



# Simultaneous Bilateral Direct Anterior Total Hip Arthroplasty Utilizing a Modular Neck-Sparing Arthroplasty Femoral Stem

## -Case Report and Literature Review-

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### Introduction:

Total hip arthroplasty for the management of bilateral hip osteoarthritis has been described in the literature since the 1970's, utilizing either a simultaneous (single anesthetic) or staged (multiple anesthetics) technique. Utilization of a direct anterior approach to the hip joint allows for simultaneous bilateral total hip arthroplasty, without the need for re-positioning or re-draping the patient during the operation. The procedure is performed in a sequential fashion focused on a single side, with completion of the procedure before immediately proceeding to the contralateral side.

The use of femoral-neck sparing arthroplasty design spans greater than 30 years,<sup>1</sup> with a focus on preservation of proximal bone stock for younger, active patients who are undergoing arthroplasty at a young age and may need future revision surgery. Success rates reported by Dr. Pipino in his series included 97% satisfactory radiographic results, and an implant survival rate of almost 100% at 25 years.

The modern, press-fit, modular neck-sparing arthroplasty design has been available in the United States and Australia for nearly 3 years, and enables the surgeon to perform intraoperative customization of the hip biomechanics for each case. Additionally, the standard 12/14mm trunnion allows the surgeon to choose the femoral head and bearing material, allowing options for metal on polyethylene, ceramic on ceramic, ceramic on poly, or ceramic on metal couples, in order to help avoid the use of metal

on metal couples that have demonstrated higher complication rates in the recent literature.

To the best of our knowledge, we present the world's first case report of a simultaneous, bilateral, direct anterior total hip arthroplasty utilizing a modular neck-sparing arthroplasty femoral stem design.

### Case Report:

A 32 year-old man presented for evaluation after having been previously diagnosed with advanced bilateral avascular necrosis of his proximal femoral heads. His management had already included a comprehensive medical and metabolic workup to assess for causes for the avascular necrosis, but none had been elucidated. He denied any known exposure to high dose corticosteroids and had no history of alcohol intake. He had previously undergone core decompression procedures at an outside institution on both the right hip (18 months prior) and the left hip (14 months prior) in the

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recent past, without any significant improvements in his clinical function or symptoms.

He reported that his pain had continued in severity to a point where it had become “impossible to walk,” and that the cracking and grinding within his hips felt as if he “was walking on glass.” He was reliant on progressively increasing doses of oxycodone, and was almost totally debilitated by the pain, relying on two crutches for maintaining the little ambulation he was capable of. His past medical history was significant for anxiety but was otherwise unremarkable.

Examination demonstrated a markedly antalgic gait pattern, profound difficulty arising from a chair, and reliance on two crutches while upright. From a seated position, he was able to flex 10 degrees to 100, had 0 degrees internal rotation, 20 degrees external rotation, and 20 degrees of abduction. Crepitus within the hip joints was both palpable and audible during examination. His prior incisions were healed, and he was intact to light touch and motor function in both lower extremities.

Radiographs were obtained, including an AP pelvis with AP and frog lateral images of each hip (Figures 1-3). These demonstrated severe avascular necrosis with collapse and prior decompression tracks with healed lateral cortices. No retained metal was evident in either hip. Both joints had severe secondary osteoarthritis, with joint space narrowing, subchondral cystic changes, and dense sclerosis.

The patient requested that both hip surgeries be performed during the same procedure if possible. Written informed consent was obtained, including



Figure 1 - preop AP pelvis.



Figure 2 - preop AP hips.

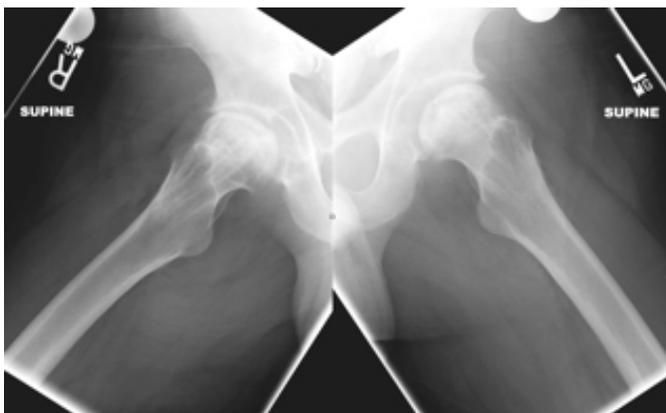


Figure 3 - preop LAT hips.

written consent for anonymous publication of his case. Selection of a direct anterior surgical approach was made to facilitate the performance of simultaneous bilateral total hip arthroplasty. The bone preserving implants were selected since the bone stock within the femoral necks was well preserved and had dense cortical structure despite the avascular necrosis with collapse seen within the femoral heads.

