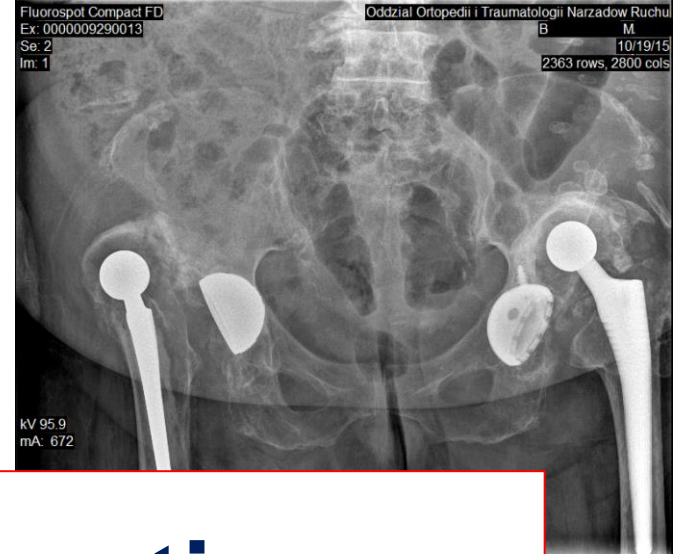




Międzynarodowy Portal Medyczny



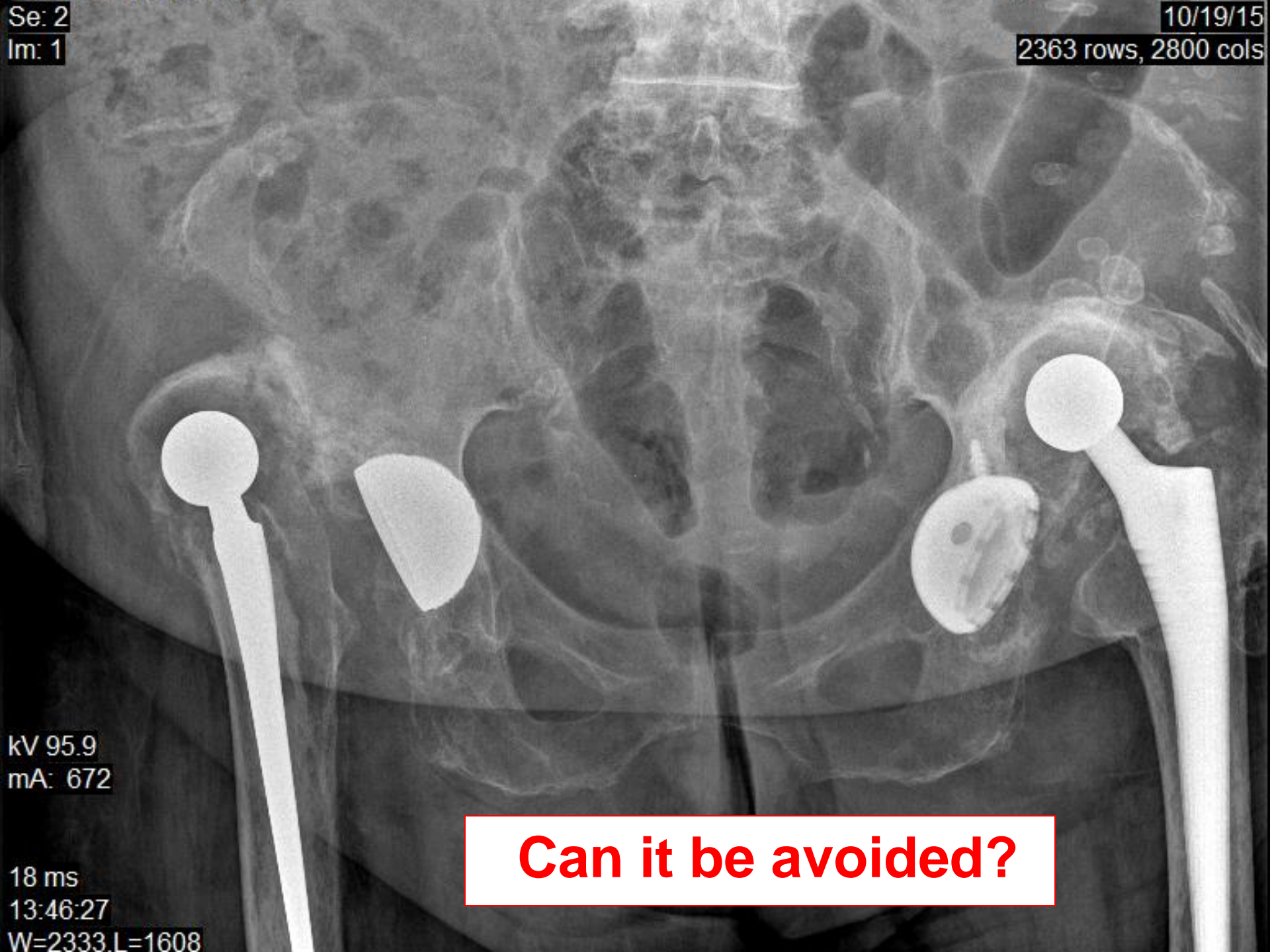
Prevention of dislocation after hip replacement in elderly patients.

**Piotr WOJCIECHOWSKI, Damian KUSZ,
Mariusz NOWAK, Konrad KOPEĆ**

Department of Orthopedics and Traumatology Medical University of Silesia
Head of Department: prof. dr hab. n med. Damian Kusz

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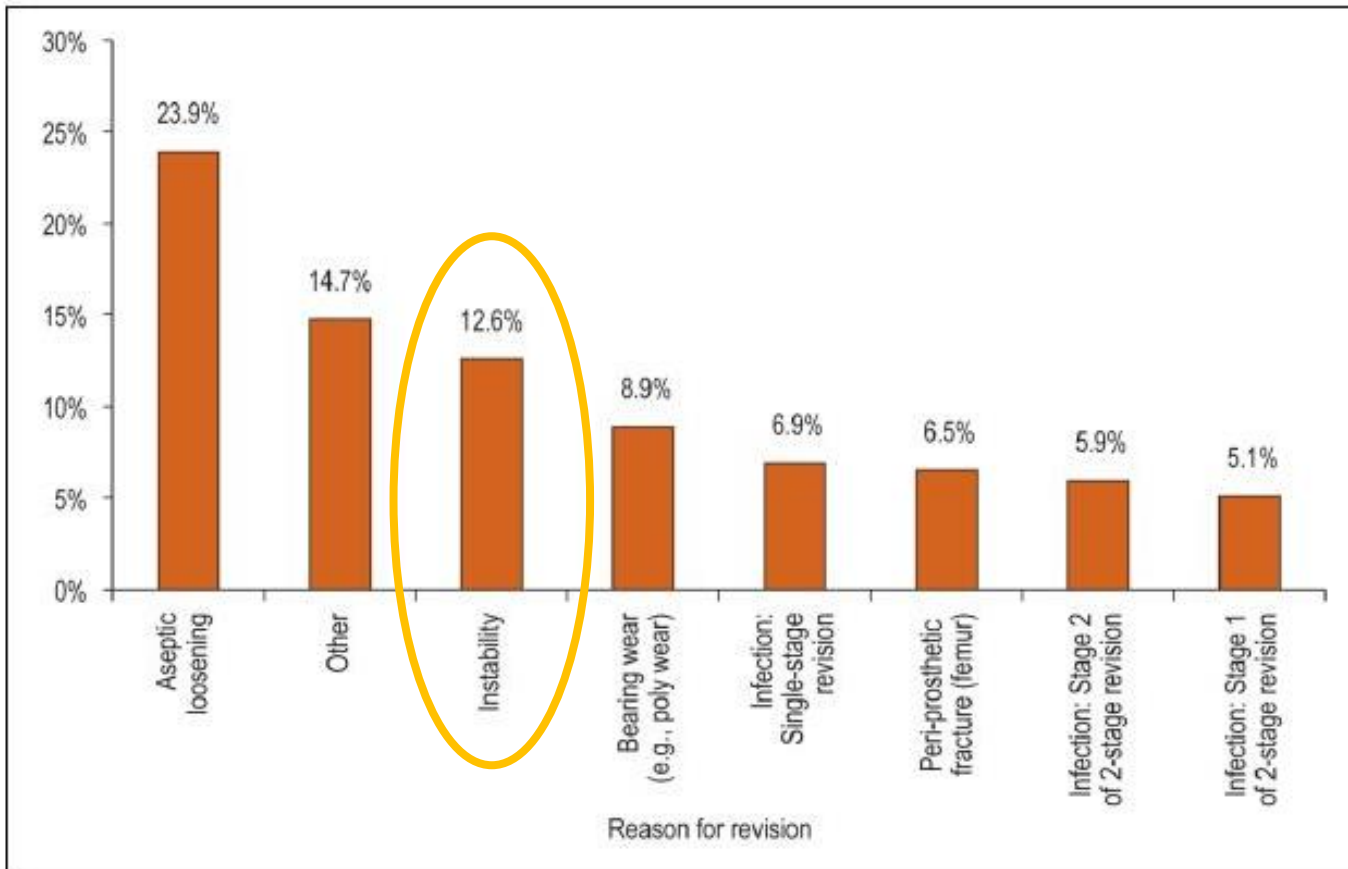


