Case study

Personalized THA in a patient with ankylosing spondylitis using **Lantern® Hip**

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Abstract

This case study outlines the treatment of a patient with advanced hip arthritis and ankylosing spondylitis, presenting with a fixed posterior pelvic tilt and limited spinopelvic motion. Lantern Hip was utilized to account for the patient's unique pelvic orientation using the Functional Pelvic Plane (FPP) feature, helping guide cup placement to execute the preoperative plan. This case illustrates how Lantern Hip can support surgeons in managing complex deformities to achieve surgical goals.

Patient profile

- 87-year-old male (5'6"and 140 lb.) with right hip arthritis
- History of ankylosing spondylitis
- Significant posterior pelvic tilt:19.5°
- Leg length discrepancy: 6mm shorter than contralateral side

Clinical and preoperative observations

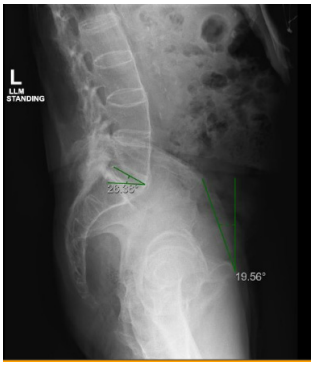
- Observed leg discrepancy
- Limitations in daily lifestyle (requiring the use of a walker)
- Ankylosing spondylitis patients are at risk for post-operative anterior instability due to the fixed posterior pelvic tilt and functionally excessive anteversion of the acetabulum
- Risk for posterior instability due to minimal change in sacral slope between standing and seated positions
- Note: for every degree of posterior tilt, the functional anteversion of the acetabulum increases by 0.8°–1.0°[1]

Radiographs confirmed clinical findings:

- Advanced arthritis
- Ankylosing spondylitis
- Operative leg 6mm shorter than non-operative leg
- Posterior pelvic tilt of 19.5°
- Stiff spine: 6° of spinopelvic motion between sitting and standing

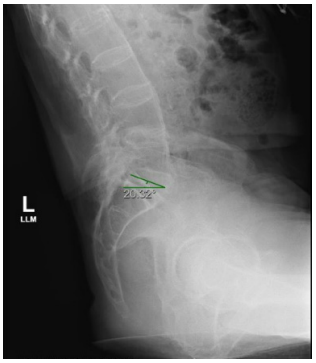
Preoperative AP X-Ray

Leg Length Discrepancy (LLD) = 6mm



Lateral standing X-ray

Pelvic tilt = 19.56°



Lateral seated X-ray

Sacral slope Δ = ~6°

1. Haffer, H., Adl Amini, D., Perka, C., & Pumberger, M. (2020). The impact of spinopelvic mobility on arthroplasty: Implications for hip and spine surgeons. Journal of Clinical Medicine, 9(8), 2569. https://doi.org/10.3390/jcm9082569

Operative plan

Preoperative plan

- **Procedure**: Total Hip Arthroplasty via direct anterior approach (DAA)
- **Technology utilized**: Lantern Hip and C-arm
- **Implant (cup):** Zimmer G7® Acetabular System
- **Implant (stem):** Zimmer Avenir Complete® Femoral System
- **Target cup orientation**: 22° anteversion, 35° inclination (in the FPP)
- **Target leg length**: Increase 7-8mm to equalize discrepancy
- **Other**: Assess stability and impingement post-reduction

Intraoperative workflow

- Standard approach and exposure for THA using DAA
- Initial cup positioning with C-arm guidance
- *Note*: During APP registration, Lantern Hip detected a 24° posterior tilt relative to the coronal plane. This confirmed the patient's fixed deformity and informed real-time intraoperative decisions to optimize cup placement.

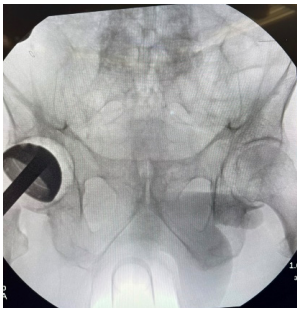
Note: This image shows intraoperative Lantern Hip readings, illustrating coronal, APP, FPP, and live pelvic positioning in real time.