Operative technique involved supine positioning on a standard operating table. Neuraxial anesthesia via an epidural catheter was utilized for intra- and post-operative pain control, in conjunction with general endotracheal and local / peri-articular injections during the procedure. A foley catheter secured superiorly and centrally on the abdomen with gauze and Ioban adhesive. A gel bump was placed centrally beneath the sacrum and the patient was positioned with the right hip elevated for the initial right hip arthroplasty procedure. An oblique incision and a direct anterior approach was performed, with resection of the diseased femoral head and a complete capsular release for femoral mobilization. A 50 degree subcapital resection was

utilized in preparation for implantation of the Neck Sparing Arthroplasty stem, with preservation of his femoral neck. An intraoperative shoot-through AP radiograph was obtained with the final trials in place to assess the position and fill of the femoral component within the right proximal femur (Figure 4).



Figure 4 - intraop trial.

Once the right total hip arthroplasty had been completed and closed, the left hip was elevated on the sacral bump, and the left total hip arthroplasty was performed using an identical technique. A single 18 gauge prophylactic cerclage wire was placed around the left femoral neck due to a small divot that occurred in the anterior femoral cortex following removal of the left femoral head. There was no intraoperative or post-operative evidence of fissure or fracture. Both hip wounds were closed utilizing a multi-layer series of absorbable sutures and dermabond advanced skin glue for cosmetic closure.

Acetabular implants utilized in the case included the Depuy (Warsaw, IN, USA) Pinnacle size 56mm outer diameter hemispherical acetabular shells with +4mm lateralized cross-linked polyethylene liners. Femoral implants included Size 2 Omni Life Science (East Taunton, MA, USA) Apex ARC stem in both hips, with a 8 degree retroverted modular femoral neck on the right and a neutral "standard" modular neck on the left. A +4mm by 36 mm Delta ceramic femoral head was used on the right and a +8mm by 36mm Delta ceramic femoral head was utilized on the left.

Gross blood loss was 1800mL, and net blood loss was 400mL after 1400mL of autologous blood was returned to the patient intraoperatively using a cell saver technique. No allogenic transfusions were given during his hospitalization. The patient stayed 4 days in the hospital and was discharged to home with visiting nursing and therapy services. Deep venous thrombosis was achieved with enteric-coated aspirin 325mg twice daily in combination with intermittent pneumatic compression boots,

active lower extremity exercises, and ambulation during his recovery.

The patient has progressed significantly over the first few months since his surgery, with a steadily decreasing narcotic dose from his preoperative baseline. He has transitioned to outpatient physical therapy and has continued to make progress towards normalizing his gait pattern and improving his hip strength, endurance, and overall function. Range of motion is once again smooth and no longer affected by crepitus, locking, and pain. Radiographs from his 4 week postoperative visit included an AP pelvis with AP and supine frog lateral views of both hips (Figures 5-7), demonstrating that the components are well-seated in an anatomic position.



Figure 5 - postop AP pelvis.



Figure 6 - postop AP hips.



Figure 7 - postop LAT hips.

## Discussion:

Bilateral total hip arthroplasty was described in the 1970's and was presented as an option for younger, healthier patients who could sustain undergoing a larger surgery.<sup>2,3,4</sup> When compared with the single procedures at that time, the duration of surgery in the one-stage procedure was not quite doubled, while the blood loss was increased by about one-third, and the length of stay lengthened by about one week. However, the total length of stay in the hospital was reduced by about one-half in comparison with single-admission two-stage replacements and the incidence of local and systemic complications was similar across the groups, as were the clinical and roentgenographic results. This was felt to be favorable at that time, and judicious use of the technique also helped reduce hospital costs associated with two admissions, two anesthetics, and two trips to the operating room for the patient.

Ganz et. al.<sup>5</sup> analyzed one stage versus two stage bilateral hip arthroplasty in 1996 and found that there were no differences in operative, early local, or general complications among the groups. In particular, no higher incidence of pulmonary embolism or deep vein thrombosis was found in the 1 stage group. Preoperatively, very stiff hips (total range of motion < 50°) gained significantly more motion in the 1 stage group than in the 2 stage groups. The degree of pain reduction was the same in all groups, but patients in the 1 stage group had a significantly better capacity for walking after their procedure. Average total hospital stay was 5 to 6 days less for the patients in single stage group, which, combined with using the operating room only once, resulted in a reduction of overall hospital costs by more than 30% when using the 1 stage procedure.