kV 95.9
mA: 672

18 ms
13:46:27
W=2333.L=1608

Can it be avoided?

Figure 5: Reasons for hip revisions, 2013–2014



Notes

N = 2,674 revision hip replacements.

Less common reasons for hip revisions, such as osteolysis, pain of unknown origin, implant dissociation, implant fracture acetabular erosion (e.g., hemiarthroplasty), peri-prosthetic fracture (acetabulum) and leg length discrepancy, were each less than 5%.

- Dislocation after hip replacement is a serious complication (reoperation is often required)

Dislocation after hip replacement

- Risk factors:
 - elderly
 - after femoral neck fx
 - neuromuscular disorders (low muscle tone and motor coordination)
 - noncompliant patients (low chair, leg crossing)
 - obesity
 - surgical errors; **aiming for correction of leg length discrepancy**, revision surgeries, improper cup or stem positioning
 - women

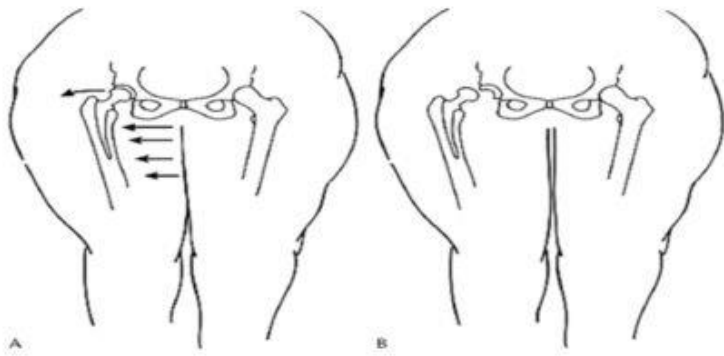
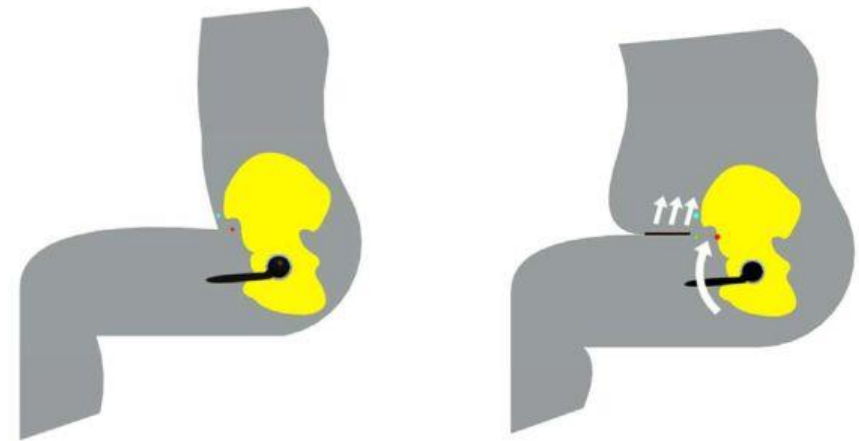


Figure 28: Possible mechanisms for dislocation in obese THA patients. (A) Thigh impingement during adduction creates a laterally directed force on the femoral component. (B) Thigh impingement is relieved if dislocation occurs.

- Causes of hip instability in obese (**BMI >30**) THA patients
- Soft tissue impingement during walking and sitting is relevant in morbidly obese



27: Possible soft tissue impingement leading to decreased stability post-THA for obese patients. Left: Sagittal plane schematic at the instant of maximum flexion prior to lift-off of the buttocks during a sit-to-stand maneuver. Right: Adverse kinetics involved in the obese sit-to-stand, demonstrating panniculus impingement, which creates an additional abdominal force and subsequent torque tending to cause subluxation of the hip joint.

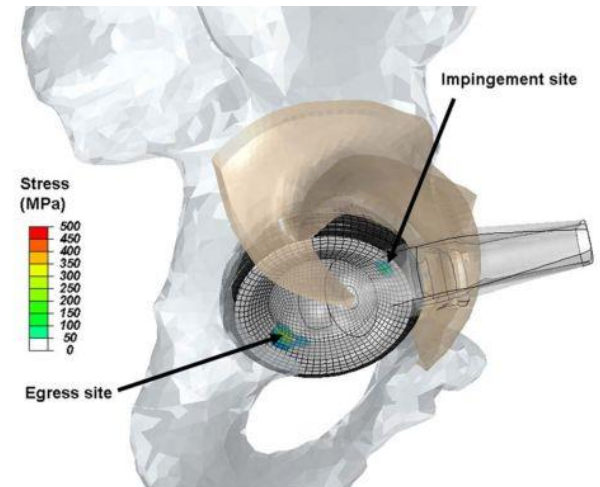


Figure 38: Contour plot of liner von Mises stresses developed during impingement/subluxation of a right hip at high flexion. Stress concentrations occur at two distinct regions of the cup: the impingement site (anteriorly) and the egress site (posteriorly). For visualization clarity, the bony femur is removed, the femoral component is rendered translucent, and only the anterior half of the capsule is shown.

