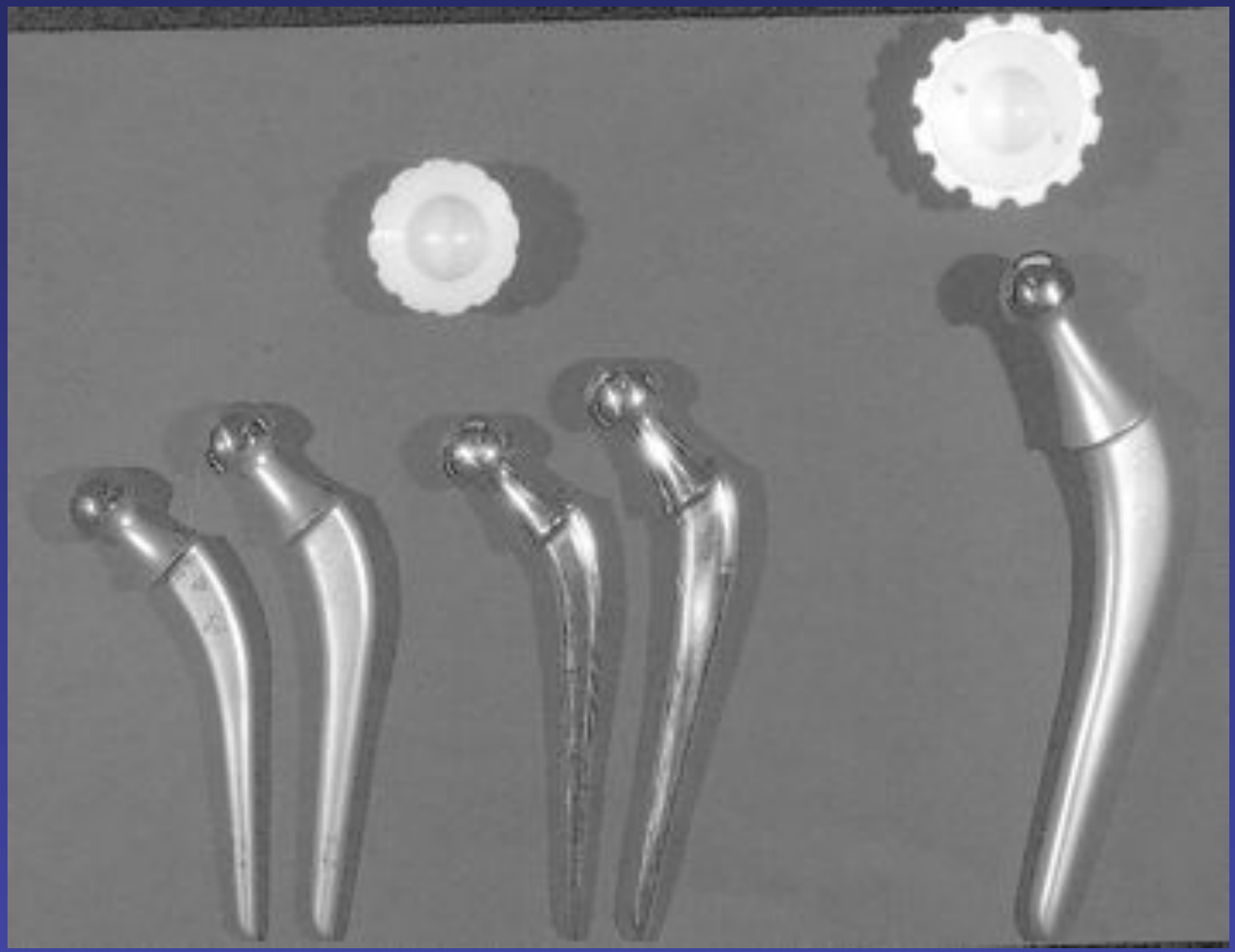
L'intervention sur ce terrain se doit donc d'avoir un triple but : redonner au patient une ou deux hanches indolores, stables et mobiles, égaliser la longueur des membres inférieurs et soulager la souffrance du rachis lombaire et du genou. Pour atteindre ces objectifs il nous semble qu'il faut reconstruire la hanche artificielle en situation anatomique, lui rendre une architecture proche de la normale, redonner aux membres inférieurs leur longueur normale, respecter l'intégrité de la musculature périarticulaire et au besoin en rétablir l'équilibre.

Pour comprendre les modalités techniques de l'arthroplastie totale sur ce terrain, ses possibilités de reconstruction articulaire et d'égalisation en longueur des membres inférieurs, une étude anatomopathologique et physiopathologique de la hanche luxée et des répercussions de la luxation sur le rachis et le genou nous semble nécessaire.

Surgical Technique: preoperative planning

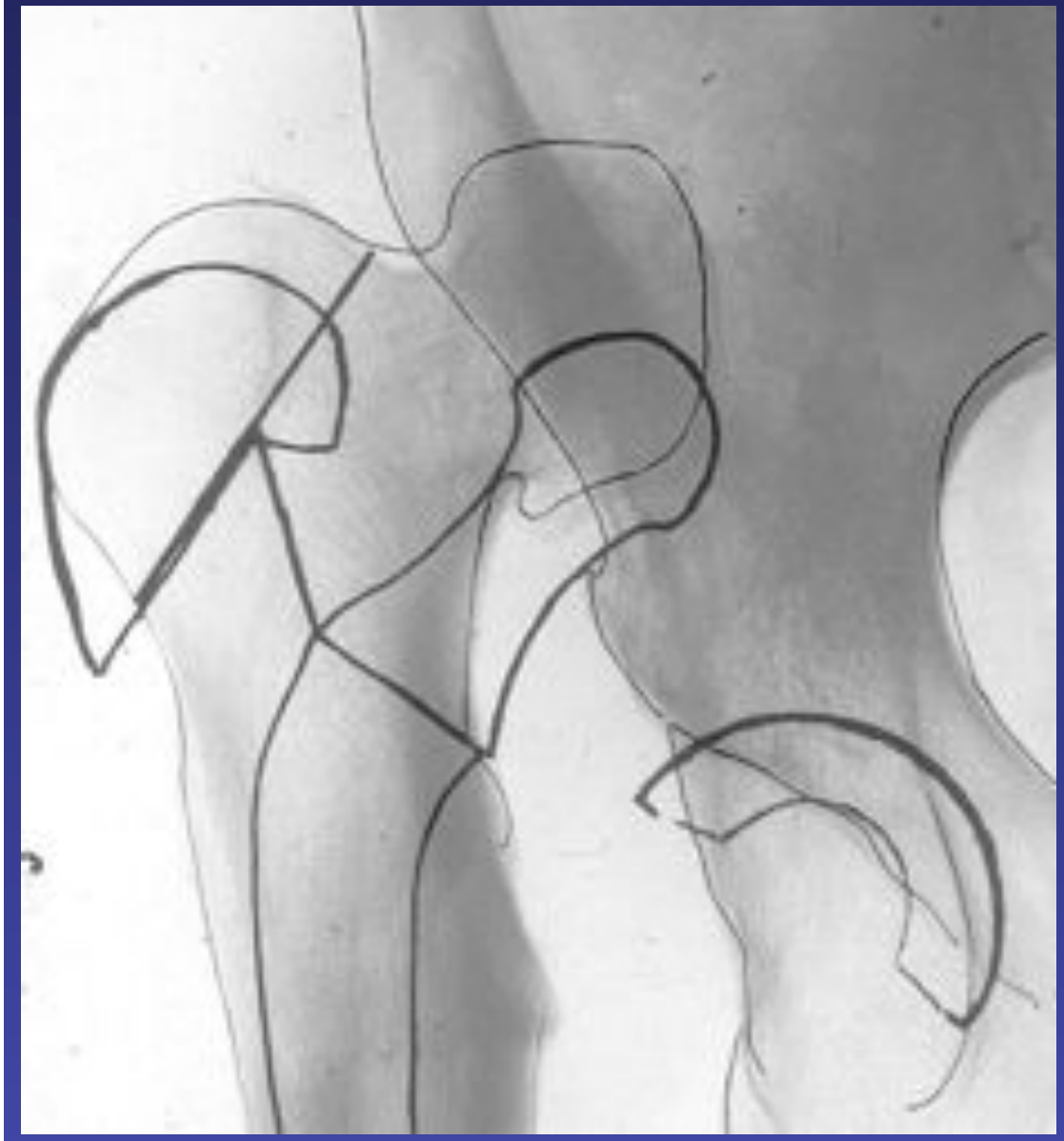
- Measurement of leg length discrepancy
- Choice of the suitable components
- Level of femoral neck section with respect to the desirable lengthening
- True acetabulum location and reconstruction
- The need for an alignment or shortening femoral osteotomy