Other modern reviews of this technique have also lent support to the safety of performing the procedure. Alfaro-Adrian et. al.<sup>6</sup> showed that bilateral total hip replacement was equally safe whether performed as a 1-stage or 2-stage procedure. This was the case in both the low-risk (ASA 1 and 2) and high-risk (ASA 3 and 4) patient subgroups. From their perspective, one-stage bilateral THR was cheaper and involved less time in the hospital. In a follow-up to an earlier study, Ritter et. al.<sup>7</sup> compared the morbidity, mortality,

and outcomes of 900 simultaneous bilateral total hip arthroplasties in 450 patients and 450 unilateral total hip arthroplasties. Pulmonary complications were significantly higher in the simultaneous bilateral group (1.6% vs 0.7%;  $P < .0312$ ). Patients with mortality in the first postoperative year were significantly older (69.8 vs 62.3 years;  $P < .0012$ ). Long-term patient survival, the prosthetic survival, and functional outcomes were not significantly different between groups.

In contrast, Berend et. al.<sup>8</sup> showed that significantly more inpatient complications and adverse events occurred in patients undergoing simultaneous bilateral THA in the lateral decubitus position. There were significantly higher transfusion requirements, and more patients failed to reach physical therapy goals during admission, requiring more transfers to rehabilitation facilities. Need for subsequent hip surgery was also significantly higher in simultaneous bilateral patients. In addition to these negative results, the hospital system realized a 28% reduction and the surgeon suffered a 15% reduction in potential reimbursement.

Simultaneous bilateral total hip arthroplasty may have advantages where both hips are symptomatic for younger patients, who are inherently more fit to sustain a larger surgery. Schwarzkopf et. al.<sup>9</sup> reported on a follow-up of 30 patients who underwent simultaneous bilateral total hip arthroplasty with hydroxyapatite implants and were followed for an average of 19.4 years. Using the Kaplan-Meier survivorship analysis, with revision for any reason as an end point, survivorship was 94% at 12 years, 88% at 15 years, 74% at 18 years, and 61% at 23 years. All revisions were for the acetabular component, and the survivorship for the femoral component was 100% throughout the 23-year period.

Long-term results of the modular neck-sparing arthroplasty design are not yet available, but utilization of the press-fit, hydroxyapatite coated stem design for young patients should lead to high long-term femoral component survival rates based on the data presented above. Additionally, since the surgeon can select high-performance low-wear bearing surface combinations such as ceramic on ceramic and ceramic on cross-linked polyethylene, the long term survival of the components also

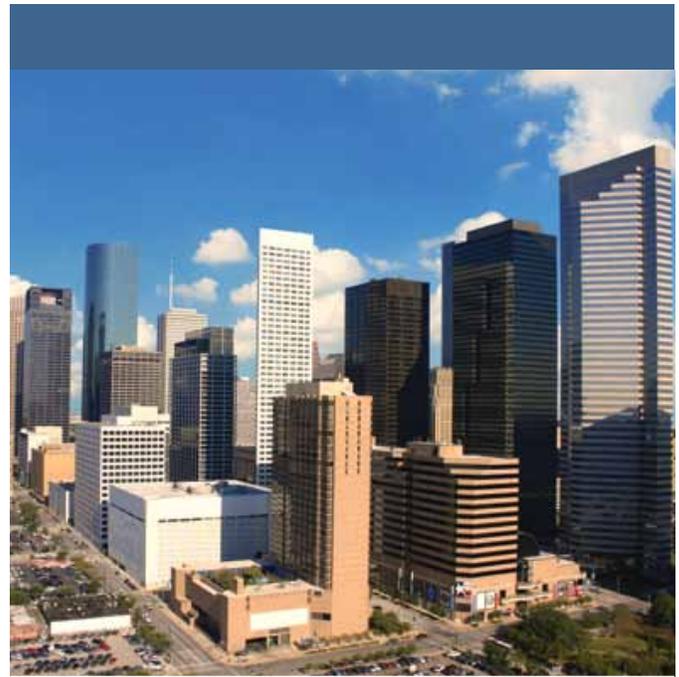
should be enhanced by the improvements in the bioengineering of the bearing surfaces.

The use of a direct anterior surgical approach in combination with neuraxial anesthesia and autologous cell saver harvest to facilitate performance of simultaneous bilateral total hip arthroplasty may allow for reductions in OR time, blood loss, length of hospital stay, and complication rates compared to laterally based approaches to the hip joint. Additionally, the direct anterior approach is also likely to improve the short term recovery for patients undergoing a bilateral procedure by preserving the peri-articular musculature compared to other historic techniques.

The present case demonstrates the utility of the direct anterior approach in performing simultaneous bilateral total hip arthroplasty, without the need for traction tables or expensive intraoperative exposure devices. The patient's uneventful hospital course and outstanding early progress suggests that this technique can be successfully repeated for carefully selected young, healthy patients affected by severe bilateral hip disease. The costs for the hospital and the surgeon's reimbursement may impact the decision to pursue this type of intervention, but it can be safely performed with outstanding clinical and functional results for carefully selected young patients.

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