Dislocation after hip replacement

- High risk group – **it is right to maintain higher jump-distance**
- Jump-distance depends on:
 - level of anteversion and inclination of the cup
 - cup and neck relation
 - head diameter and its cover
 - presence of antiluxation rim of the cup

Jump distance

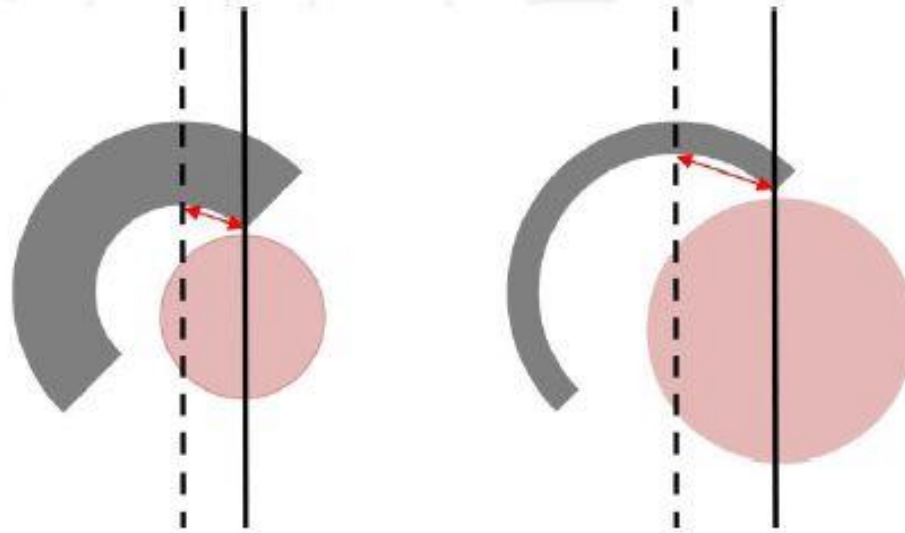
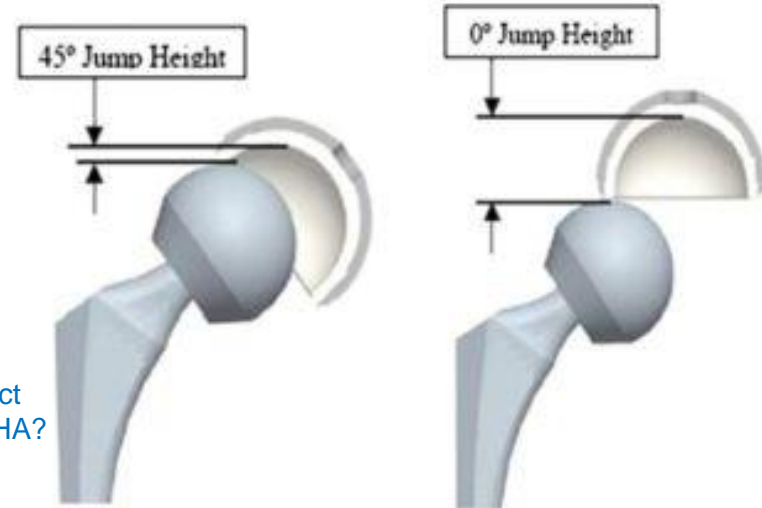


Figure 3. Jumping Distance highlighted by red arrow demonstrates distance the head needs to travel before dislocation occurs. Increasing head size increases this distance



Nevelos J I wsp. What Factors Affect Posterior Dislocation Distance in THA? Clin Orthop Relat Res (2013) 471: 519–526



Jump distance

- Jump distance:
 - **is lowered by cup inclination**
(**0,25 mm per 1°** with **32 mm** head diameter)
 - **is increased by cup anteversion**
(**0,05 mm per 1°**)
 - **is increased by head diameter**
(**0,4 mm per 1 mm** of head diameter when inclination is **45°**)

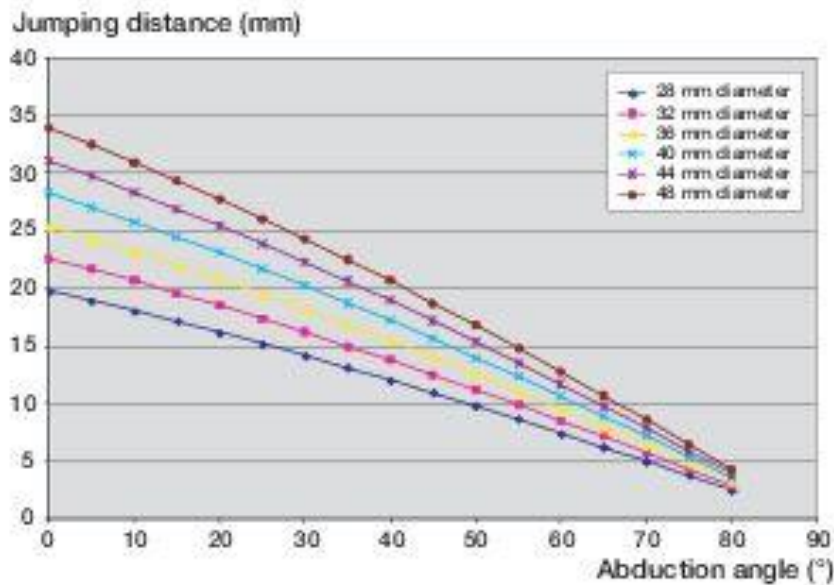


Figure 4. Variation in jumping distance according to the cup abduction angle

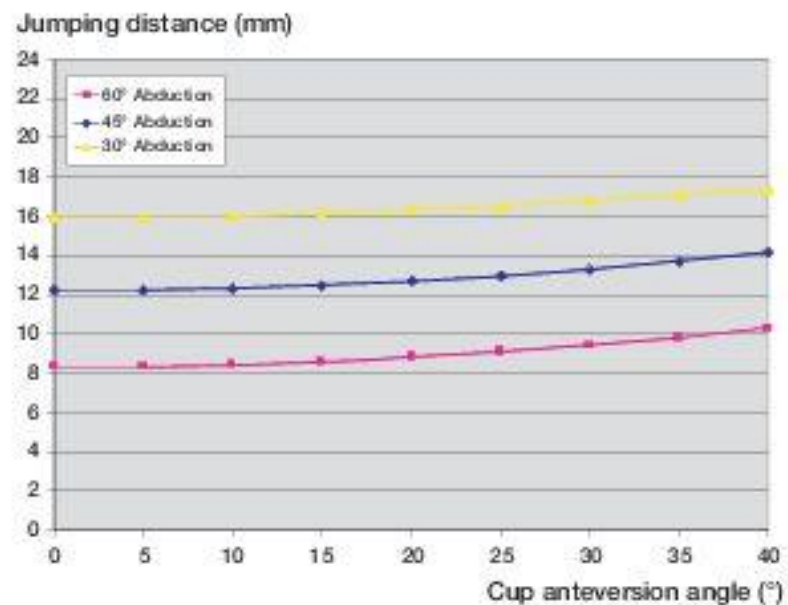


Figure 5. Variation in jumping distance according to acetabular anteversion angle.