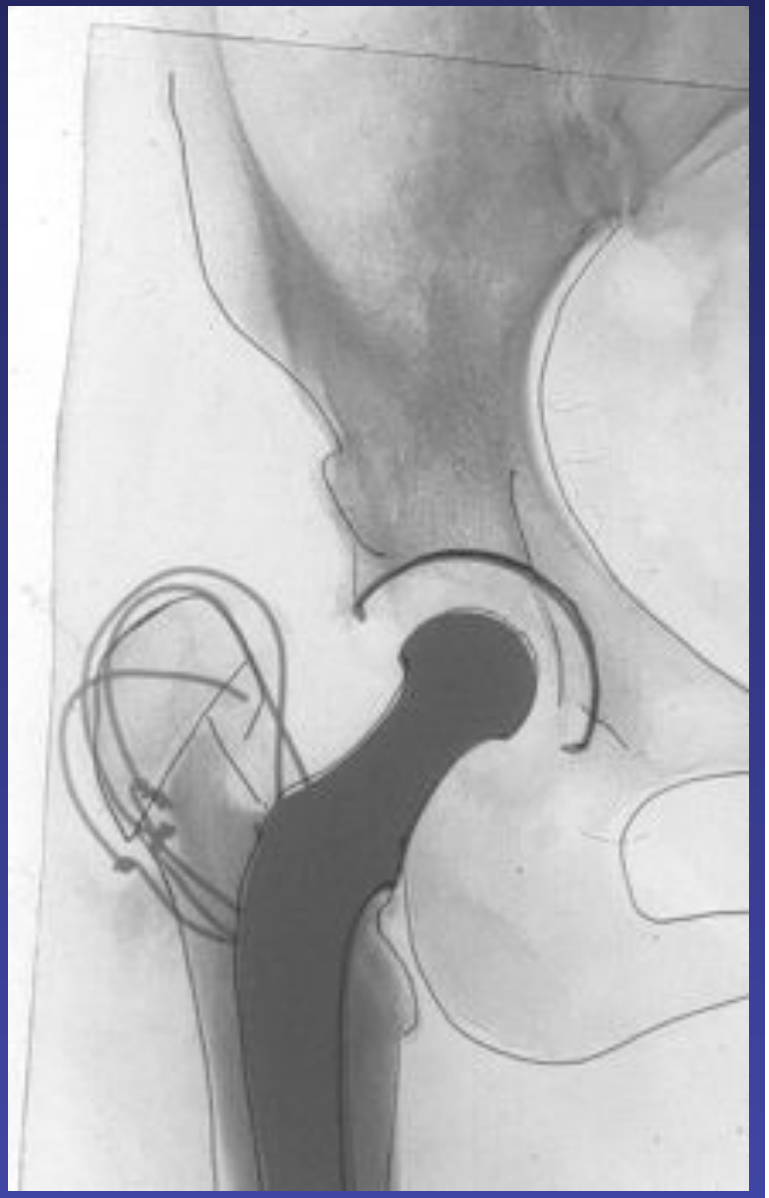
Choice of the suitable implant



standard dysplastic

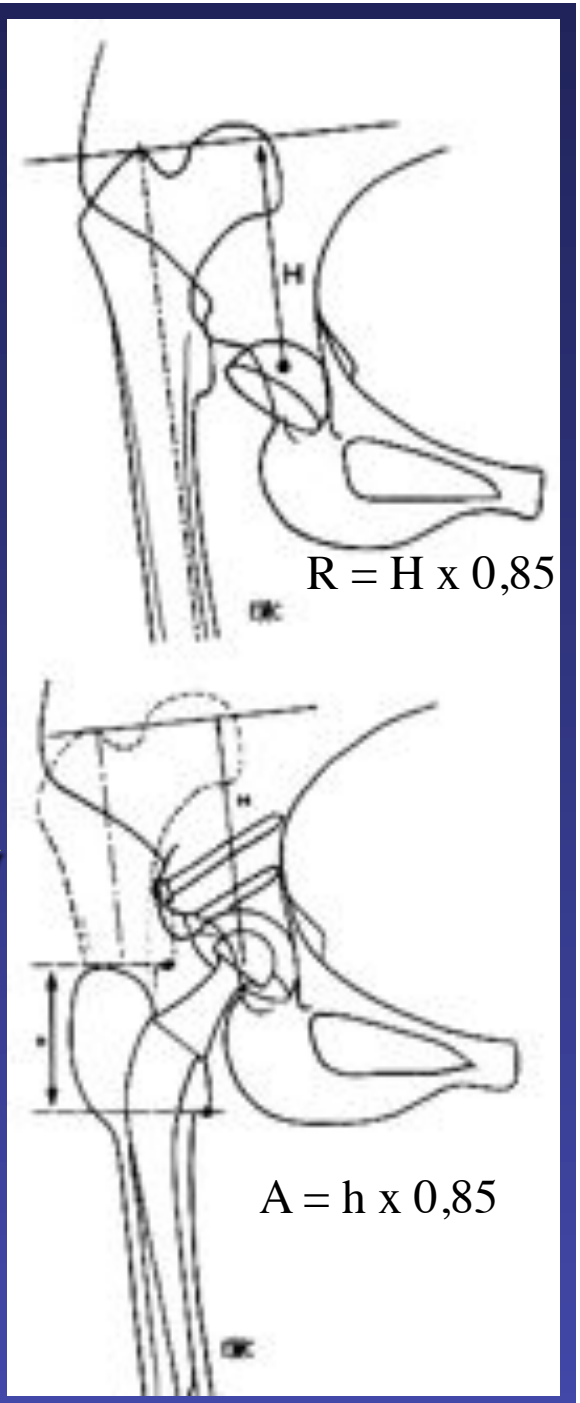
Drawing of the preoperative planning



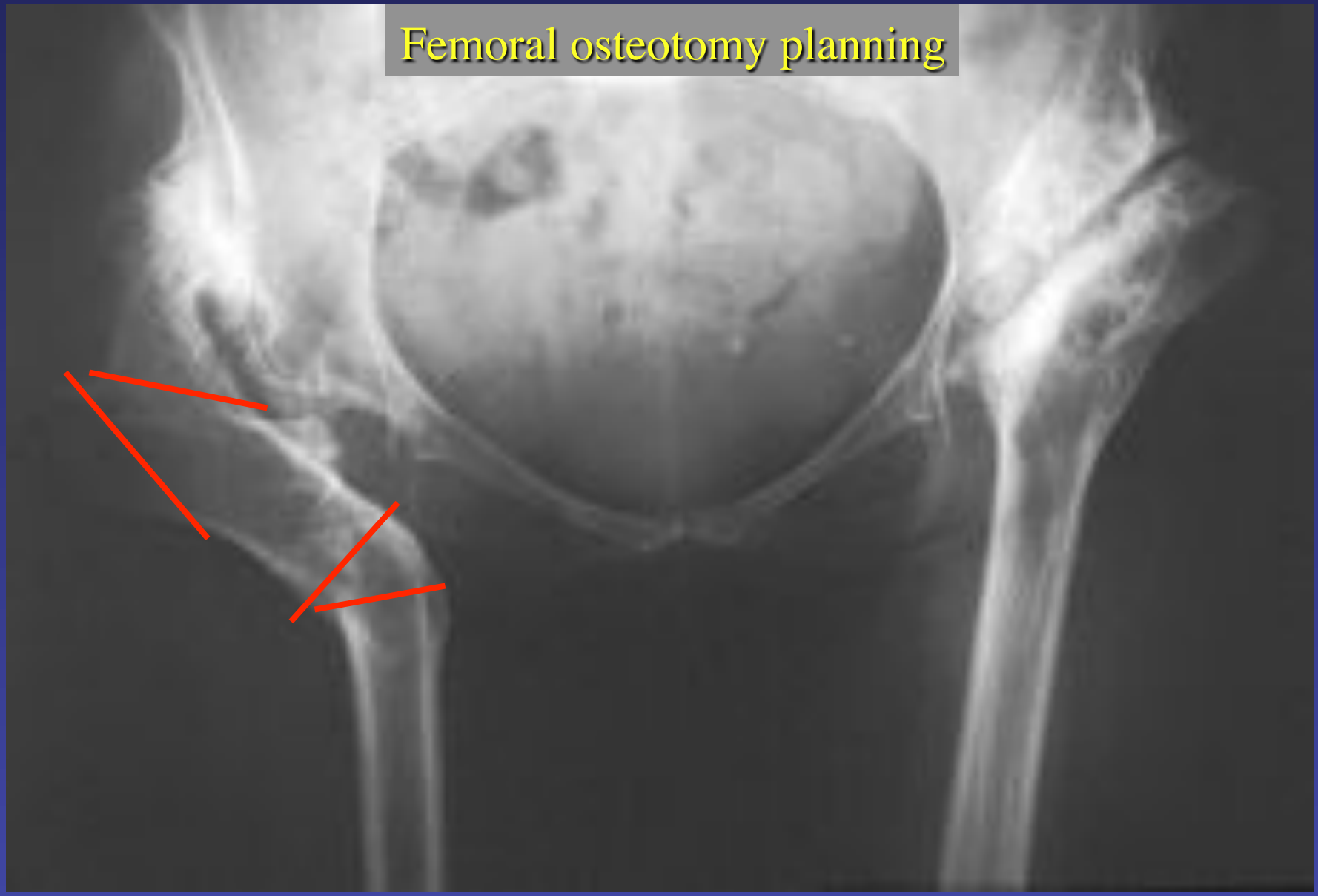


Long standing view
of the lower part of the body

Measurement of leg length discrepancy And Leg lengthening

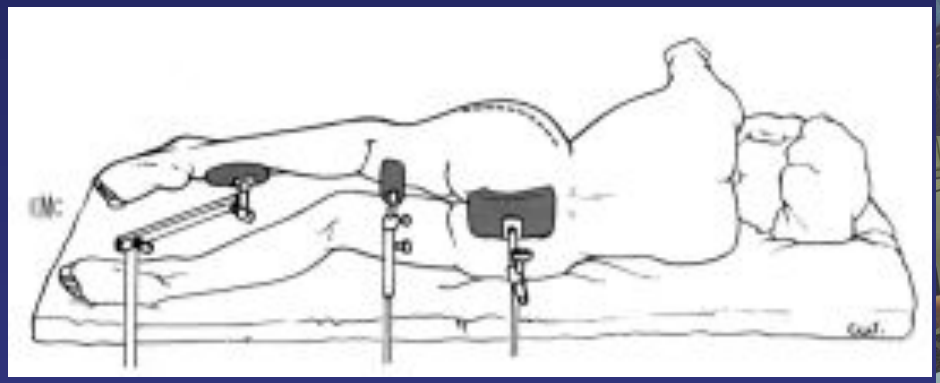


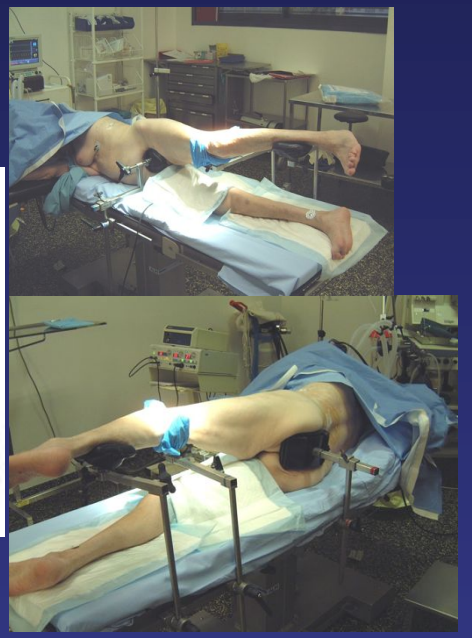
Femoral osteotomy planning



surgical technique : stages

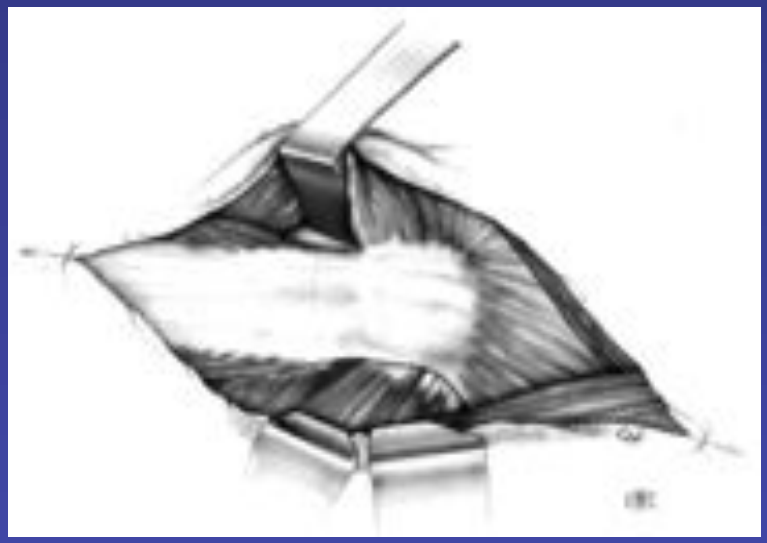
installation



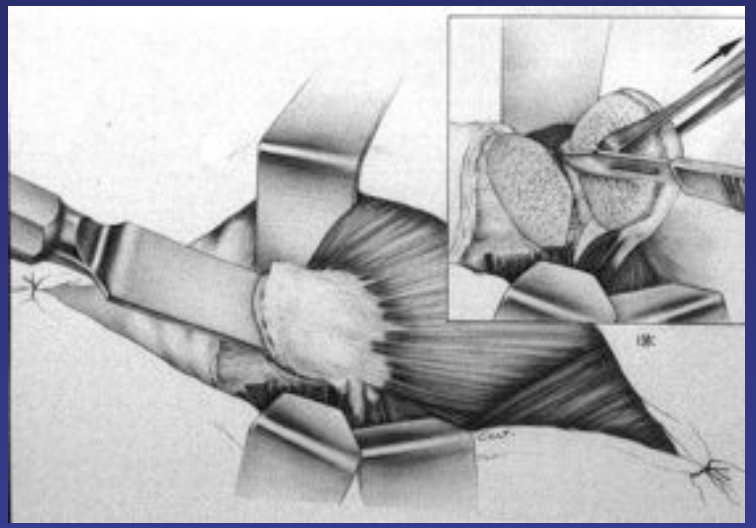


Sciatic nerve position

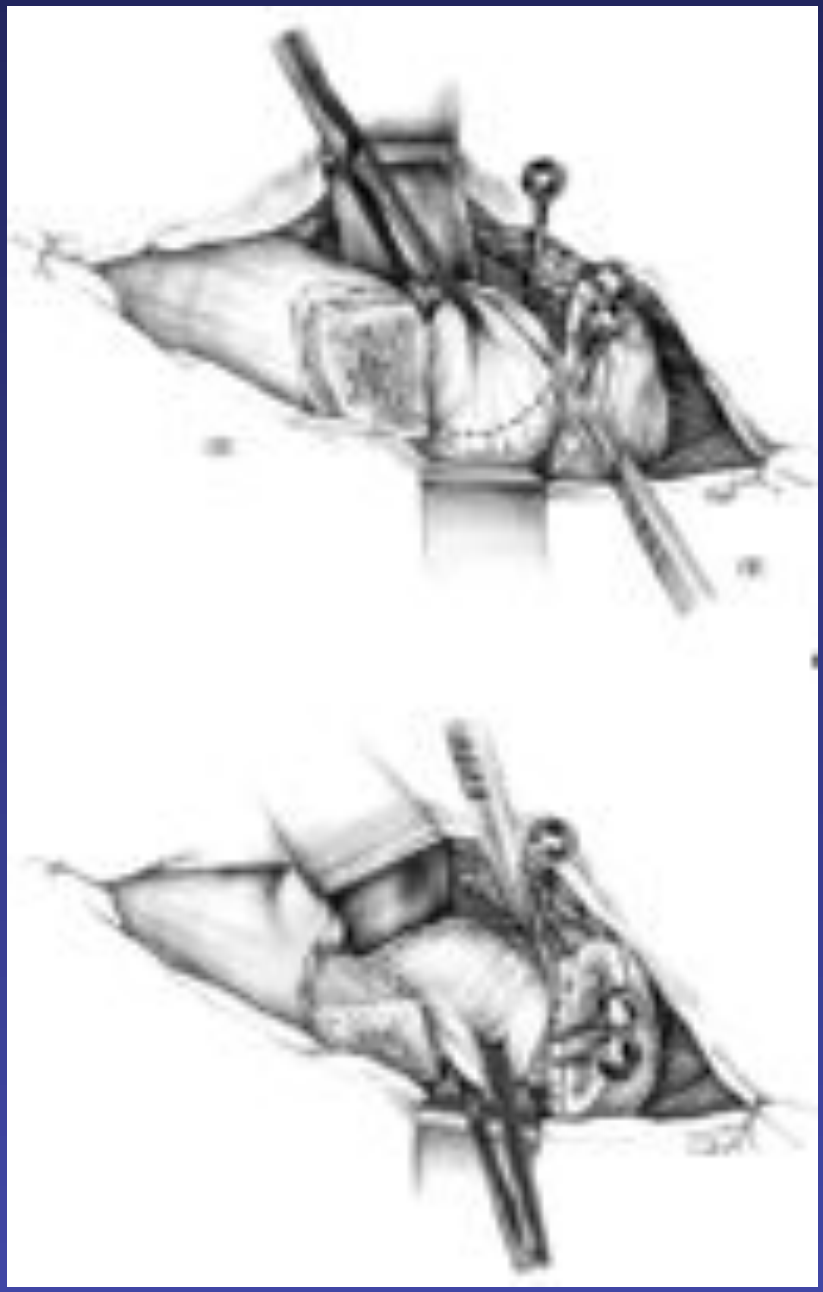
G. Troch exposure

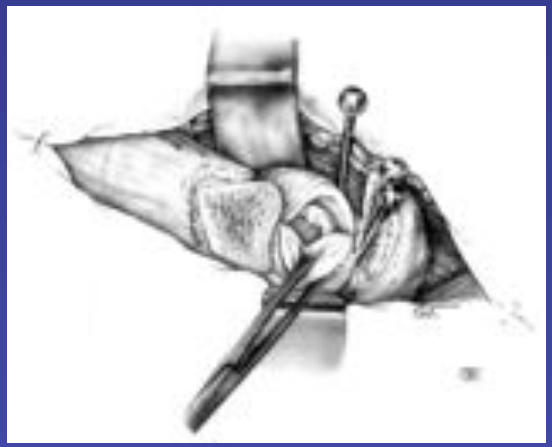


Trochanteric osteotomy

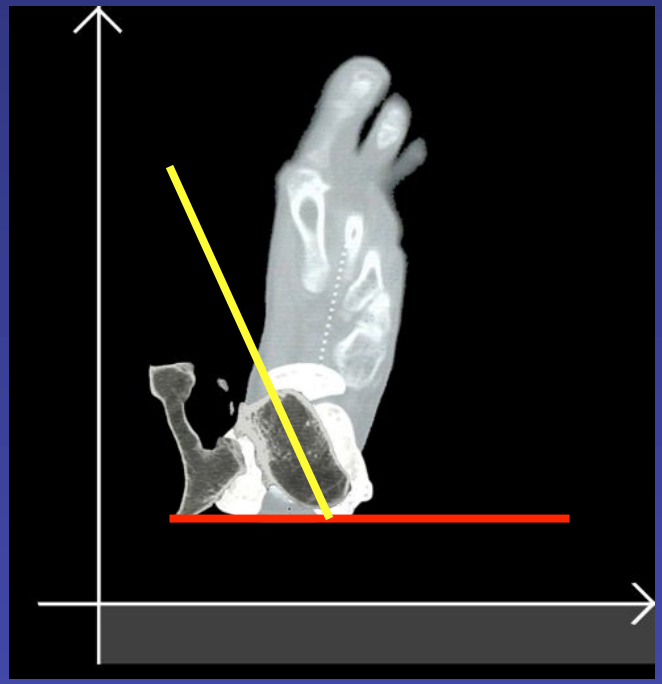


- Joint release
- Complete resection of joint capsule, scar fibrous tissue, osteophytes and shelf …
- No muscular or tendon section

