Anterior Total Hip Arthroplasty: Are We Moving Forward?

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Objectives

- Differentiate between the various total hip arthroplasty approaches, including multiple anterior approaches.
- Discuss the perceived advantages of various approaches.
- Recognize the variability on the need for precautions during rehabilitation.
- Describe the components of a rehabilitation program following an anterior total hip arthroplasty.

Number of total hip replacements among inpatients aged 45 and over, by age group and year: United States, 2000–2010

Source: CDC.gov

Percent distribution of total hip replacements among inpatients aged 45 and over: United States, 2000 and 2010

Source: CDC.gov

Reasons for THA

- Osteoarthritis
- Rheumatoid arthritis
- Fracture
- Traumatic arthritis
- Avascular Necrosis
- Childhood diseases

Source: CDC.gov
Hip Joint: Capsule

- Articular capsule – has two sets of fibers
  - Superficial – longitudinal fibers
  - Deep – circular fibers

Hip Joint: Capsular Ligaments
**Hip Arthroplasty**

- **Earliest recorded attempts** 1891 using ivory
- Smith-Peterson (1925) – mold arthroplasty from glass
  - Later utilized stainless steel
- John Charnley (1960s) – considered father of modern arthroplasty
  - Low friction arthroplasty – metal femoral stem, polyethylene acetabular component, acrylic bone cement

**Components**

- **Metal on polyethylene**
  - Good evidence to support
  - Good lifespan
  - Cost Effective
- **Metal on metal**
  - Reduced wear
  - Larger femoral head
- **Ceramic on ceramic**
  - Low friction
  - Inert substance
  - Low debris particles

- **Polyethylene debris**
- **Leads to aseptic loosening**
- **Metallosis**
- **CA effect of metal ions**
- **Expensive**
- **Expert insertion required**

**Cemented vs Cementless**

- **Cemented**
  - Used less frequently
  - Typically in elderly population (>65 years)
  - Better early fixation
  - Possible early loosening
Cemented vs Cementless

- Stem has porous coating
  - Allows for ingrowth of bone and fixation
- Used in younger, more active lifestyle
- Greater preservation of bone
- Possible easier revision

Total Hip Approaches

- Posterior
  - Southern, Moore, Gibson, Kocher-Langenbeck, posterior lateral, maximum splitting
- Lateral
  - Lateral, Hardinge, transtrochanteric
- Anteriolateral
  - Watson-Jones, anteriolateral, Rottinger
- Anterior
  - Direct anterior, Heuter, Smith-Peterson
- Additional descriptions: modified, mini, minimally invasive, muscle sparing

Posterior Approach

- Most commonly used approach
- Technically simpler
- Does not interfere with abductor mechanism
- Gluteus maximus divided
- Piriformis, gemelli, obturator externus are released
- Performed in side lying
- Femur internally rotated and flexed to expose area
- Disadvantages
  - Higher dislocation rate

Mini-Incision Posterior

- Described by DiGioia et al. (2003)
  - Modified Moore posterior approach
  - Shortens the incision length from 22-25 cm to 10-12 cm
  - Reports improved distance walked, stair climbing, and less limp at 6 months
  - No difference in pain, function, or range of motion

Direct Lateral Approach

- Described by Hardinge (1982)
  - Placed patient in supine rather than side lying
  - Allows for improved:
    - Orientation of the implant
    - Insertion of cement
    - Correction of leg length discrepancy
  - Splits the gluteus medius but leaves posterior aspect attached
  - Vastus lateralis also preserved
  - Better access to femur for reaming
Lateral Transtrochanteric Approach

- Popularized by Charnley (1962)
  - Performed in side lying
  - Good visualization of anterior and posterior hip
  - Utilizes a trochanteric osteotomy
    - Separates glut medius and minimus insertions
- Disadvantages
  - Trochanteric nonunion
  - Trochanteric bursitis
  - Delayed weight bearing
  - Abductor dysfunction