Elhadi Sariali E i wsp. Mathematical evaluation of jumping distance in total hip arthroplasty. Influence of abduction angle, femoral head offset, and head diameter. Acta Orthopaedica . 2009; 80 (3): 277-282

- ~ 50% of dislocations is associated with cup position

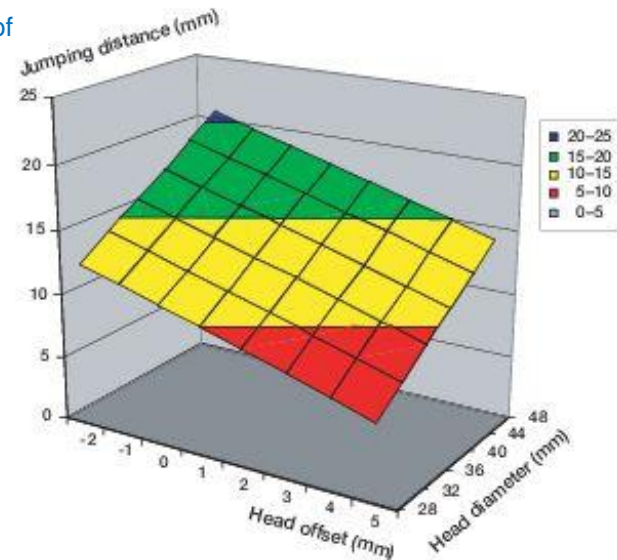
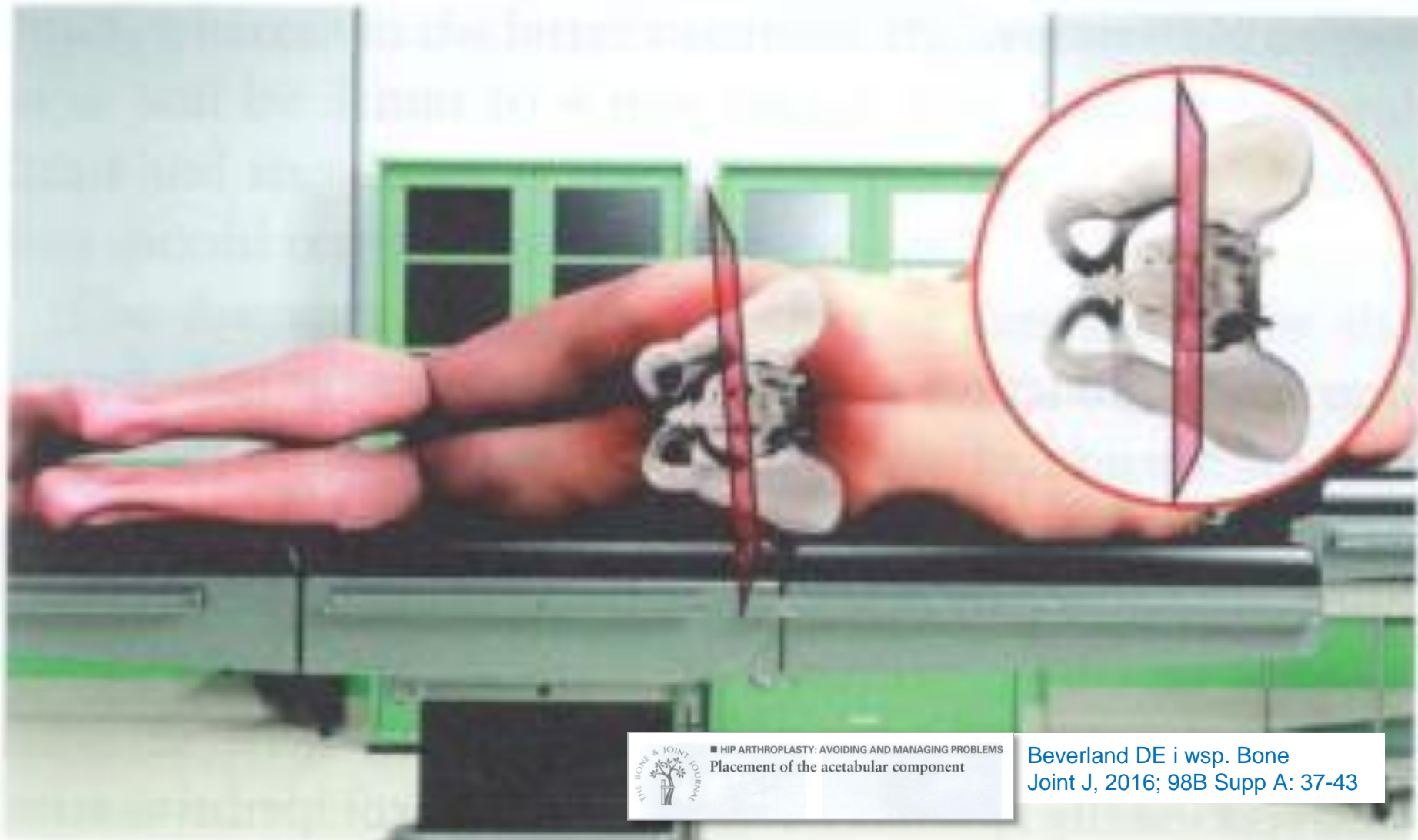
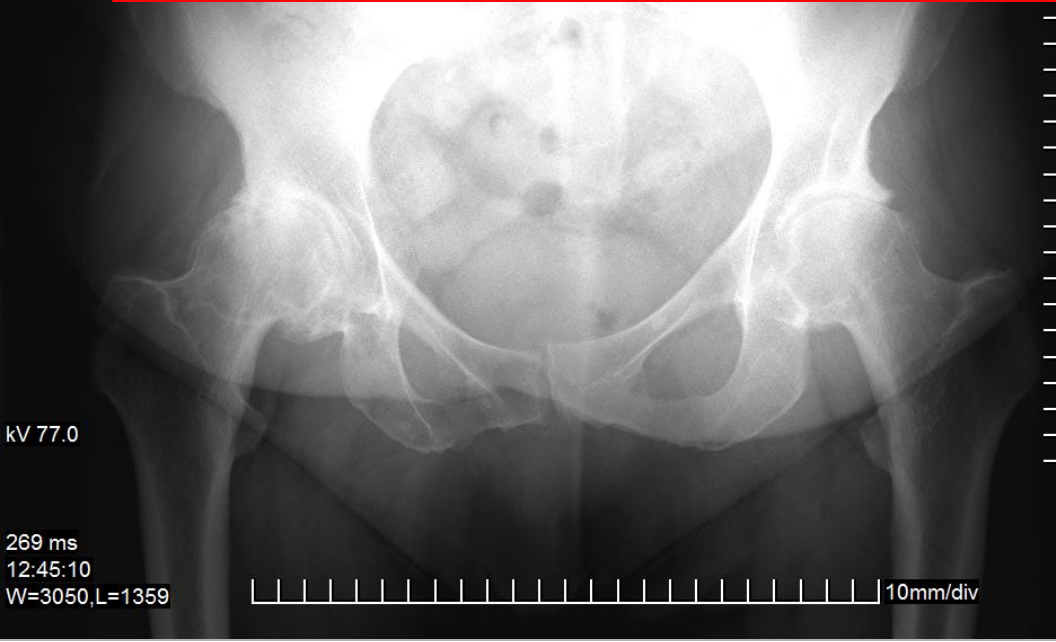


Figure 6. Combined influence of head offset and diameter on the jumping distance. 45° abduction and 15° anteversion cup angles are used.