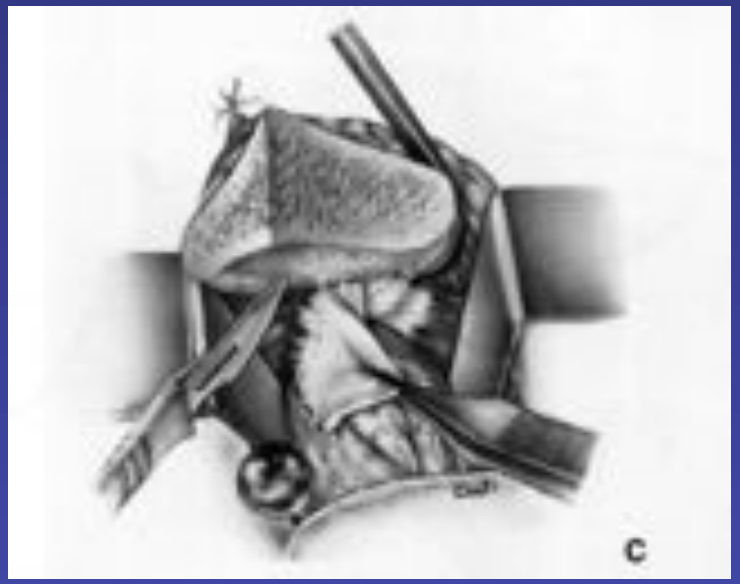


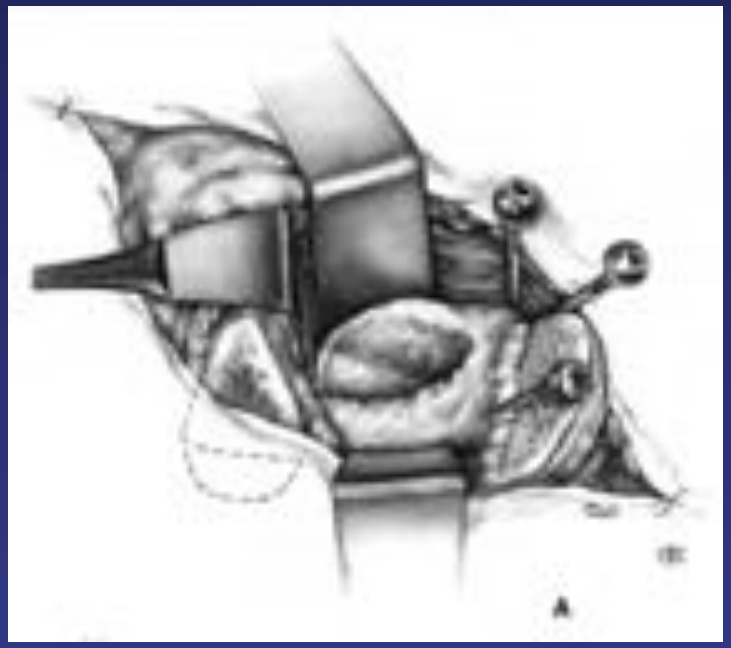


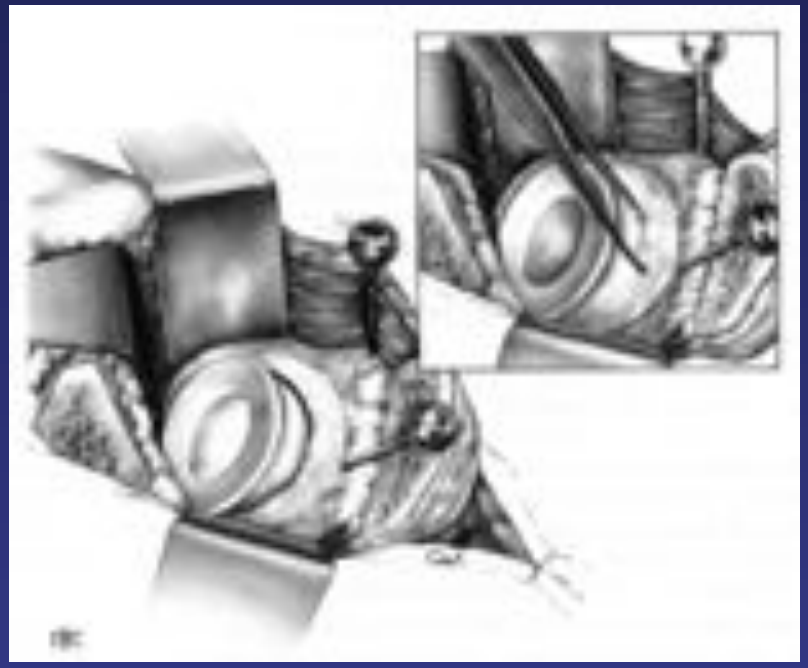
Femoral neck cut done at the level of the lesser trochanter to allow correction of the excessive anteversion of the femoral neck

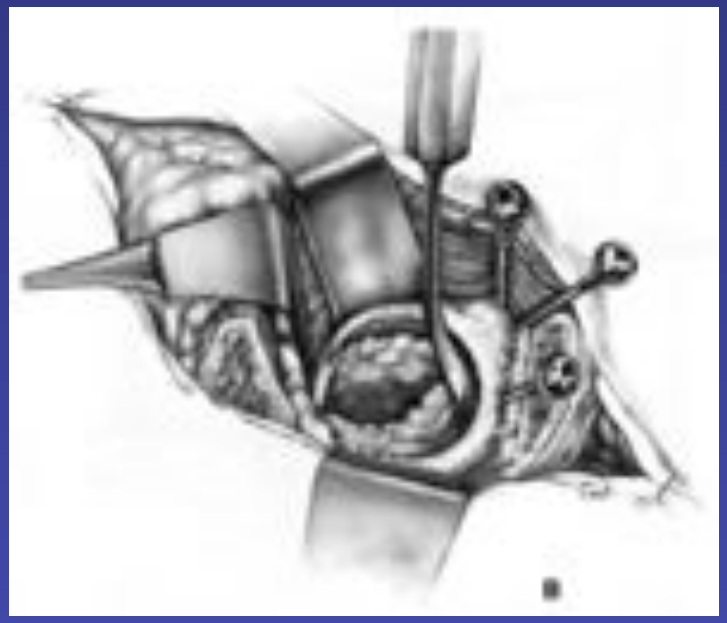


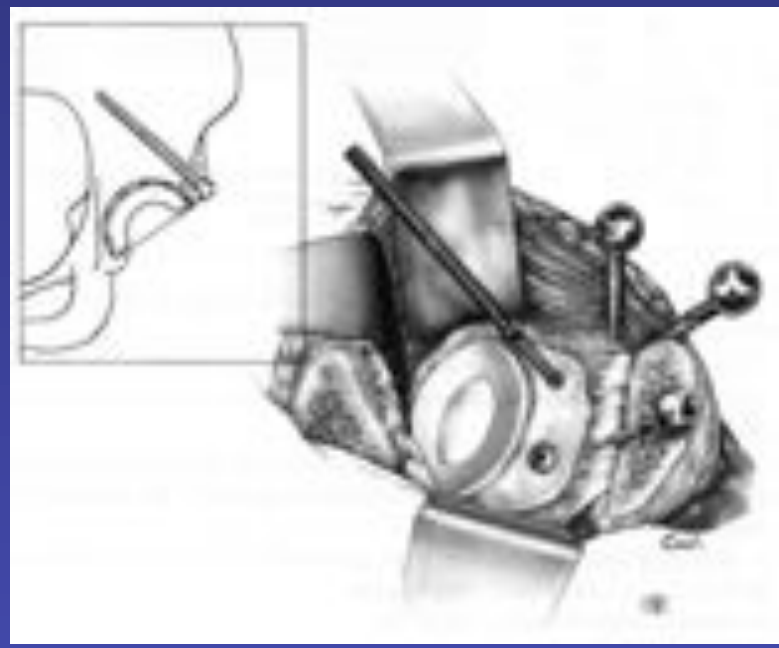
Resection of the inferior part of the elongated capsule led to the tear drop and true acetabulum