Anterolateral Approach

- Described by Watson-Jones (1936)
  - Separates gluteus min/med and TFL
  - Does not require osteotomy of greater trochanter
  - No removal of tendons
  - Allows for good view of anterolateral capsule
  - Patient placed supine

Modified Anterolateral Approach

- Rottinger approach (2004)
  - Uses interval between TFL and abductor musculature
  - Muscle sparing
  - Utilizes split table with patient in side lying

Anterior Approach

- First described by Heuter in 1881
- Popularized by Smith-Peterson in early 1900s
- Often utilized with children and hip dysplasia
- Uses the interval between Sartorius and tensor fascia latae
- Judets in 1950s into the 1980s
- Light and Keggi (1980) minimally invasive
  - Split the TFL
Anterior Approach

- Matta (2005) – minimally invasive approach
  - Utilized Heuter incision but shorter
  - Leaves all muscle insertions intact
  - Utilizes the orthopaedic table

Anterior Approach

- Posterior capsule and external rotators left intact
  - Possible decrease in dislocations
- Gluteus medius and minimus left intact
  - Decreasing abductor dysfunction post surgery
- Less pain
- Improved recovery times
- Possible damage to lateral cutaneous nerve
- Technically difficult
- Possible effect from body habitus

Which Approach is Better?

- Pain
  - Miller (2018) – systematic review and meta-analysis - Pain severity and narcotic use less with DAA
  - Zawadsky (2014) - Decreased pain and narcotic use with DAA
- Function
  - Petis (2015) – DAA improved function with stair climbing and walking distances early
  - denHartog (2016) – faster return to functional activities and less reliance on assistive devices with DAA
  - Zawadsky (2014) – earlier discharge and less use of assistive devices

Which Approach is Better?

- Outcome measures
  - Miller (2018) – reported better function with Harris Hip Score
  - Higgins (2015) – decreased length of stay
  - Cheng (2017) – DAA decreased length of stay, no difference in WOMAC scores, no difference in 10 m walk test, DAA did indicate they could bend during functional activities better (putting on socks, picking up objects)
  - Peters (2018) – All approaches had significant improvements in self reported measures; DA and PA had slightly better improvements

Which Approach is Better?

- Complications: Dislocations/Blood Loss/Fracture/Infection/Hematoma
  - Miller (2018) – no significant differences between DAA and PA
  - Higgins (2015) – slightly favored DAA in fewer dislocations
  - Fleischman (2019)
    - DL had fewer mechanical complications (dislocations/fx)
    - PA had the most with instability
    - DAA had more femoral failures (fx and loosening)
  - Angerame (2018) – no significant difference in revision rates
  - PA higher incidence of femoral loosening
  - PA higher incidence of instability
  - Marott (2016) – no significant difference in dislocations, longer length of stay with PA, ↑ blood loss and hematoma with DAA
Other Thoughts

- Surgeon Volume Effect on Outcomes (Malik, 2018)
  - No significant difference in patient mortality
  - High Volume (HV) surgeons had fewer revisions
  - Significant difference in dislocations
  - HV surgeons had significantly lower rate of infections
  - LV surgeons had higher cost of stay and longer length of stay
- Learning curve for DAA (denHartog, 2016)
  - First 100 cases – higher blood loss, increased operative time, more complications, possible poor placement of acetabular cup

Cape Fear Valley Program

- 1 orthopedic surgeon who performs a direct anterior THA
- 2 previous surgeons who performed the direct anterior THA
- All other surgeons perform posterior THA
  - All utilize standard posterior hip precautions
- One surgeon who sends patients home the day of surgery
  - Performs posterior THA

Conclusions

- All differences typically noted within first 90 days.
- Studies that had longer comparisons note that by one year no differences remain.
- Higgins concluded “unable to provide a firm recommendation” as to which approach is superior.
- Miller concluded the choice of approach should consider surgeon preference and experience as well as preference and anatomy of the patient.

Cape Fear Valley Program

- Posterior Total Hip Arthroplasty
  - Patients have one side or single joint THA
- Direct Anterior Total Hip Arthroplasty
  - Majority of patients have one side or a single joint direct anterior THA performed
  - Have had 3 cases of bilateral direct anterior total hip replacements performed

Direct Anterior THA: A Surgeon’s Prospective...