- Main cause of higher cup inclination – error during patient positioning (**internal rotation and adduction**)

Prevention of dislocation after THA



- Increasing jump-distance:
 - dual mobility cup
 - anatomical head with large diameter (anatomical)
- Constrained acetabular component

Prevention of dislocation after THA

- Dual mobility cup provide highest jump distance, which is a result of **larger head diameter**

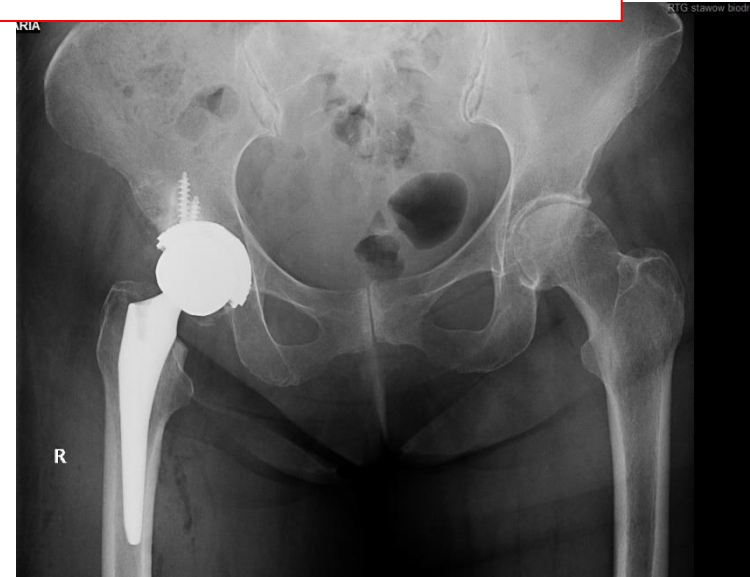


van Heumen M I wsp: Dual mobility acetabular component in revision total hip arthroplasty for persistent dislocation. J Orthopac Traumatol (2015) 16:15-20

- Disadvantages:
 - Increased polyethylene wear (wearing on the metal cup increases risk of aseptic loosening)
 - Potential iliopsoas conflict
 - Inability to perform close reduction after dislocation

Prevention of dislocation after THA

- **Anatomical heads** with large diameter:
 - better mobility and jump-distance
 - thin both cup and PE insert (resistant to wear with ceramic or ceramic coated metal head)
- **Disadvantages:**
 - it is possible to deform the cup during implantation – faster wear



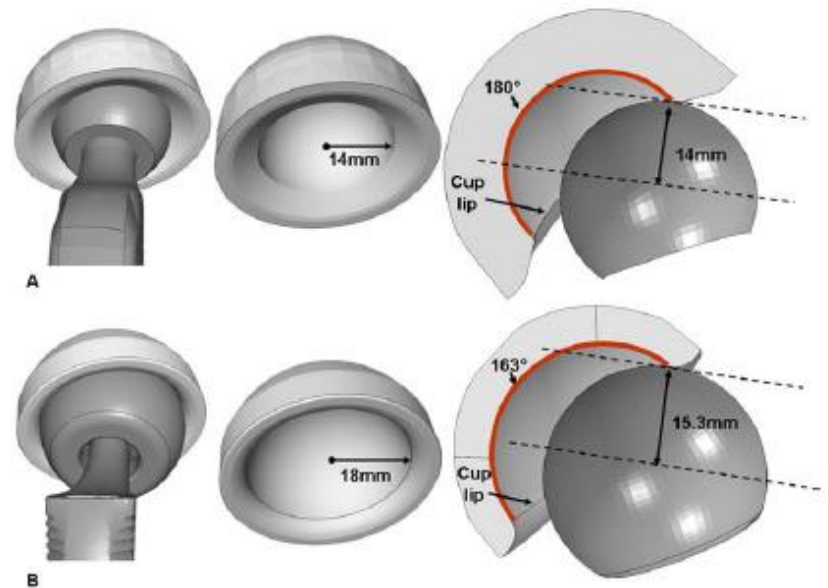
Prevention of dislocation after THA

- Constrained cups are reserved for patients:
 - with Alzheimer's,
 - after revision procedures with damaged abductors
 - after revision procedures because of dislocation, especially with improper positioning of the implants
 - lowered muscle tone because of neurological illnesses or immobility



stryker®

Large head?



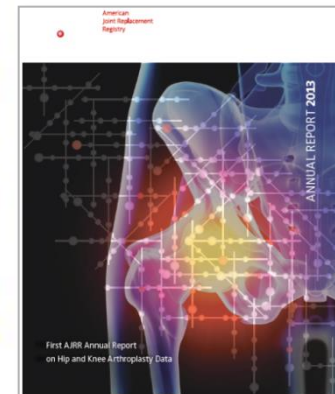
Biomechanics of failure modalities in total hip arthroplasty, Elkins JM, *University of Iowa, 2013*

Figure 35: Jump distance with larger heads and rounded cup edges. The 28mm THA hardware (A) consisted of a standard offset neck with a 5° anteverted stem (left), and a 28mm cup diameter cup (middle) with a flat lip and chamfer (right) and 180° of head articular coverage, resulting in 14mm of “jump distance” required for dislocation. The 36mm THA hardware (B) also consisted of a standard offset neck anteverted to 5° (left). The cup diameter was 36mm (middle), but the rounded lip/chamfer of the cup (right) resulted in only 163° of articular coverage, decreasing the “jump distance” from a full head diameter (18mm) to only 15.3mm.

Table 12. Percentage of Femoral Head Sizes Implanted by Year (for most frequently reported* hip components 2010-2013) (N=26,119)

Head Diameter	2010 (n=291)	2011 (n=999)	2012 (n=8,164)	2013 (n=15,797)
<28mm	1.0	3.6	3.6	3.4
28mm	6.5	8.4	9.2	15.0
32mm	27.5	35.2	29.8	26.4
36mm	40.2	36.4	45.8	41.3
40mm	19.6	8.8	7.3	5.2
>40mm	5.1	7.5	4.3	8.7

* Does not include all hip replacement procedures, only frequently reported components



Revision algorithm

- **Type 1:** malposition of the acetabular component
 - **cup revision and larger head**
- **Type 2:** malposition of the femoral component
 - **stem revision and larger head**
- **Type 3:** abductor deficiency
 - **dual mobility or constrained cup**
- **Type 4:** impingement
 - **removing the impingement and larger head**
- **Type 5:** late wear
 - **replacement and larger head**
- **Type 6:** unclear etiology
 - **dual mobility or constrained cup**