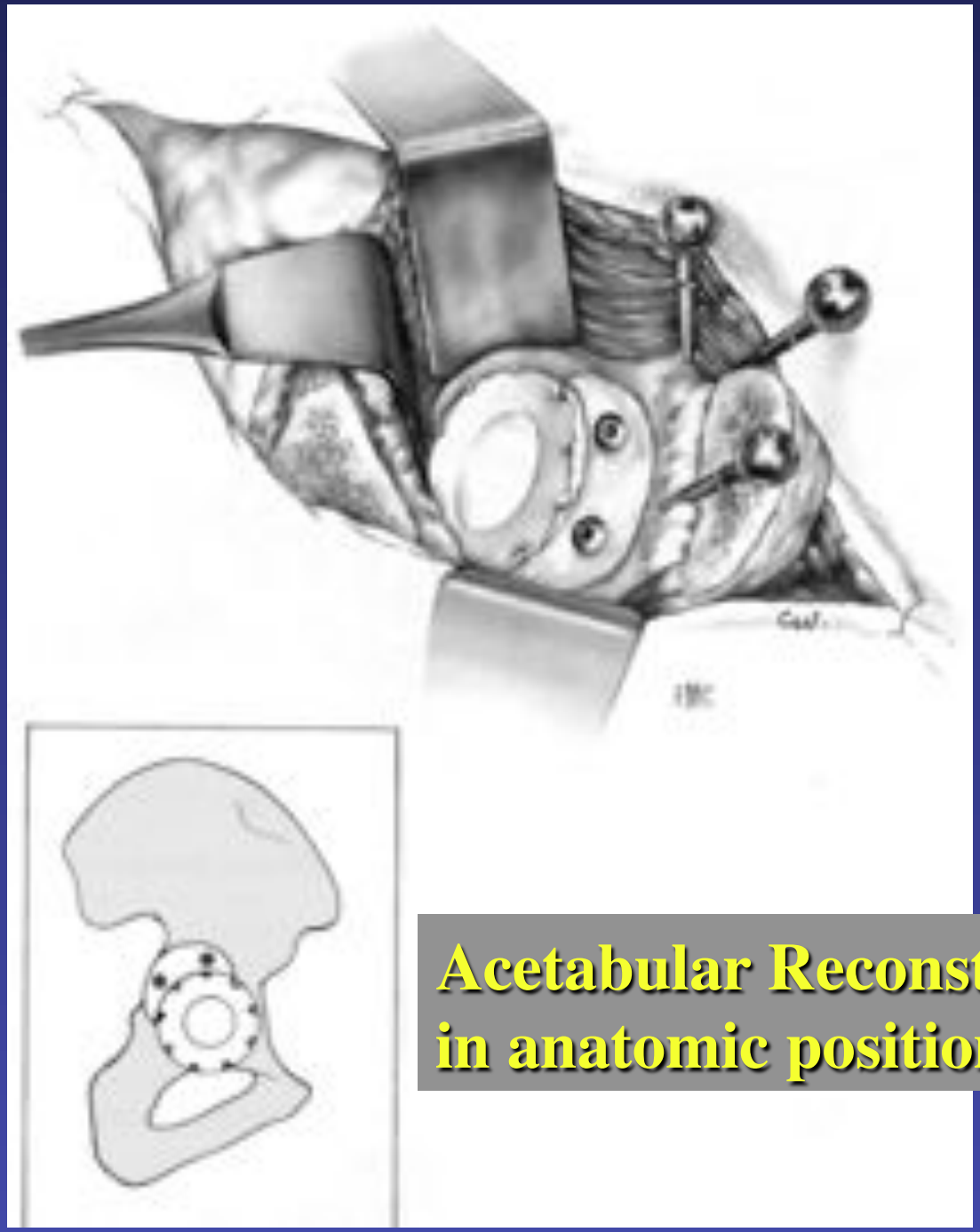






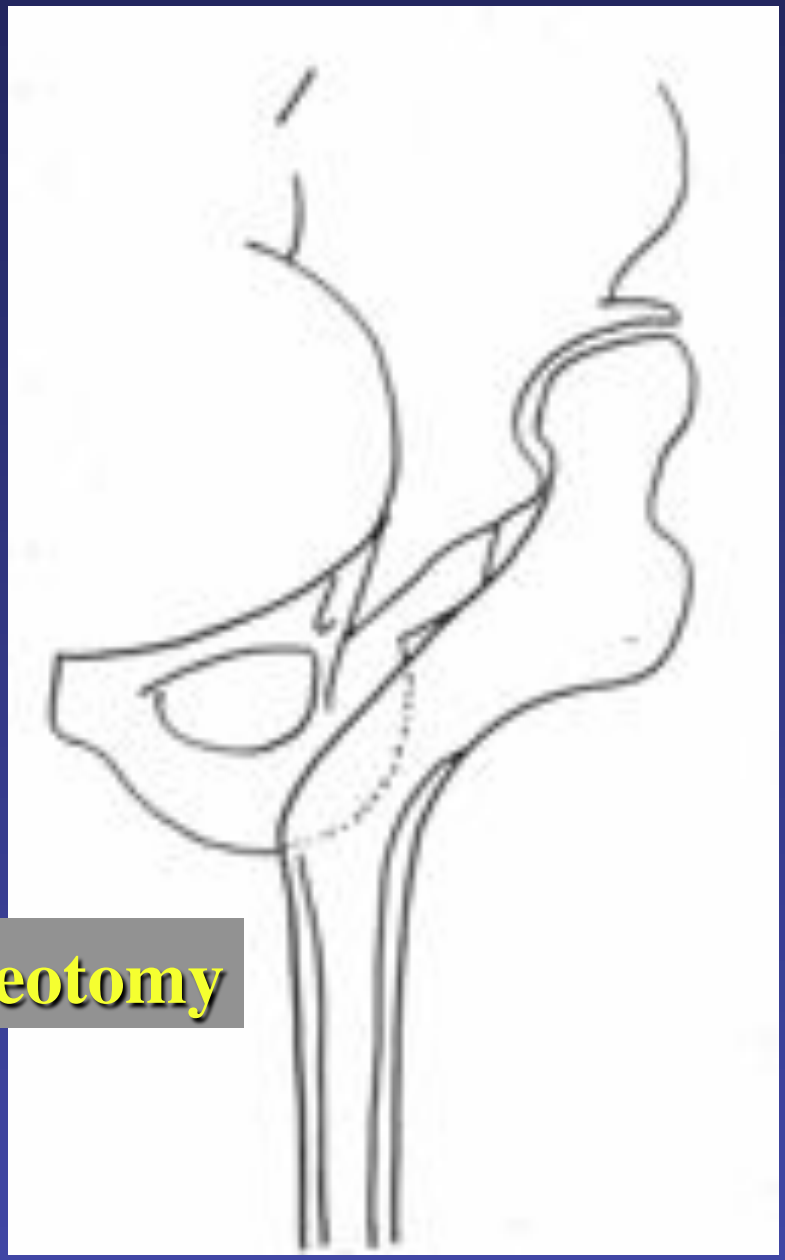




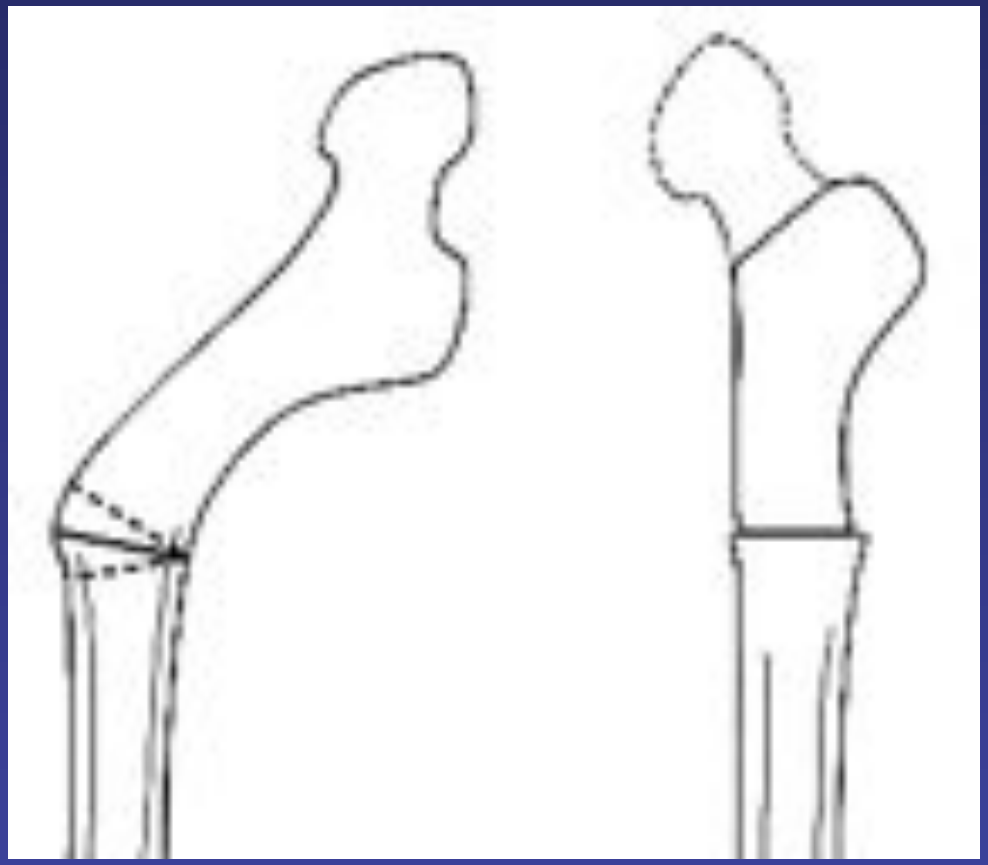


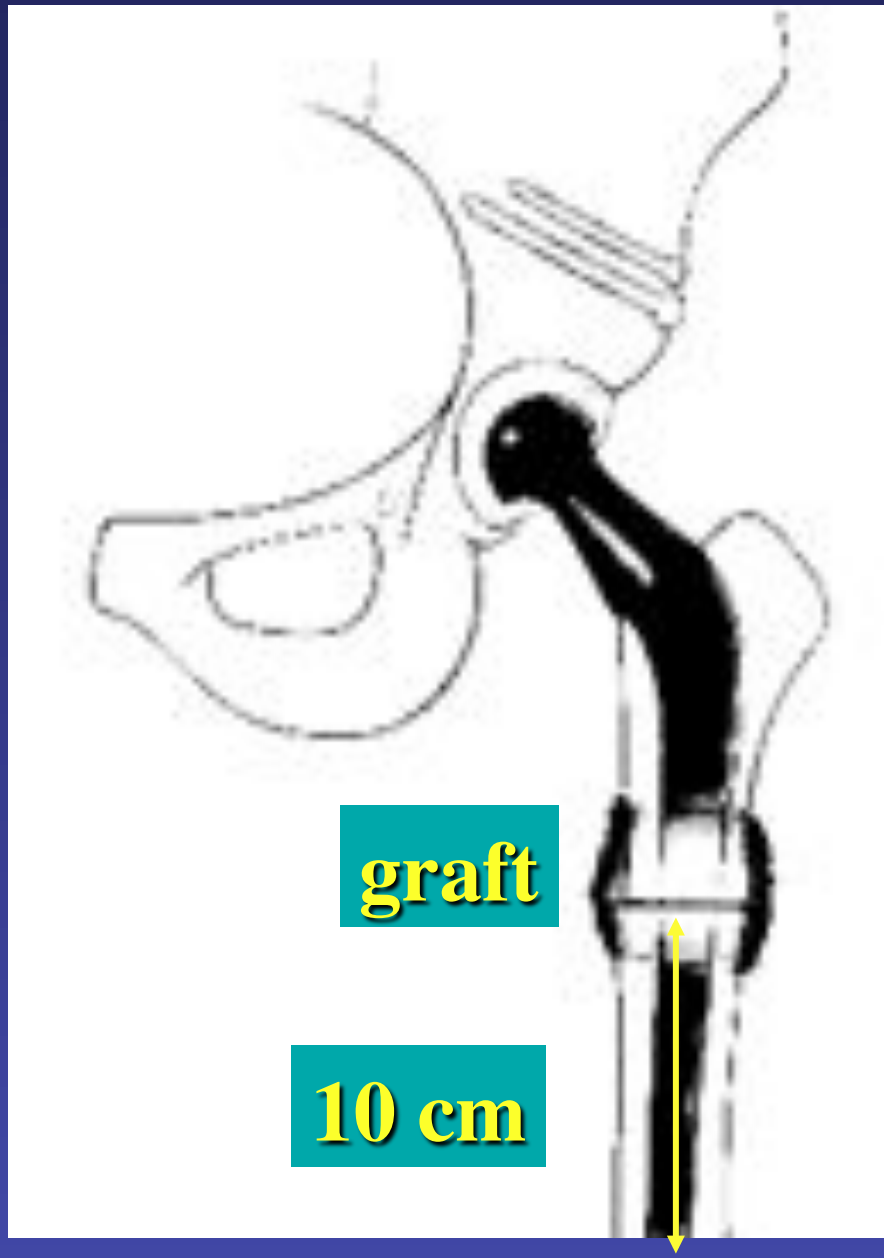
Acetabular Reconstruction in anatomic position