- Dr. Edwin Newman
  - Performing Direct Anterior THA since 2012
  - Originally trained in the posterior approach
    - Disliked due to risk of dislocation and abnormal gait pattern often caused by abductor weakness
  - Uses the Hanna Table
  - Makes a 4 inch incision
  - Has performed bilateral direct anterior THA on 3 patients
  - Performs all of his THAs with a direct anterior approach and now has started to perform hemiarthroplasties for repair of hip fractures with this approach.

The Surgeon’s Prospective...

- Why he likes the direct anterior approach...
  - Spares the muscles around the hip
  - Quicker recovery
  - Improved stability
  - Easier to restore or match leg length due to supine position during the operation
  - Can perform bilaterally
  - Better approach for someone with spinal stenosis or flexed posture due to lack of hip flexion precautions
The Surgeon’s Prospective...

- No exclusions on who can have this surgery
  - If someone is a candidate for a total hip surgery then they are a candidate for the direct anterior approach
- Do need to be more cautious if a patient has a larger abdomen
  - Potential for excess tissue of abdomen to lay over the incision and create delayed healing or increased risk of infection without proper care
  - Initially had a cutoff with BMI of 50 but now more comfortable performing the procedure

Race to Recovery Program

- Race to Recovery Program
  - Both THA and TKA patients attend.
  - NASCAR Racing Theme
  - Horse Racing Theme – Hoke Hospital

Race to Recovery Program

- Pre-operative joint class
  - Multi-disciplinary education class provided by PT, OT, nursing, TENS provider, and a previous patient.
  - Free to everyone and provided 3x/month
  - PT educates the patient on:
    - Home safety set-up prior to surgery
    - Walker use and set up
    - Expected course of PT after surgery
    - Hip precautions
    - Exercises to perform prior to and after surgery
    - DVD available
    - Race to Recovery book provided to all patients

Race To Recovery Program

- Patients evaluated by PT on the day of surgery (post-op day 0)
  - Patients perform OOB mobility and ambulation on the day of surgery
  - Sit up in a recliner on day of surgery
- Okamoto, et al. (2016) - Mobilization of patients on the day of elective hip arthroplasty shortens the time to readiness for discharge from hospital and can decrease hospital cost.
Race to Recovery Program

- Patients attend AM and PM group exercise classes on post operative day 1
- Ambulation and stair training on post operative day 1
- Expected discharge on post operative day 1 after group exercise class
- Ambulation before each group exercise class
  - Program goal to ambulate 250 feet prior to discharge

Race to Recovery Program

- Group Exercise Class
  - Perform seated and standing exercises in a group setting
  - Usually run by a PTA
  - Provide patient education on:
    - Precautions
    - Signs and symptoms of post operative complications such as PE, DVT, infection
    - Exercises as part of a home exercise program
    - Use of provided equipment including TENS unit, compression hose, ice packs
  - Patient’s family/caregiver included in class

Direct Anterior THA Precautions

- NO TWISTING AT THE HIPS
- Patients taught not to perform twisting movements from the hips such as...
  - Don’t turn and reach behind you.
  - Make sure to pick up your feet when turning around.

Same Day Discharge or Next Day?

- Kim, et al. (2018) – Explored the reasons that patients where unable to discharge on day of surgery (post-op day 0)
  - 163 patients enrolled for same day discharge
  - Delayed PT was the 4th highest reason for delayed discharge
- Sibia, et al. (2015) – Identified variables that correlated with length of stay
  - Pre-operative variables that increase LOS include higher BMI, female gender, and pre-existing medical conditions such as CVA
  - Post-operative variables include later surgery start time, general anesthesia, posterolateral approach, increased operative time, increased blood loss, and not ambulating on the day of surgery.

Dislocations

- The majority of hip dislocations seen have had posterior THA
  - Have seen 3 cases of hip dislocation with patients who had direct anterior THA in last 8 years.
  - Have not seen any repeated dislocations with the direct anterior THA.
  - Have seen repeated dislocations with patients that had posterior THA.
  - Many require a revision surgery.