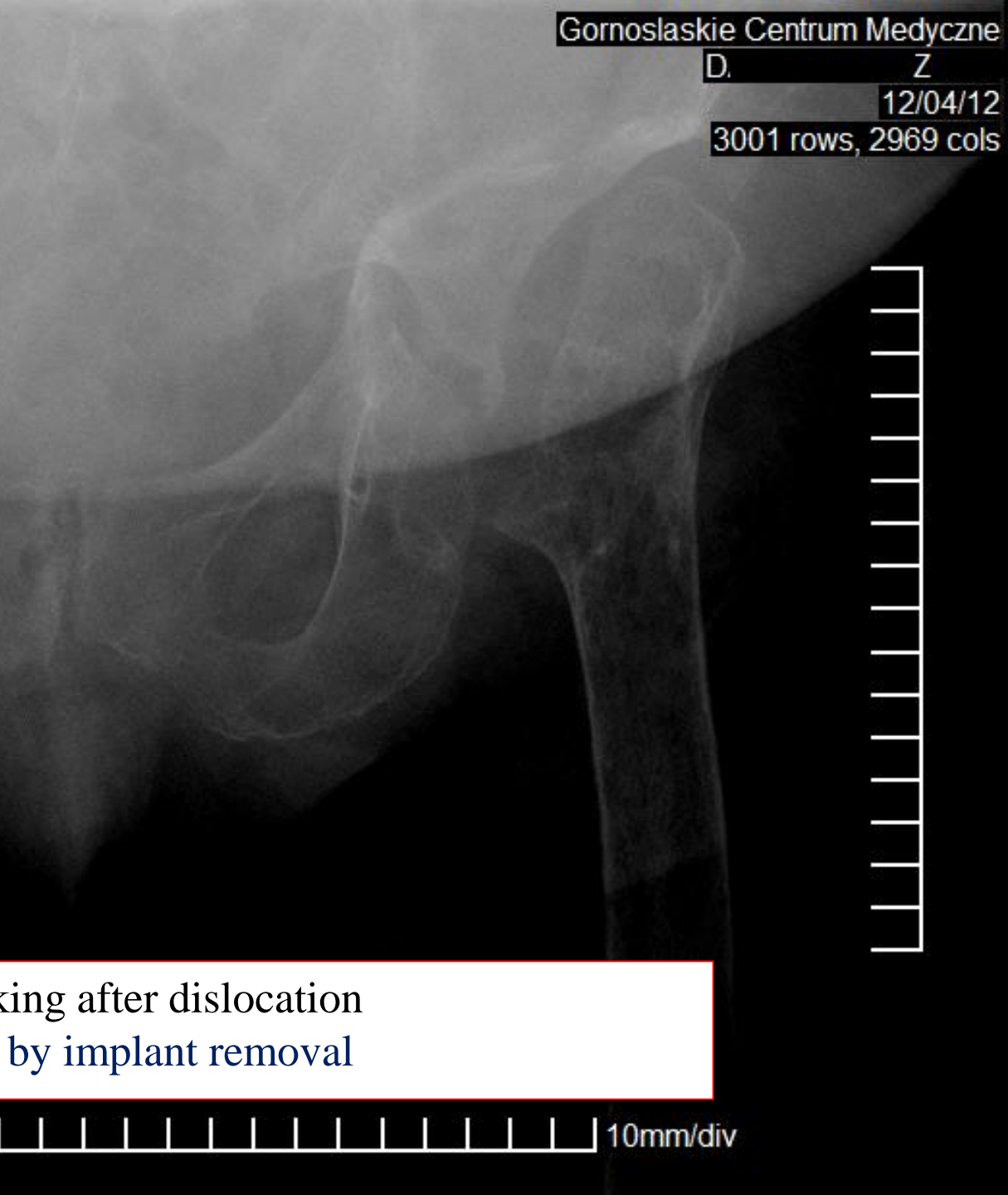
D. Z
12/15/08
2048 rows, 2500 cols

Page 2
1:ml



- Patient **D.Z.**, born **1935**, BMI **36**
- Primary **THA 2011**
- Dislocation **2011**

Case 1



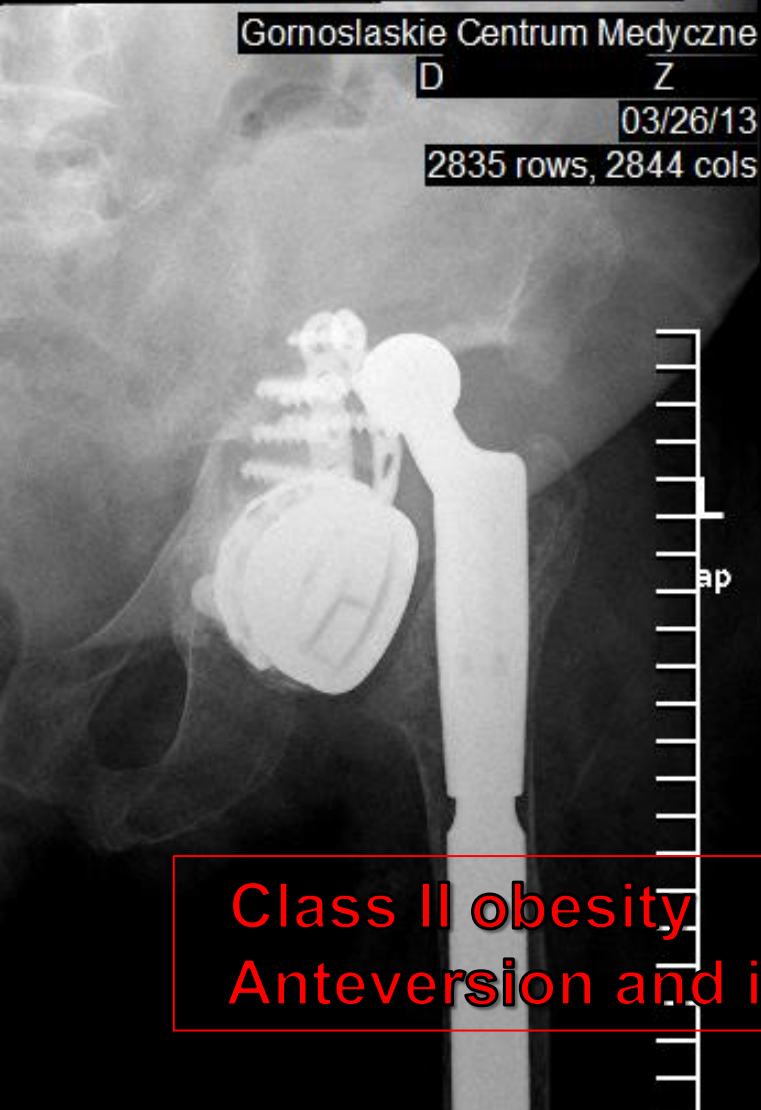
- Acetabular breaking after dislocation
- Infection treated by implant removal





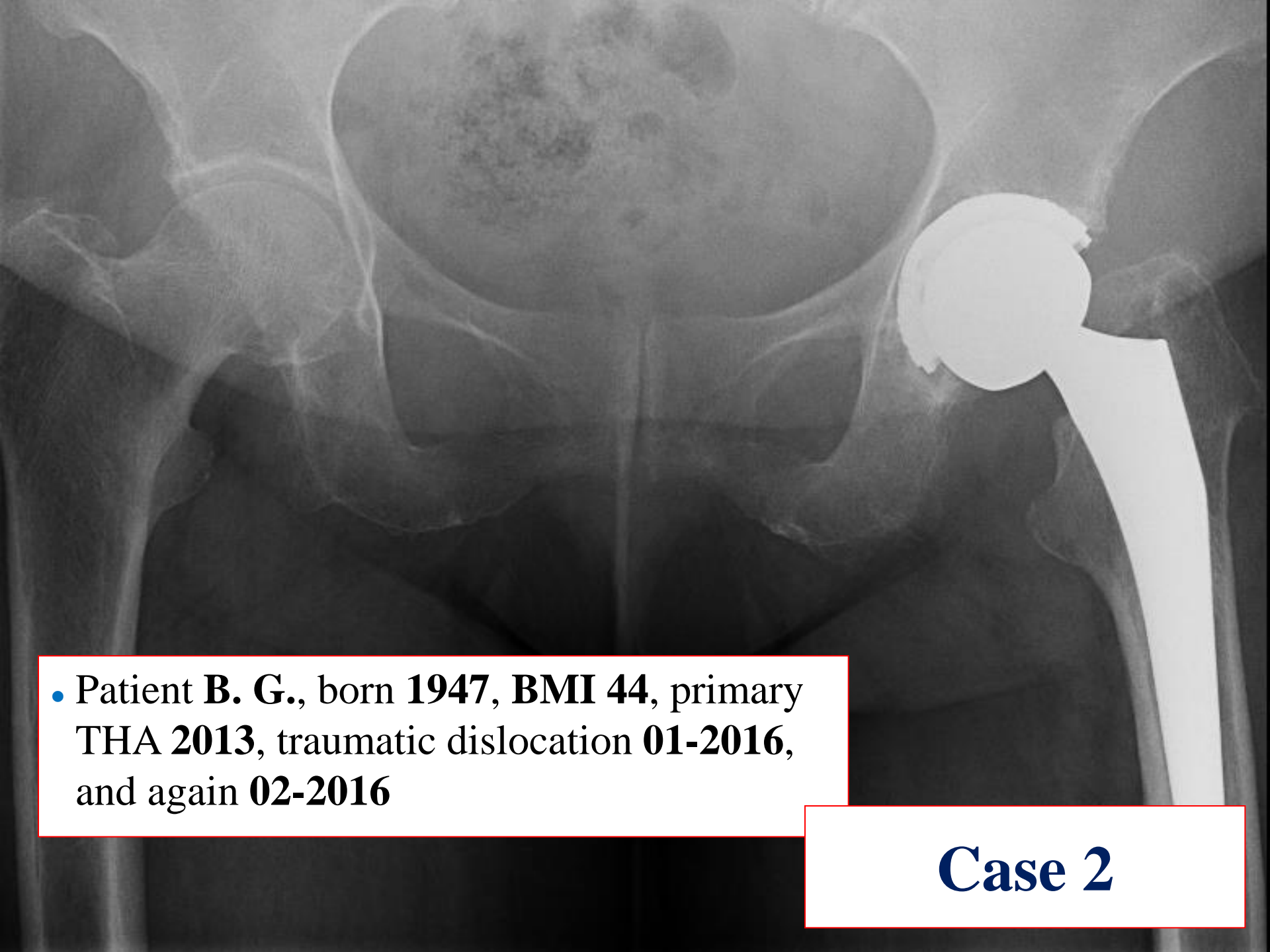
- Surgery - **12-2012**: antiprolusion cage GAP II, RESTORATION stem
- Dislocation at home
- Surgery – **02-2013**: PE insert removal, AVANTAGE cup