Femoral side

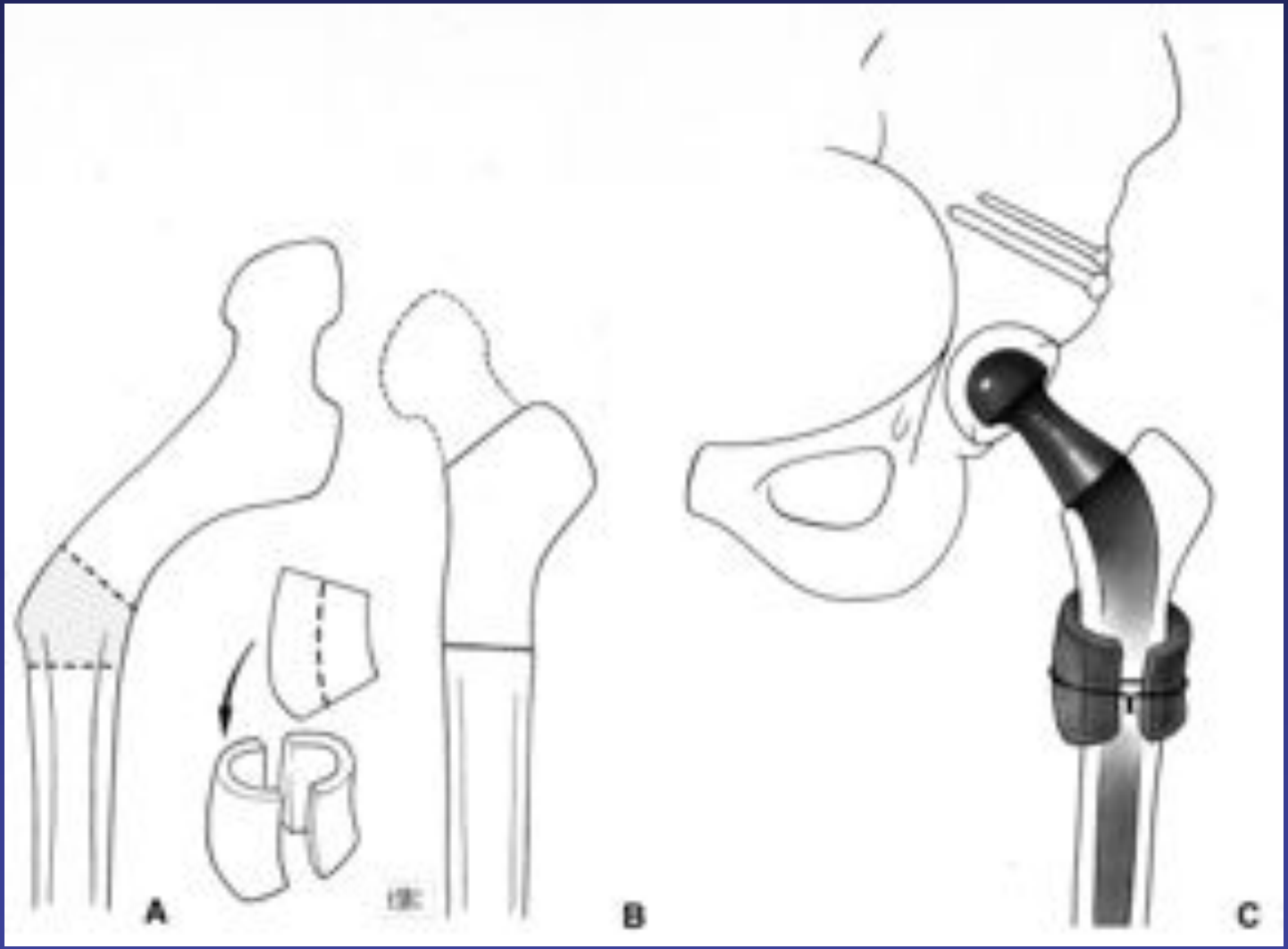


Femoral osteotomy

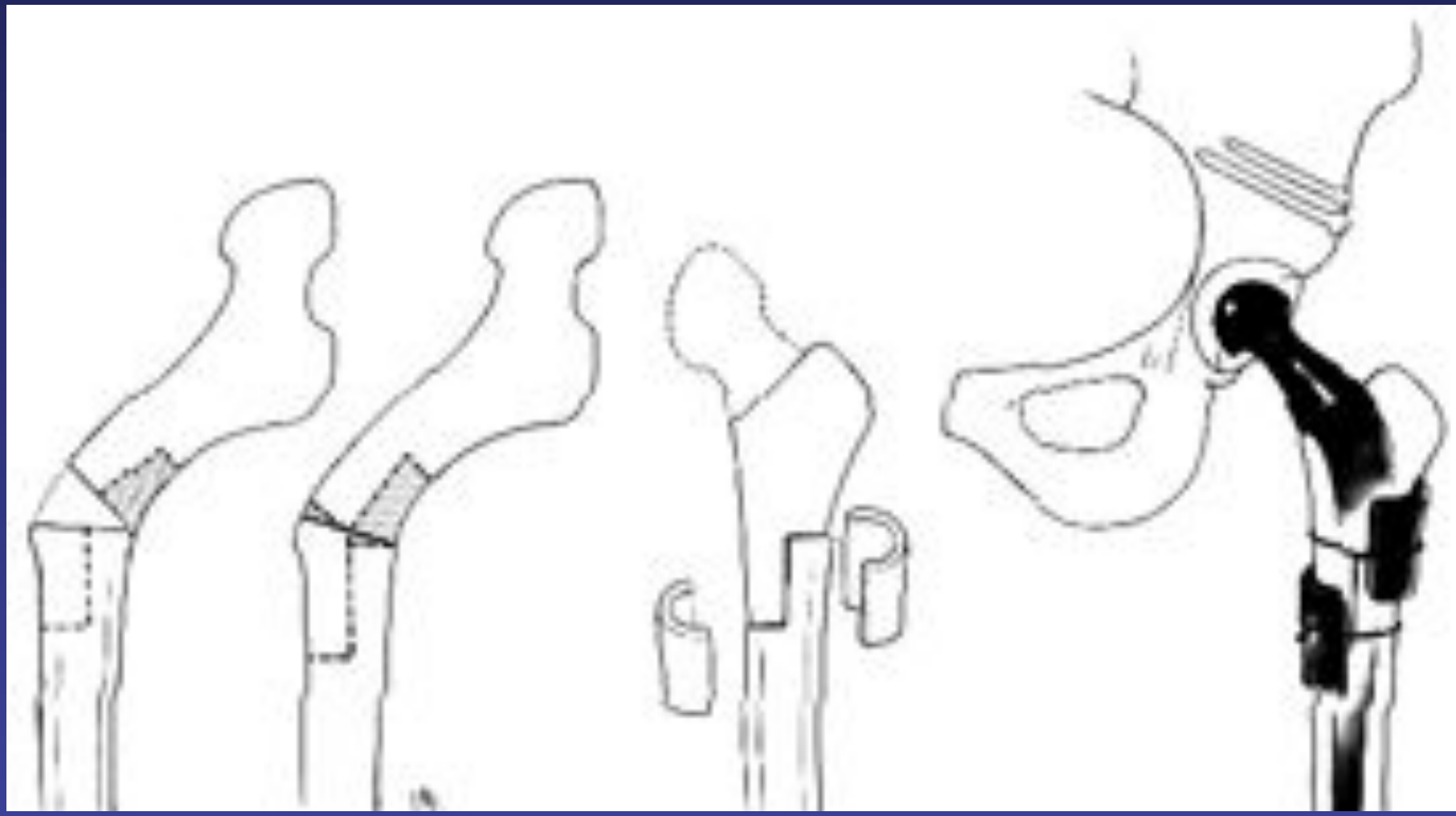




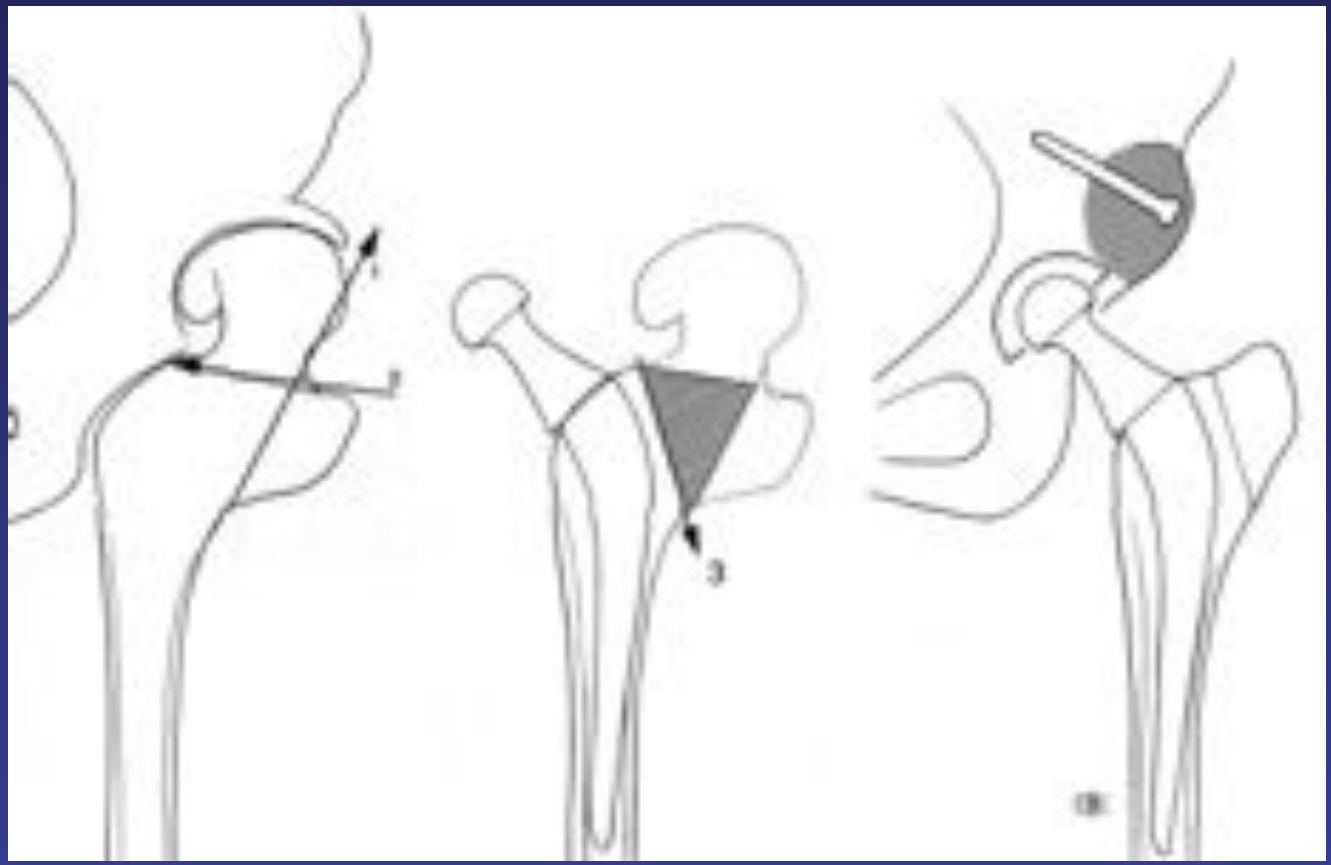
Alignment Osteotomy
Wedge resection



Alignment and shortening osteotomy trapezoidal resection



Alignment and shortening osteotomy
step resection



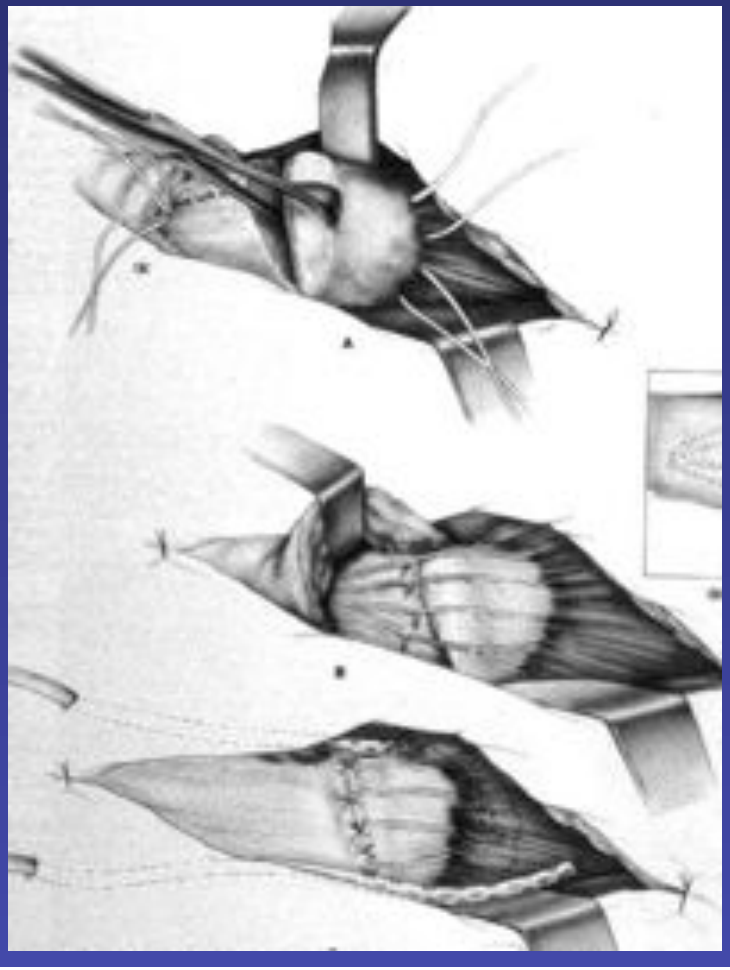
in some case the femoral osteotomy is not necessary. The prosthesis is implanted in the old osteotomy site. A metaphyseal remodeling leads to a normal anatomy

Hip Reduction

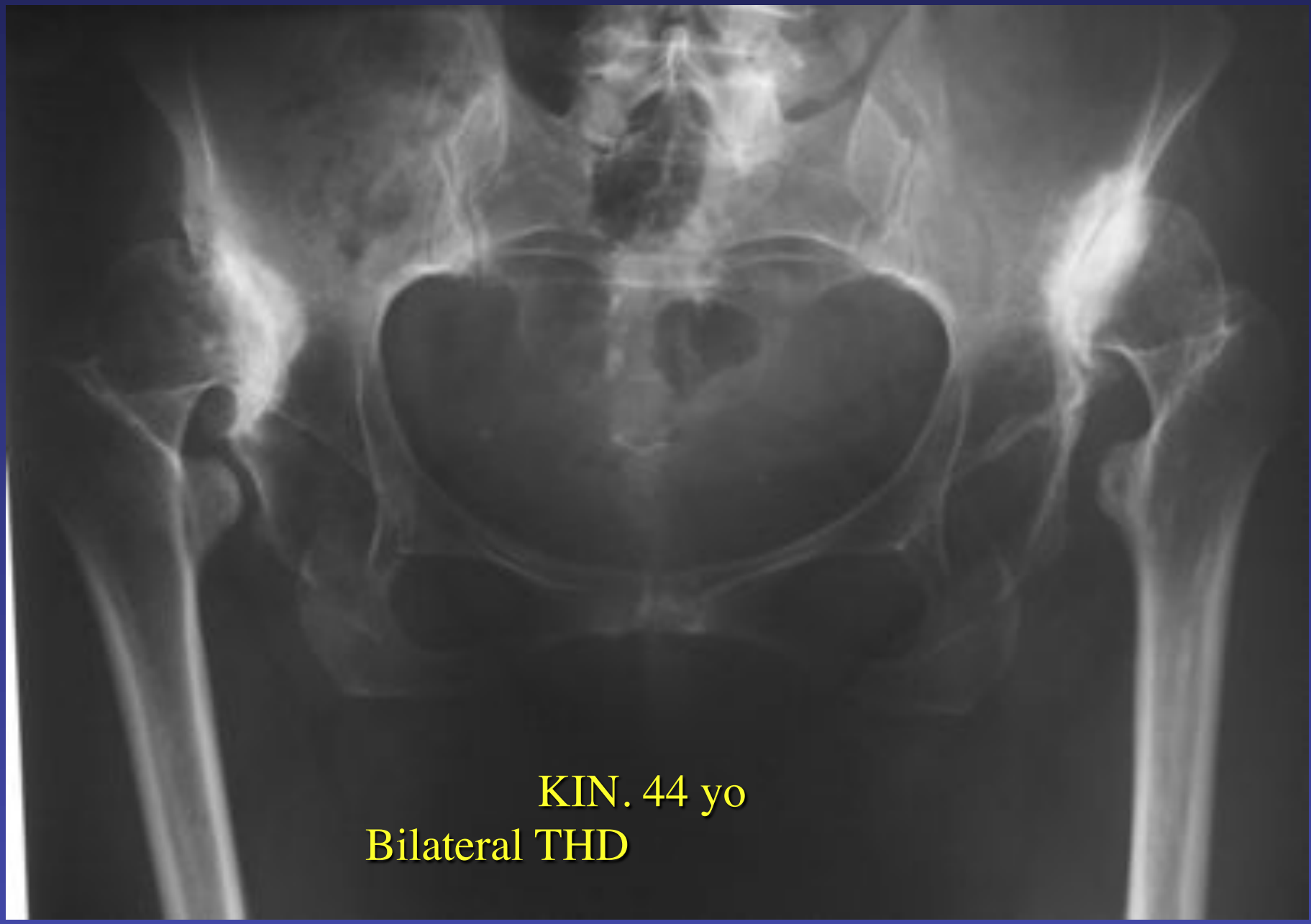
- limb in adduction and slight flexion
- knee flexed by 90°,
- direct pressure inferiorly directed on the femoral neck.

To protect the sciatic nerve from elongation

- Trochanter reattachment using metallic wires
- limb in abduction to facilitate the trochanter descent
- Remodeling of trochanter and femoral lateral cortex if necessary to increase bone surface contact



EXEMPLES


KIN. 44 yo
Bilateral THD


DROIT
COUCHE
KIN. 16 y PO

Unil THD

JAG. 54 yo

21 y PO

CAU. 42 yo

Unil THD

22 y PO

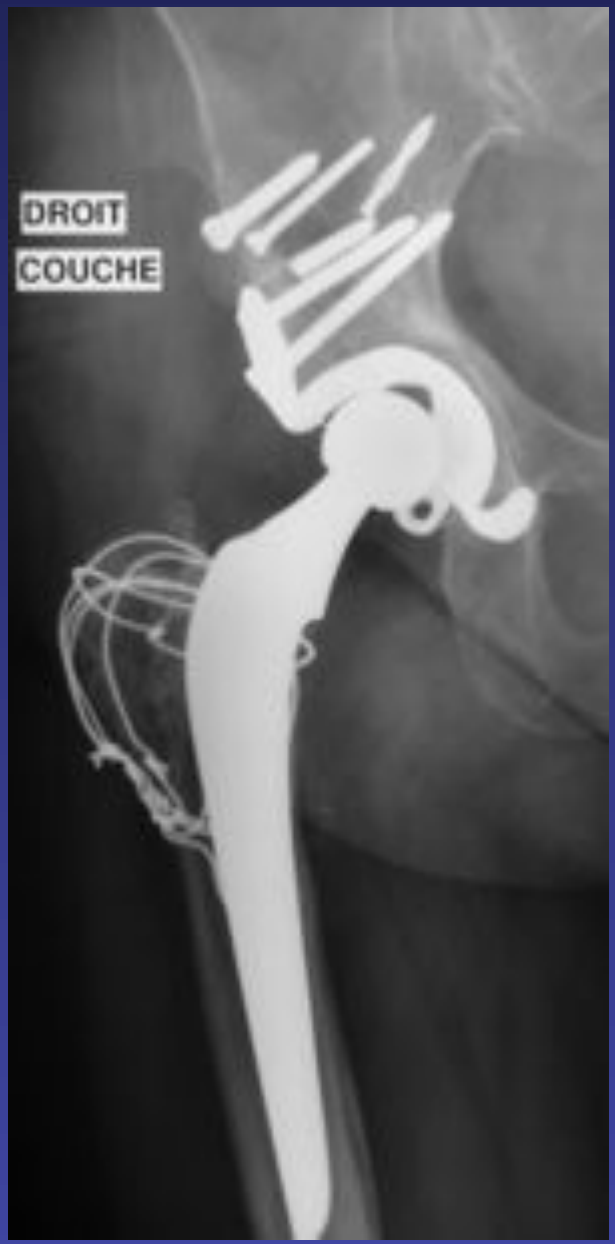
Unil THD

5 y PO

18 ans PO

19 y PO

CAR.