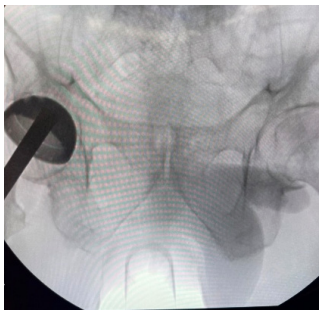
Cup positioning

Initial cup positioning

Lantern Hip measurement of radiographically placed cup

	Abduction	Anteversion
FPP	35˚	15˚
APP	31˚	-1˚
Coronal	35˚	19˚





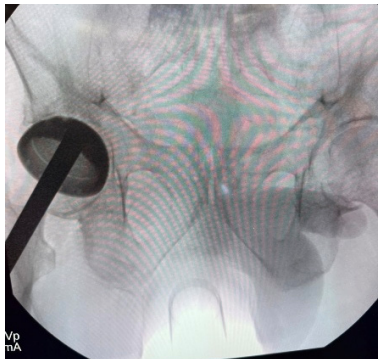
- The cup was initially positioned using C-arm guidance
- Post-impaction images were evaluated, and inclination was measured manually
- Lantern Hip was then used to measure cup placement

Initial cup placement with C-arm guidance was based on what the surgeon thought would be appropriate abduction and anteversion based on anatomic landmarks and recreating native acetabular version. Lantern Hip measurement revealed an FPP anteversion of 15°, showing adjustments were needed to achieve 22°.

Second cup impaction

Lantern Hip was utilized to align cup orientation with the patient's FPP. This allowed for fine tuning of the anteversion number to match the planned target of 22°.

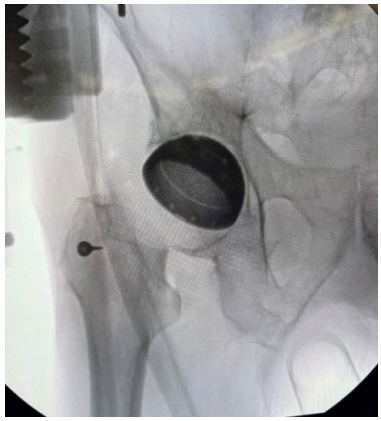
Adjusting to the FPP with Lantern Hip		
	Abduction	Anteversion
FPP	35°	22°
APP	32°	6°
Coronal	36°	25°



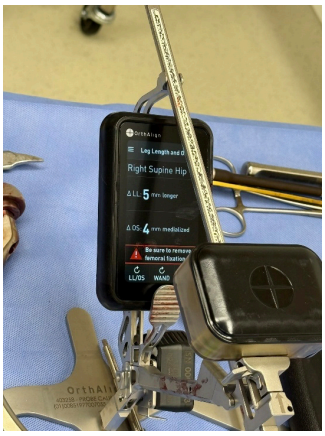
Final cup measurement with Lantern Hip

Final cup position was fully seated at the preoperative planned 21° anteversion to the FPP.

Lantern Hip final cup values		
	Abduction	Anteversion
FPP	37°	21°
APP	34°	5°
Coronal	38°	24°



Leg length assessment

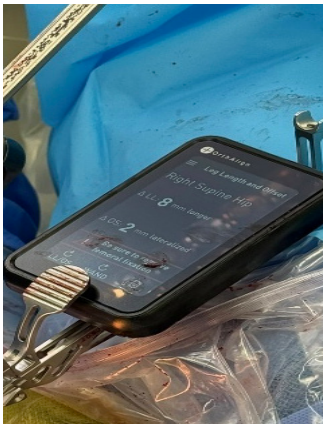


First reduction

Components:

- Size 6 high offset stem
- -3.5mm head

Leg length = 5mm longer
Offset = 4mm medialized



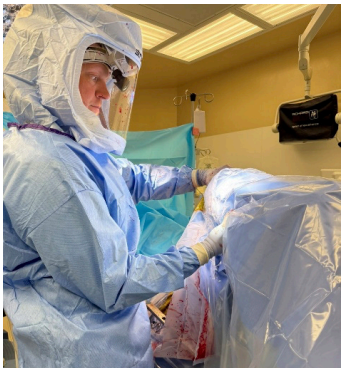
Final reduction

Components:

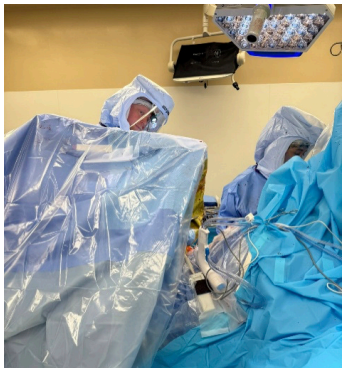
- Size 6 high offset stem
- +3.5mm head

Leg length = 8mm longer
Offset = 2mm lateralized

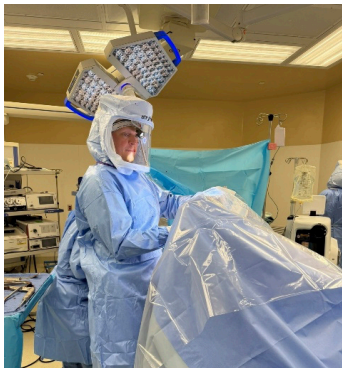
Stability and impingement test



Hip flexion at 90°



Hip flexion and rotation at 90°



Hip flexion and rotation at 90°

Due to the patient's limited change in sacral slope and increased lumbar spine-pelvis stiffness, which can impact posterior stability, an intraoperative stability and impingement test was performed. Dr. Purcell wanted confirmation of anterior stability while ensuring posterior stability within a very narrow safe zone. Without FPP guidance, the initial anteversion was 15° in the FPP and -1° in the APP. After adjustments, the final measurements showed the cup anteversion was 21° in the FPP and 5° in the APP. Without Lantern Hip's FPP guidance, the cup would've been underanteverted by 6°. Given the stiff spine and pelvic tilt, the patient remained at risk for both anterior and posterior instability. The Lantern system aided in confirming anterior stability, but additional measures were taken to verify posterior stability prior to closure.

Final implant choices

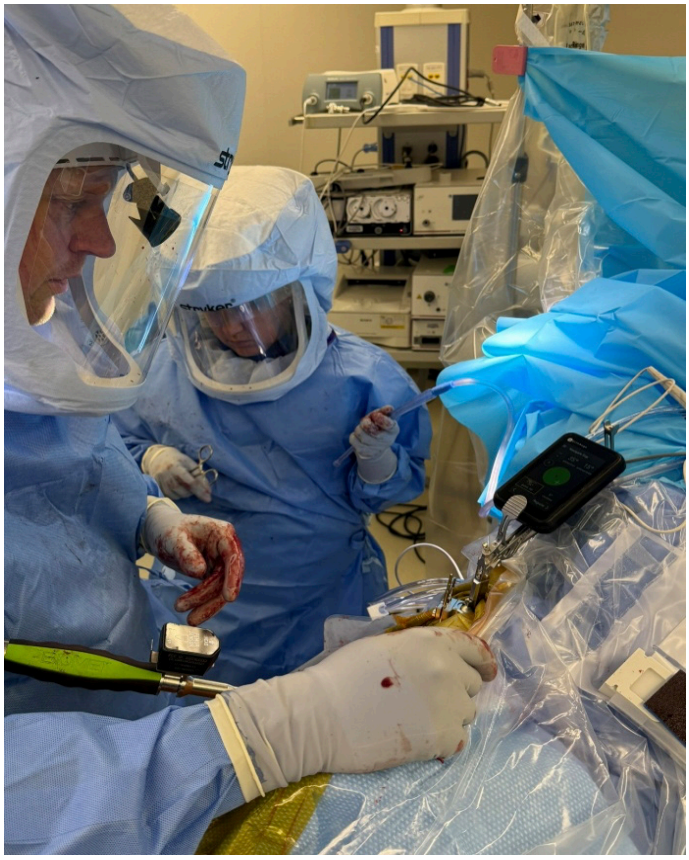
- Acetabular cup: 56mm
- Acetabular liner: Dual mobility
- Femoral stem: Avenir Complete size 6 high offset
- Femoral head: 28mm, +3.5mm

Follow-up appointment

Four months post-op:

- Incision well healed
- Finished physical therapy
- Walking without pain

Why Lantern Hip for this case?



"This complex primary THA patient demonstrates the highest risk patient for post-operative instability due to the fixed posterior pelvic tilt and the need for a patient specific acetabular safe zone to minimize risk of stability complications. Without Lantern, I would have missed this patient's acetabular safe zone and likely increased his risk for post operative instability."

- Richard Purcell, MD

Richard Purcell, MD is a paid consultant of OrthAlign