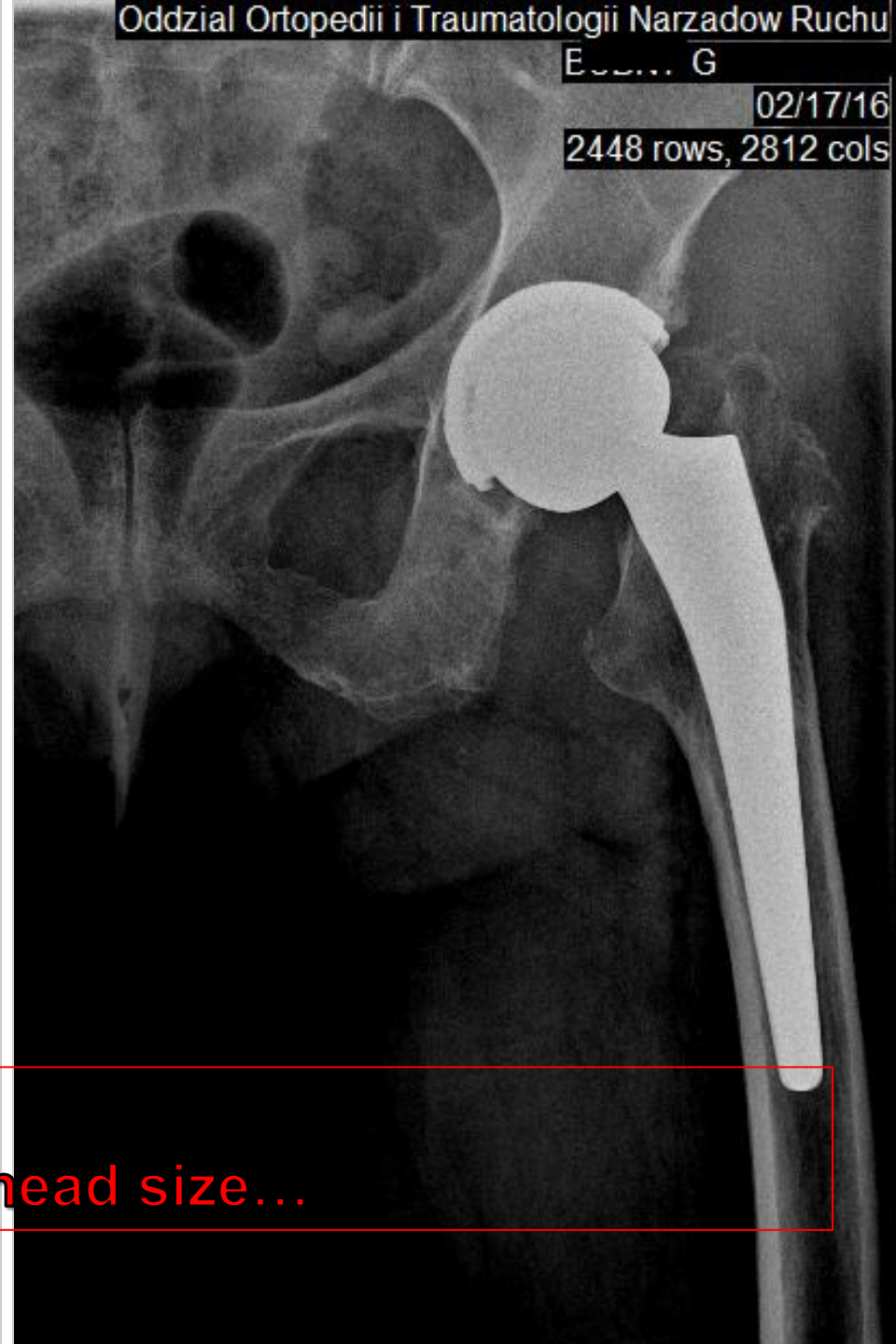
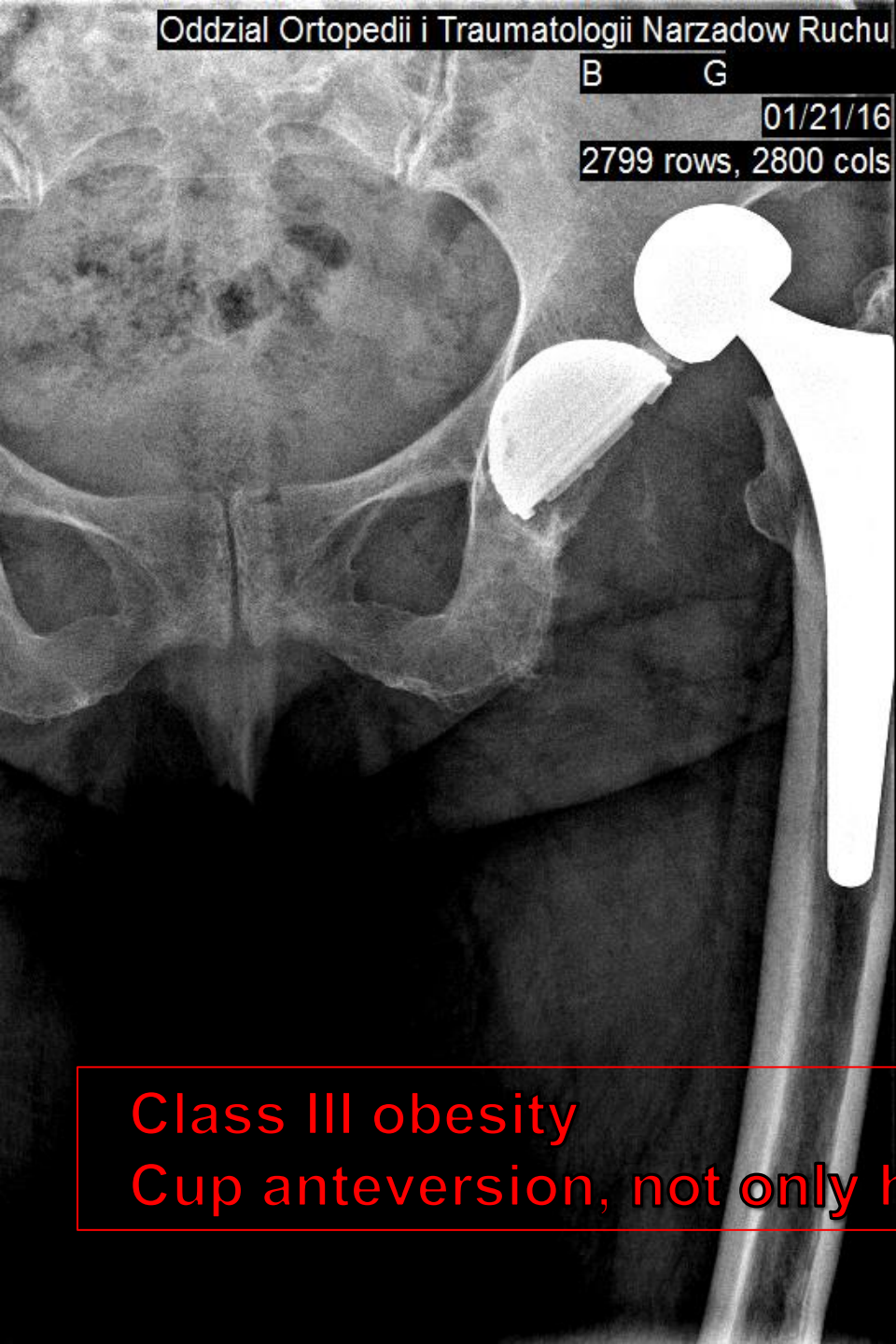
Class II obesity
Anteversión and inclination of the cup...