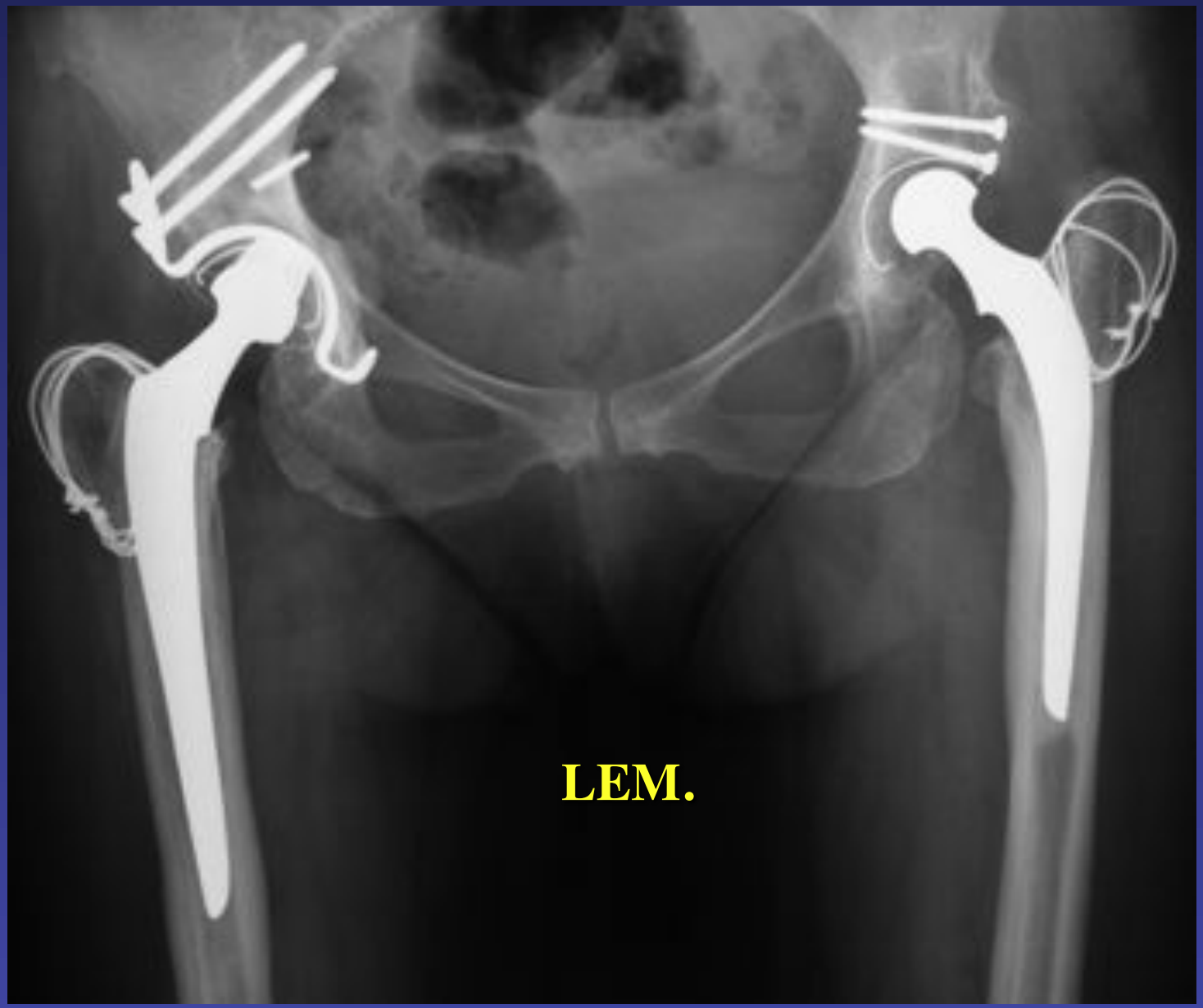
3 y after revision


LEM. 41 yo

LEM. 14 y PO

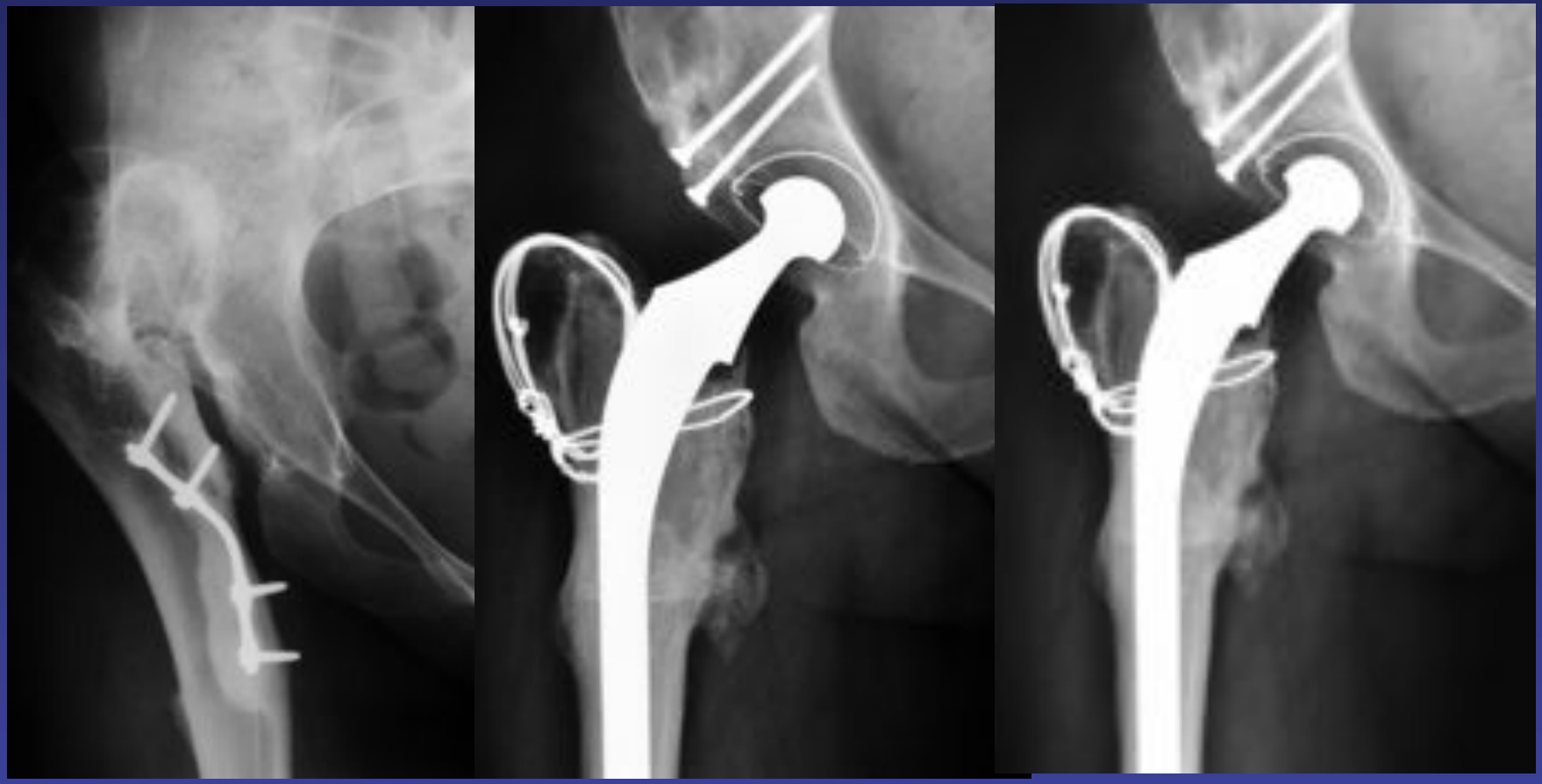
LEM. 16 y PO

LEM. 18 yo PO



3 y after revision

21 y PO



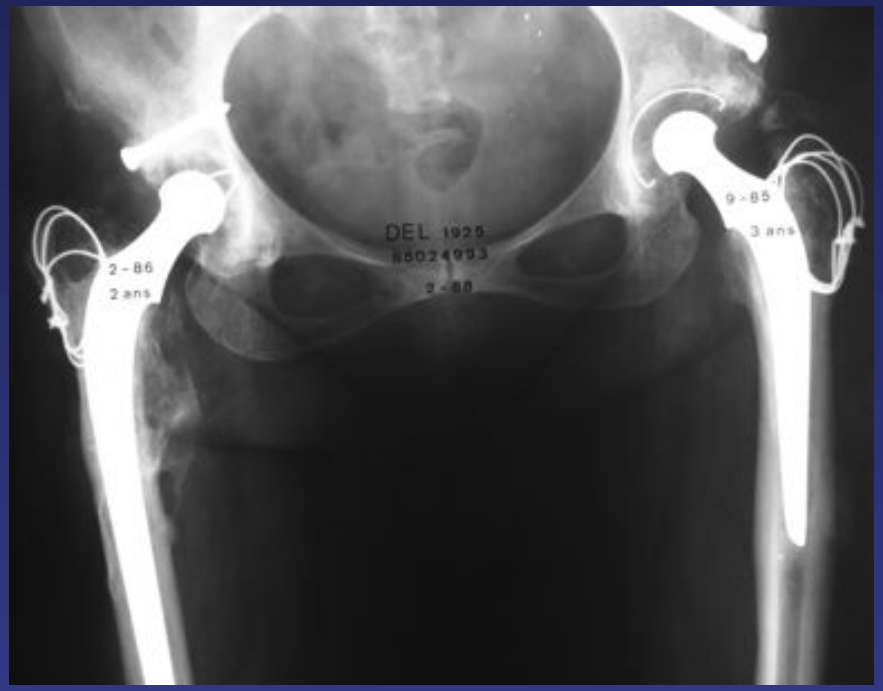
VDM 1991 31 yo

6 y PO

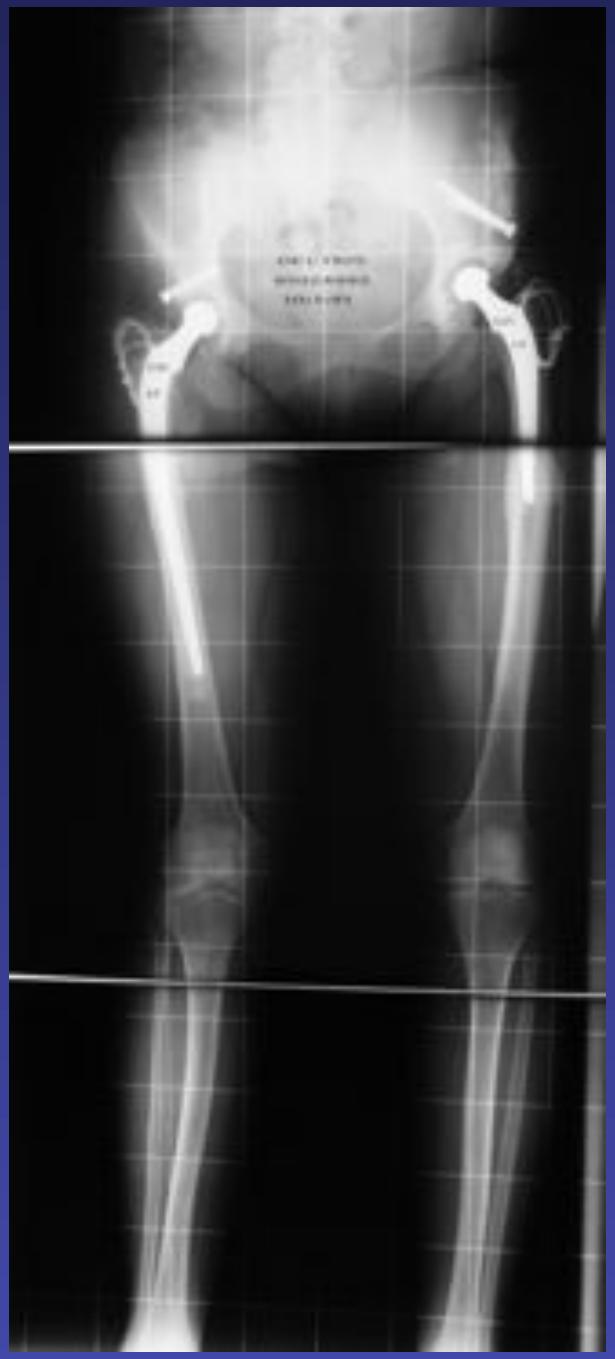
13 y PO

DEL. 09.85 61 yo.