My clinical experiences...

- Patients that undergo direct anterior THA seem to report less pain than posterior hip THA.
- Direct anterior THA patients have one precaution to remember vs 3 precautions
  - Better able to remember 1 precaution vs 3
- Have experienced that direct anterior THA patients consistently go home sooner than patients with posterior THA.
My Clinical Experiences...

- Patients who attend the pre-operative joint class tend to do better than those that do not.
  - Patients know what to expect throughout the process
- Snow, et al (2014) - The use of preoperative physical therapy was associated with a 29% decrease in the use of any post-acute care services including the need for rehab or home health PT.

Outpatient Rehab

- May be seeing short time after surgery
- Protocols
  - Vary per surgeon
  - Check to see if any precautions
- Caution
  - Patients usually feel great – easy to overdo it!

Outpatient Rehabilitation

- Phase I (post op day 1-5)
  - Wound care: Observe for signs of infection.
  - Observe for signs of DVT or dislocation.
  - Modalities PRN for pain or inflammation (ice, IFC)
  - Gait: Ambulation with walker or 2 crutches on flat surfaces only with weight bearing as tolerated unless specified by M.D.
  - ROM: AROM/AAROM/PROM: Knee and hip within precautions. Check with MD. Many allow active extension and ER but not passive.
  - Strengthening: Isometric quadriceps, hamstrings, and gluteal exercises. Closed chain exercises with bilateral upper extremity support, while observing weight bearing restrictions, if any.

Outpatient Rehabilitation

- Phase II (5 days – 4 weeks post-op.)
  - Continue to observe for signs of infection. Begin scar management techniques when incision is closed.
  - Modalities: Continue PRN
  - Gait: Based on post-op. WB status
  - If WBAT to FWB, may wean to one cane at 1-2 week post-op.
  - If FWB and no assistive device were used preoperatively, wean off assistive device by 2-6 weeks, if muscle performance is sufficient.
  - Balance/Proprioception training: Weight-shifting activities.
  - ROM: AROM, AAROM, PROM: Knee and hip within precautions.
  - Strengthening: Continue isometric quadriceps, hamstrings and gluteal exercises. Stationary cycle or stepper, closed chain exercises and progressive resistance exercises, weeks 3-4.

Outpatient Rehabilitation

- Phase III (4 weeks – 10 weeks post-op.)
  - Wound: Continue scar mobilizations.
  - Gait: Normalize gait pattern.
  - If no assistive device was used preoperatively and muscle performance is sufficient, progress to ambulation without an assistive device by 4-6 weeks.
  - If assistive device was used preoperatively or muscle performance is insufficient, continue with appropriate assistive device.
  - ROM: AROM, AAROM, PROM: Knee and hip within precautions. Hip extensors may be stretched into extension at 6 weeks.
Outpatient Rehabilitation

- Strengthening: Increase resistance of closed chain exercises.
  - Forward and lateral step up/down
  - 3-way SLR (exclude prone extension)
  - 1/4 front lunge
  - Sit to stand chair exercises
  - Sidestepping and backwards ambulation
  - Ambulation on uneven surfaces
- Balance/Proprioception: Progress to single leg balance challenges
  - Pushing or pulling
  - Return to work tasks
  - Progress HEP or fitness center exercise routine

Summary

- Number of total hip arthroplasties continues to rise and estimated to be > 4000,000 soon.
- Approach may affect early outcomes but long term outcomes show no differences.
- Therapists should be familiar with the surgeon approach and any precautions.
- Early mobilization and PT has an impact on acute inpatient discharge.
- Pre-operative training has been shown to decrease post-operative care.
- Care should be taken during outpatient rehabilitation not to over stress the implant.

Key Reminders

- Be aware of surgical approach and any muscle involvement
- Take it slow! Patients after DAA usually feel much better quickly. Need to honor the healing time.
- Beware of torqueing motions.

References

1. CDC. Total Hip and Knee replacements. CDC.gov

References