- Dislocation at home
- Surgery **03-2013**: reimplantation of antiprotrusion cage GAP II **52** \Rightarrow **60 mm** and antiluxation AVANTAGE cup **44** \Rightarrow **54 mm**



- Patient **B. G.**, born **1947**, **BMI 44**, primary THA **2013**, traumatic dislocation **01-2016**, and again **02-2016**

Case 2



Class III obesity

Cup anteversion, not only head size...

R

GCM

Se: 1002
Im: 1002

L

4280 row

R

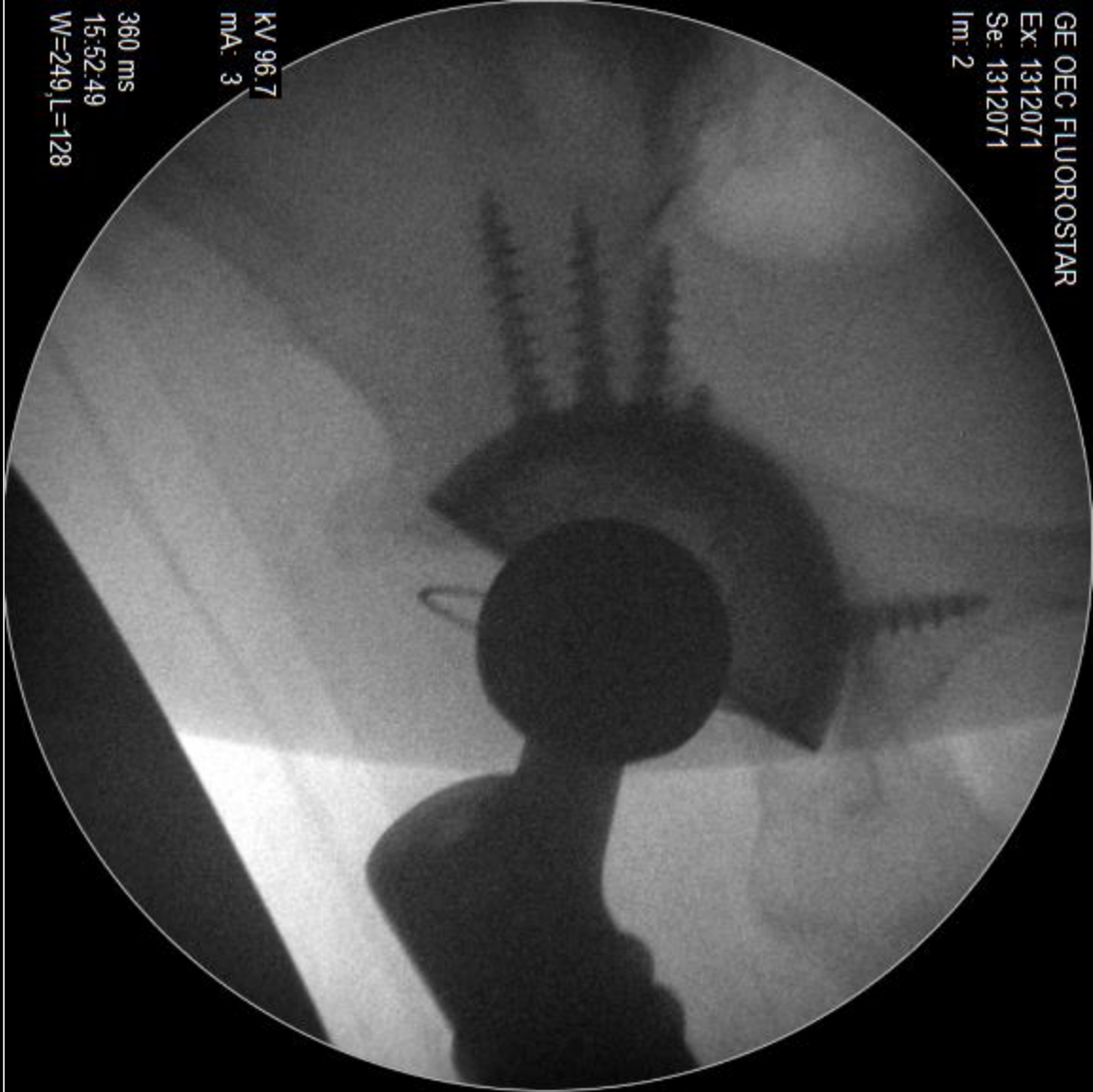
11:39:58

W=3128,L=1287

- Patient **L. K.**, born **1951**, **BMI 50**, primary THA **1995**, revision surgeries **2002, 2004, 2011, 2012**, dislocation **december 2013**

Case 3

10mm/c



KV 96.7
mA: 3
360 ms
15:52:49
W=249, L=128

Class III obesity
Constrained cup is not perfect..

2/2
J7 12.2013
15:52:49
Autowindow
* 50
53

37 KV
500 mA
0.07 mGy/cm²
308.96 µGy



Summary

- Larger head:
 - provides larger jump-distance,
 - increases joint mobility and helps to restore leg length
 - new type of cups with thinner cup and PE insert allow to implant large head (size close to anatomical)
 - theoretically increasing head **>36mm** is not relevant, when inclination is steep

- Most effective treatment of dislocation is **prevention done by surgeon and patient**

Table 1 Risk factors for instability following total hip arthroplasty

Patient factors	Surgical factors
Female gender	Surgical approach
Age > 80 yr	Capsular repair
Neuromuscular disorders	Soft tissue tension
Cognitive disorders	Component malpositioning
Alcoholism	Femoral head size
Abductor weakness	Impingement
Prior hip surgery	Surgeon experience



Thank you for your attention