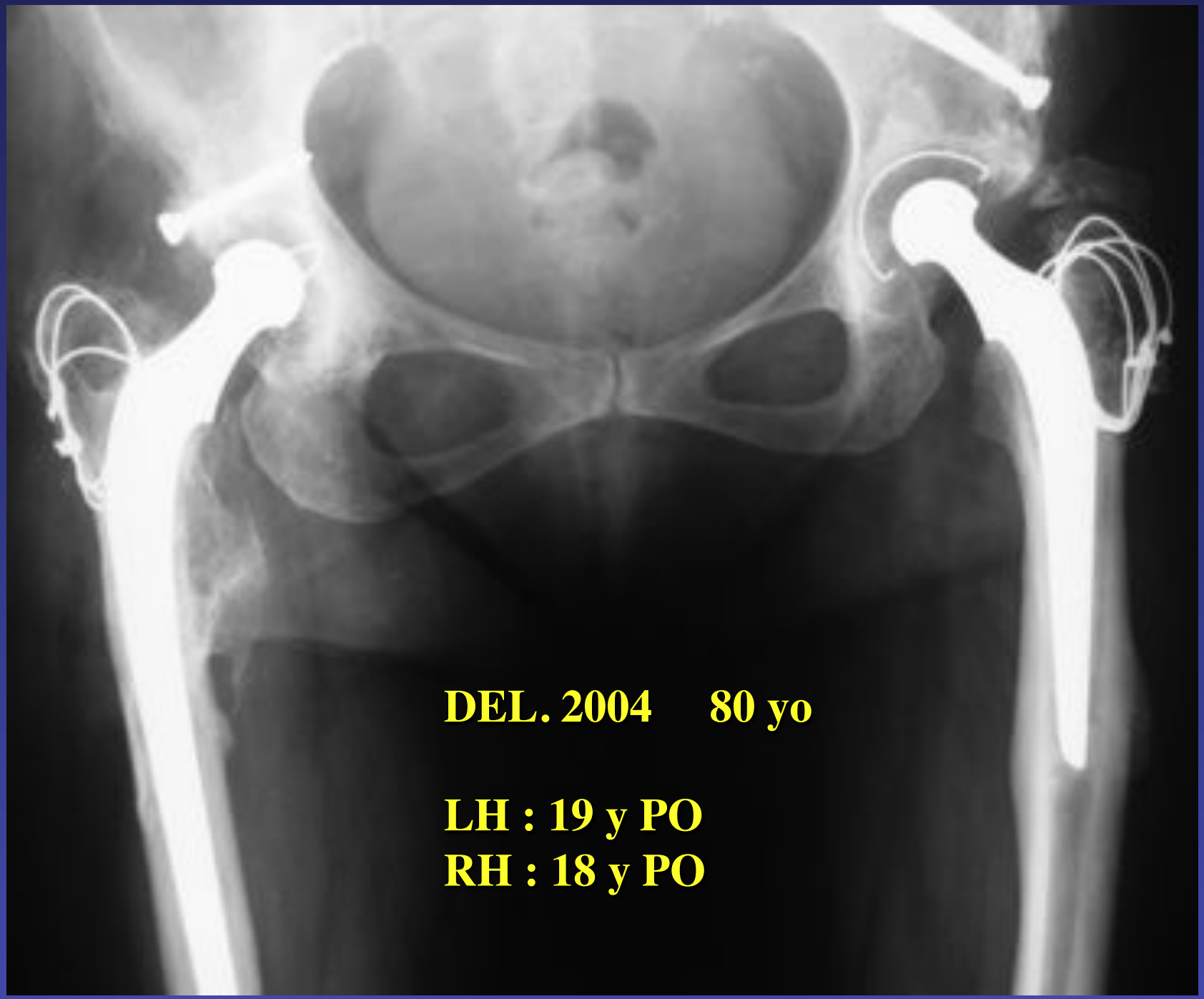
Bilat THD,
previous femoral abduction osteotomy

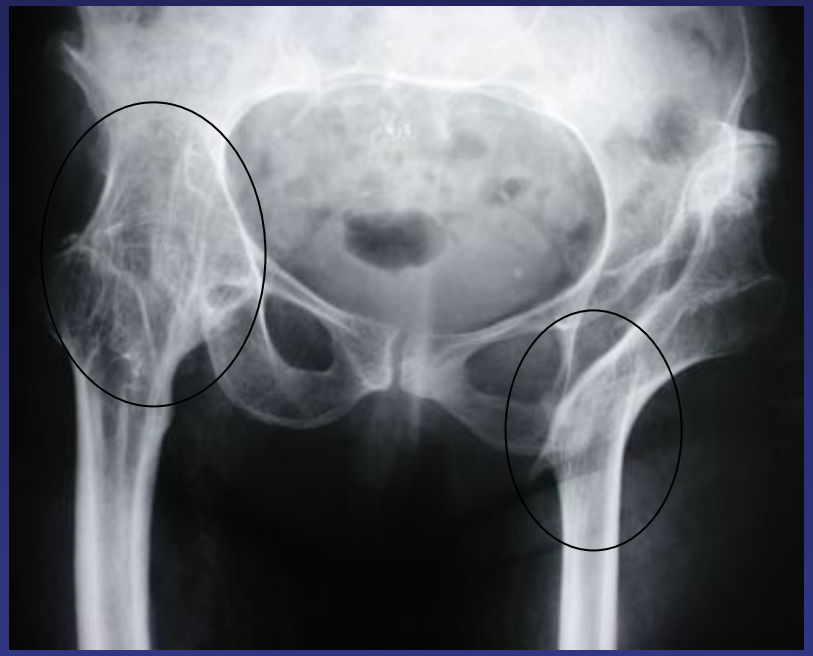


DEL. 1988 64 yo.



Left 3 y PO
Right 2 y PO
Improvement of body static balance and almost correction of the valgus deformity of the right knee


DEL. 2004 80 yo
LH : 19 y PO
RH : 18 y PO



BOU. 1985 75 yo

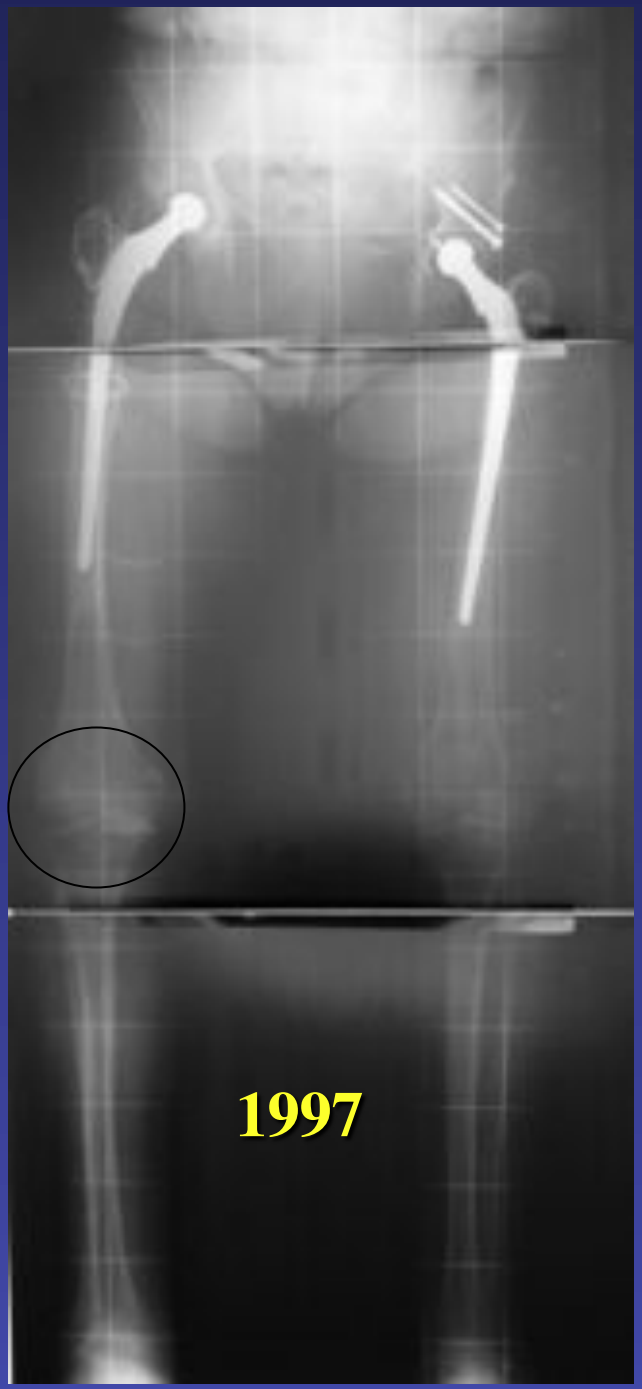
Arthrodesis on the right hip

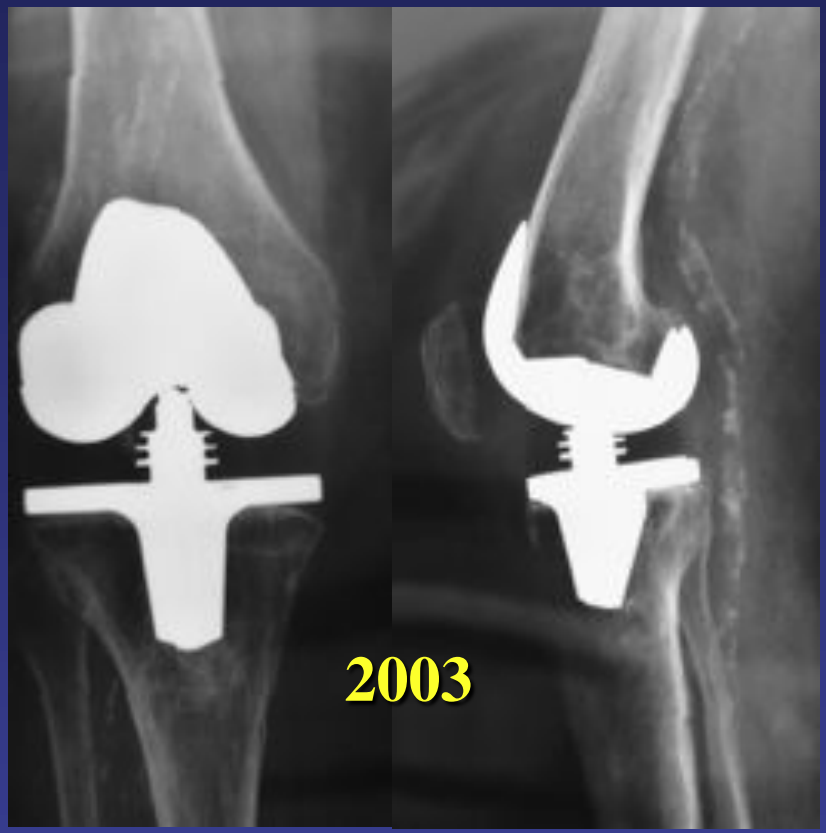
Schanz osteotomy on the left hip

BOU. 1989 79 yo

Left hip : 4 y post-op.

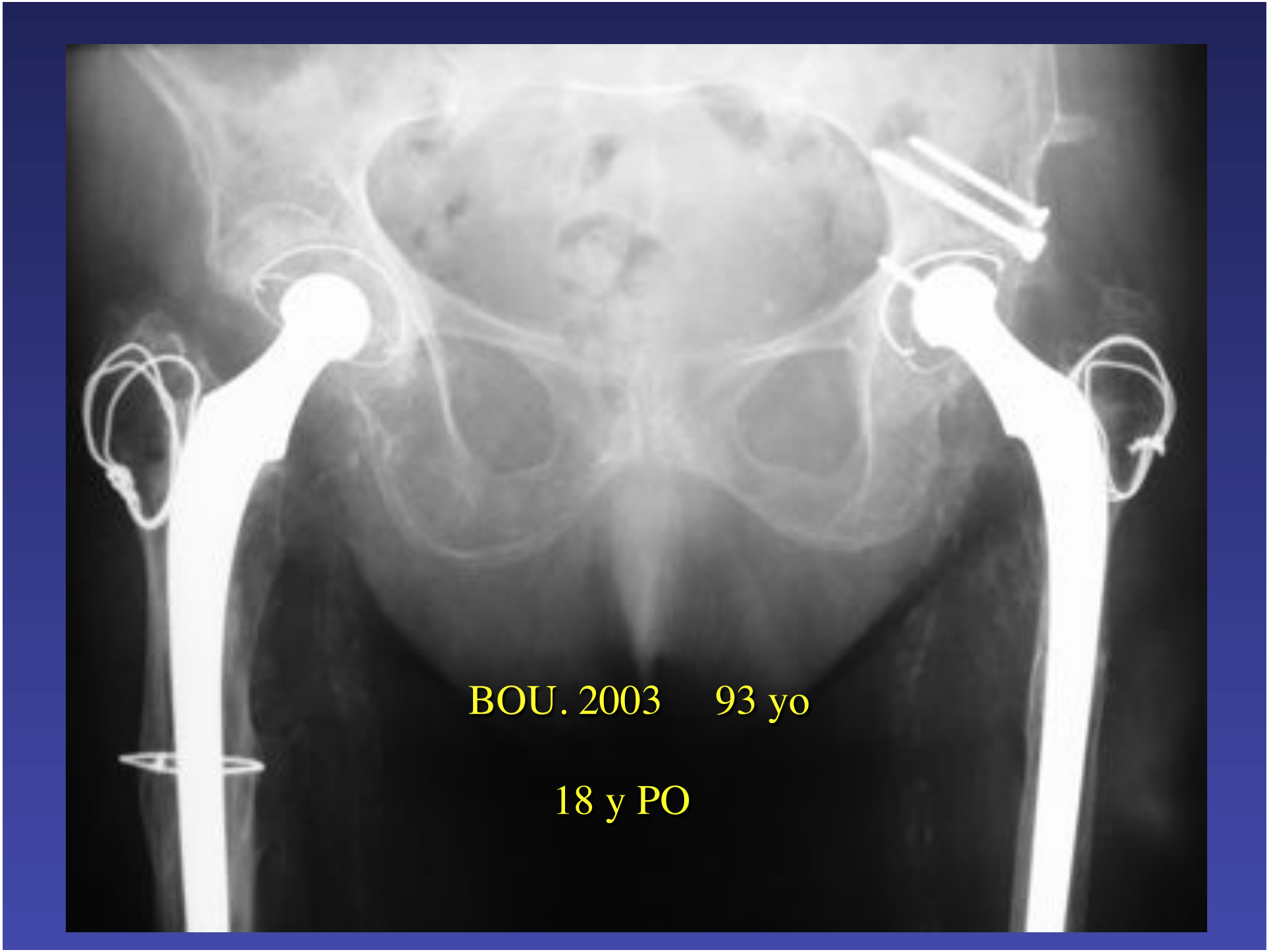
Right hip : 1 y post-op.

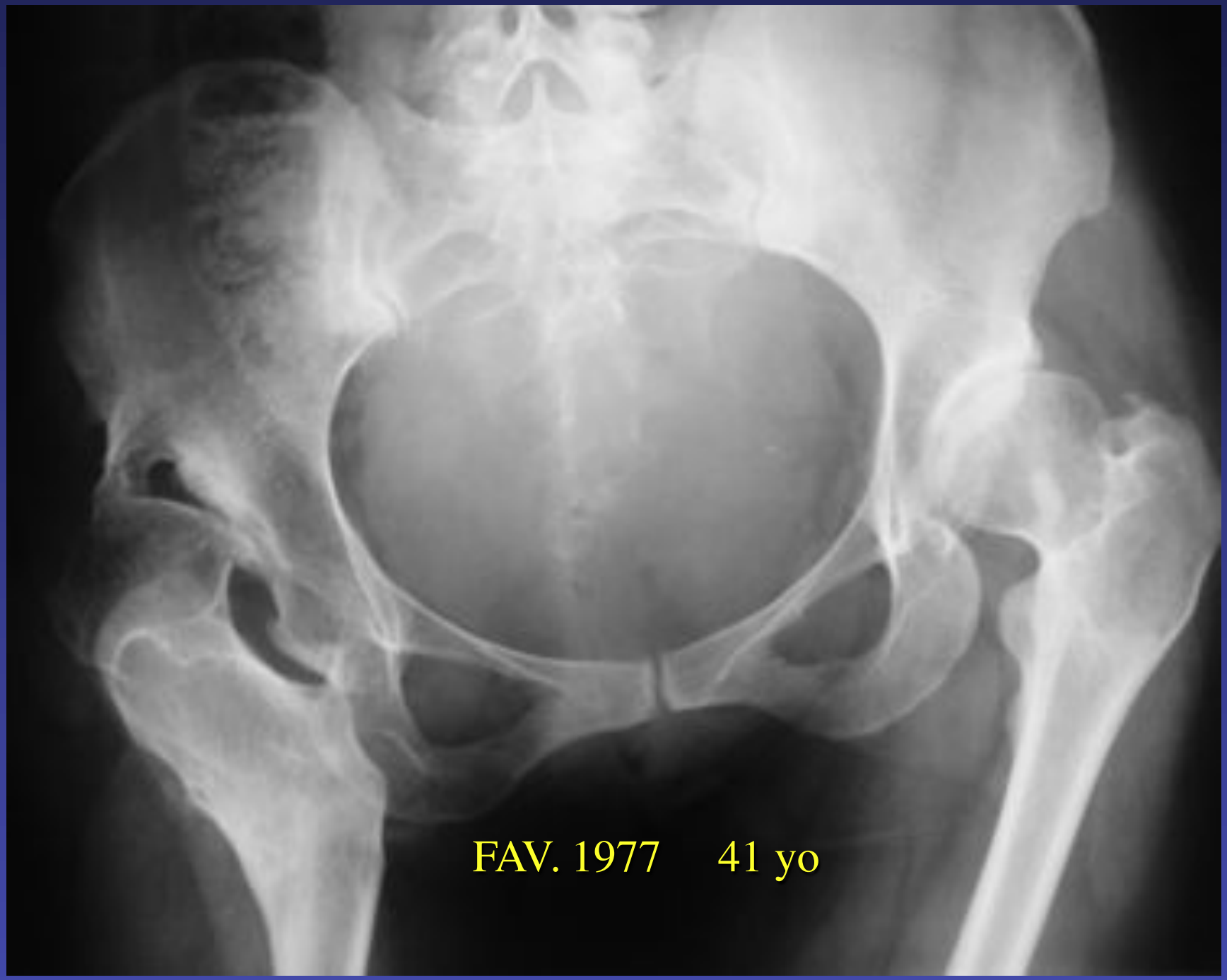


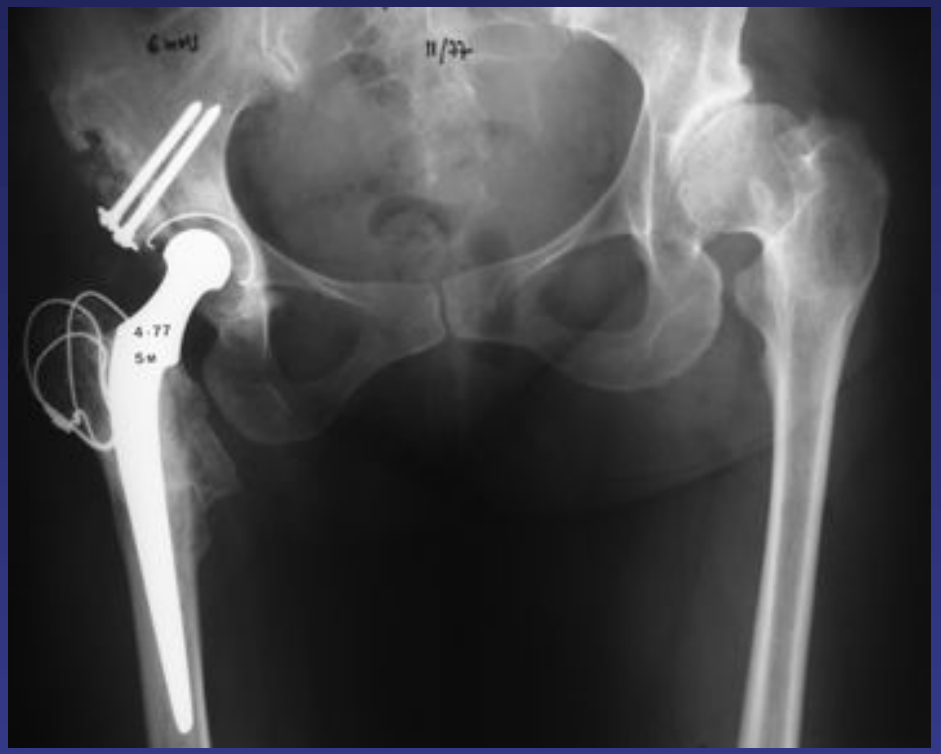


BOU.

R Knee : 6 y PO


BOU. 2003 93 yo
18 y PO


FAV. 1977 41 yo



FAV. 41 yo 1977
Mobile lumbar spine
R THR with femoral osteotomy
L H : vicious rotational position

FAV. Anteversion 60°

Good feature of the joint line in 50° of internal rotation

FAV. 1978 rotational osteotomy
good clinical result during 12 y

Secondary OA in 1990

FAV. 1991

Left THR
Knee pain due to valgus deformity

FAV. 2004 68 ans

H.D : 27 y PO

H.G : 13 y PO

L.Knee : femoral varus osteotomy
10 y PO

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Total Hip Arthroplasty for Crowe Type IV Developmental Hip Dysplasia

A Long-Term Follow-Up Study

Marcel Kerboull, MD,*† Moussa Hamadouche, MD,*‡ and Luc Kerboull, MD*†‡

Upgraded in 2004

Materials

- 89 patients (8 males, 81 females)
  mean age 52 y (29-78)

- 119 THD Crowe type IV

30 bilateral

59 unilaterales, with opposite hip

- Crowe type II or III (15)
- dysplastic (23)
- normal (21)

- 118 THA from 1970 to 1986
- Consecutive series – one surgeon (MK)

Materials

- 34 hips first procedure
- 84 had previous surgical procedures (mean 2,2)
  - Attempted external reduction orthopédique 27
  - Attempted open reduction 11
  - shelf 32
  - Femoral osteotomy 23
  - Girdlestone 8
  - Athrodesis 1
  - Arthroplasty (cup, acrylic …) 9

Materials

- Indication for THA was pain in the dislocated hip, associated with stiffness and limitation in activity for 78 patients
- For 11 patients (12,35 %) lower back or ipsilateral knee pain was the primary complaint

Materials

- 10 Original Charnley (straight stem)
- 108 Charnley-Kerboull
- PE cemented cup (37 to 42 mm diam)
- 81 acetabular bone autograft
- 21 femoral osteotomies (19 alignment and 2 shortening)

COMPLICATIONS

- 1 peroperative fracture of the femoral shaft
- 1 transcient PN palsy
- 2 non union of the GT
- 1 dislocation
- 4 heterotopic ossification
  - –2 Brooker II
  - –1 Brooker III
  - - 1 Brooker IV

  } Re operated
- None infection

Follow up (2004)

- **Lost to F.U : 7 patients (9 hips)**

  2 between 1 and 10 y, 5 between 10 and 20 y

- **Deceased : 41 patients (48 hips)**

  12 between 1 and 10 y, 29 between 10 and 27 y

- **Surviving : 40 patients (61 hips)**

  mean F.U. : 22 y (18 to 32y)

- **Mean F.U. of the global series : 16,9 y**

Clinical results
(Merle d'Aubigné)

• Excellent (18)	56	47,45 %	**75,4 %**
• Very good (17)	17	14,40 %	
• Good (16)	16	13,55 %	
• Pretty good (15)	11	9,32 %	
• Passable (14)	8	6,77 %	
• Fair (13)	7	5,93 %	
• Bad(12)	3	2,54 %	

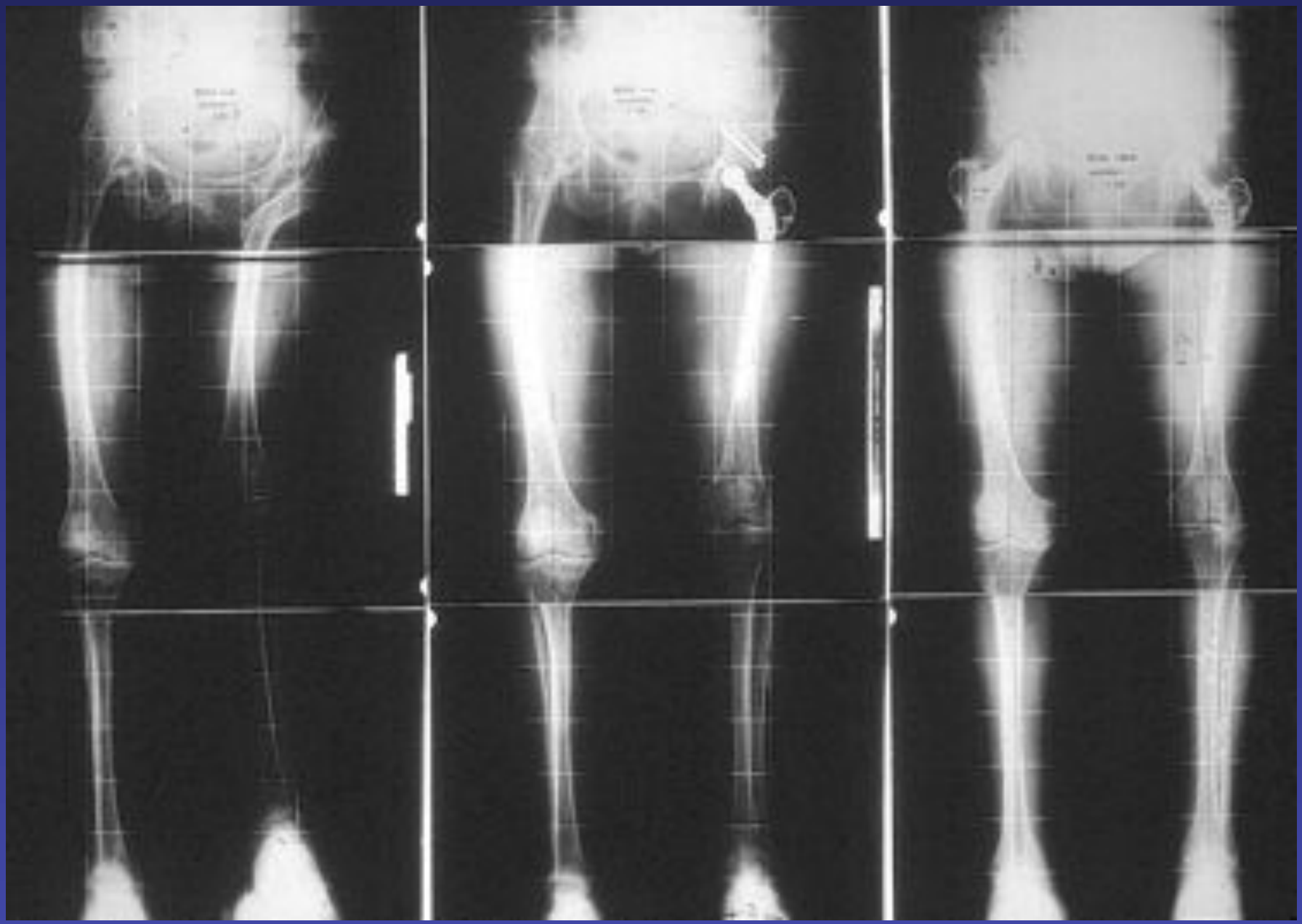
Leg length discrepancy

- Preoperative Shortening 4,8 cm (3 to 8 cm)
  - exact correction 63
  - by 1 cm 42
- Lenthening 3,8 cm (2 to 7 cm)
- Mean leg-length discrepancy
  - Pre op 2,60 cm
  - Post op 0,4 cm

2 patients need a femoral shortening osteotomy

The ipsilateral knee

- 18 painful knee before THA
  - –10 improved
  - – 8 need surgery
    (4 osteotomies et 4 TKR)



Pelvic Ring AP tilt

Preop	Postop
47	21

Lateral pelvic tilt

	Preop	Postop
Major	15	1
Mild	27	26
none	47	62

Corrected in > 50% of cases

Lumbar lordosis

	Preop	Postop
Major	20	1
Mild	42	23
Normal	27	65

Lumbosacral spine

	Preop	Postop
Normal alignment	52	62
Lateral incurvation	33	23
Scoliosis	4	4

Back pain

- Preop

  49

- Post op

  9

  2 laminectomies

  2 scoliosis operated

Radiographic results

Polyethylene wear

- Non measurable : 58 hips (48 %)
- 1 mm to 7 mm : 60 hips (52 %)

Loosening

Femoral : 1

Cup (definite + probable) : 22

Revisions : 23 (19,5 %)

loosening	femoral :	1
	cup :	20
Heterotopic ossification :		2

Survival analysis at :	20 years	25 years
Femoral loosening:	99%	99 %
Acetabular loosening	87%	79 %
Revision for any reason	78%	75 %

Conclusion : Results

- This procedure is safe and effective, able to improve hip function but also lumbo sacral and knee pain
- Wide spectrum of difficulties
- Serious risk of complications
- successful result will depend on :

  - reasonable selection of indication
  - preoperative assessment
  - attention to the details of the surgical procedure

Conclusion : surgical technique

- Transtrochanteric approach
  - Provides large exposure and facilitate joint release
  - Allows to retain periarticular muscle
- Hip center location : true acetabulum with bone reconstruction
- Neck resection at the level of the lesser troch allows to correct excessive femoral anteversion
- Leg lengthening > 4 cm is possible
- Femoral osteotomy is only required for alignment and some rare cases where shortening is necessary to achieve correction of leg lengh discrepancy.

Thank you