Mini invasive Hip Arthroplasty

Review of the Literature

Elias Dagher, Clinique des Lilas, Paris, France
Mini Invasive Surgery

• Maximum preservation of hip’s muscular environnement
Mini invasive

- Anterior
- Antero-lateral
- Two incisions

Mini incision

- Posterior
- Lateral

< 10 cm
Advantages

- Reduction of blood loss
- Reduction of post operative pain
- More rapid recovery
- Shorter duration of hospital stay
- Earlier return to normal daily living
Complications

• Inadequate prosthetic implantation
• Fractures
Anterior Approach
J Judet J, Judet R
The use of an artificial femoral head for arthroplasty of the hip joint
J Bone Joint Surg 1950; 32B:166–17
104 THA

2 dislocations
2 hypoaesthesias of the femoral-cutaneous nerve

Reduction of blood loss, of postoperative morbidity, of hospital stay
More rapid recovery

The femoral exposure necessitated 3 anterior trochanterotomies

Excellent visualization of the acetabulum is afforded by this direct approach
Modified femoral rasps are employed with the leg in external rotation

The anterior approach provides a safe and effective approach to total hip arthroplasty with limited morbidity
Kennon RE, Keggi JM, Wetmore RS, et al.
Total hip arthroplasty through a minimally invasive anterior surgical approach

2132 consecutive THA

28 (1.3%) dislocations
31 (1.5%) hematomas
5 (0.23%) infections
87 (4.1%) fractures
9 nerve injuries

Patients were discharged on the third or fourth postoperative day

They concluded that their anterior approach (with or without accessory portals) is versatile, providing excellent long-term outcomes with minimal complications via a small incision and muscle sparing exposure

1037 THA

10 (0.96%) dislocations

8 (0.77%) underwent revision surgery as follows: 3 septic loosening, 3 aseptic loosening, 2 recurrent dislocations

No heterotopic ossification, clinical limp, or Trendelenburg gait

Difficult exposure in 15 cases of obese patients
In 8 muscular males the piriformis tendon was sectioned for enhanced visualization

The authors concluded this was a safe technique that afforded a low dislocation rate and reproducible implantation of THA components via an approach that avoids sectioning of any muscles or tendons
Matta JM, Shahrdar C, Ferguson T
Single-incision Anterior Approach for Total Hip Arthroplasty on Orthopaedic Table

494 unselected, consecutive THA
Fluoroscopic-assisted anterior mini-incision approach

Length of surgery: 90 min
Hospital stay: 4 days
Walking without external support: 10 days
5 complications (1 infection, 3 dislocations, 1 temporary femoral nerve palsy)

Abduction angle: 41°
Anteversion angle: 23°
Average leg length discrepancy was 3 mm

Matta concluded that the mini-incision anterior approach with an orthopaedic table allows for no postoperative hip precautions with good outcomes, minimal complications, and maintenance of accurate leg lengths.
100 consecutive THA without exclusion criteria

Cup inclination 44.1°
Stem varus/valgus angles 0°

WOMAC score at six weeks was 90.4
Reduced Blood loss, postoperative pain, and length of hospital stay
Quicker Rehabilitation

3 complications (1 proximal femur fracture, 1 acetabular perforation, 1 infection)

The investigators concluded that this minimally invasive anterior approach was safe and advantageous
Nakata K, Nishikawa M, Yamamoto K, Hirota S, Yoshikawa H
A Clinical Comparative Study of the Direct Anterior With Mini-Posterior Approach Two Consecutive Series
J Arthroplasty June 2008 Epub ahead of print

195 THA Comparative Study

Direct anterior approach (DAA, 99 hips)
Mini-posterior approach (MPA, 96 hips)

Cup implantation: 99% within the safe zone in the DAA group
91% within the safe zone in the MPA group (P = .008)

50-m walking time of 52.3 seconds in the DDA group (P = .017)

Improvement in the use of assistive walking aids at 3 weeks postoperatively (P = .031)

The results of this study suggest more rapid recovery for hip function and gait ability after MIS-THA via a DAA when compared to an MPA
Antero Lateral Approach
Bertin and Rottinger have performed over 300 THA using this approach

No published results

For obese and muscular patients, they recommended 1 to 2 cm extension of the incision

These authors are cautiously optimistic that this approach will provide universally successful long-term results

Further experience (as exposure of femur is challenging)
Improved instrumentation
Computer navigation (as consistent acetabular component positioning is difficult)

May enhance outcomes with this approach in the future.
The duration of surgical procedure was longer and the calculated blood loss more substantial in the ALMI group.

The perioperative complications were significantly more frequent in the ALMI group, with four greater trochanter fractures, three false routes, one calcar fracture, and two rocking metal backs.

Other postoperative data (implant positioning, morphine consumption, length of hospital stay, type of discharge) are comparable, as were the early functional results.

Once the learning period is passed, and a more standardised procedure achieved, surgeons should hope to obtain better results in patients operated on using the anterolateral mini invasive approach, with a decrease in complications and in perioperative blood loss.
Dagher E, Kempf JF
Arthroplastie totale de la hanche par mini voie de Waston-Jones: bénéfices précoces et étude du positionnement des implants

**Recuperation post-op**

<table>
<thead>
<tr>
<th></th>
<th>PTH-MI</th>
<th>PTH-C</th>
<th>p</th>
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<tbody>
<tr>
<td>Antéversion du cotyle</td>
<td>$45,1° \pm 10,5°$</td>
<td>$32,7° \pm 6,9°$</td>
<td>&lt;0,05</td>
</tr>
<tr>
<td>Inclinaison du cotyle</td>
<td>$41,2° \pm 8,8°$</td>
<td>$42,5° \pm 9,4°$</td>
<td>&gt;0,05</td>
</tr>
<tr>
<td>Antéversion de la tige</td>
<td>$24,1° \pm 8,2°$</td>
<td>$17,3° \pm 7,3°$</td>
<td>&lt;0,05</td>
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</table>
Two Incisions Approach
Two Incisions Approach

- Recent approach
- Learning curve
Two Incisions Approach

Good results reported by promoters
High complication rate

<table>
<thead>
<tr>
<th>Two-incision</th>
<th>Number of Cases</th>
<th>Average BMI</th>
<th>Incision Length</th>
<th>Dislocations</th>
<th>EBL</th>
<th>Surgical Time (minutes)</th>
<th>Length of Stay</th>
<th>HHS</th>
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<tbody>
<tr>
<td>Berger</td>
<td>100</td>
<td>176 lb</td>
<td>n/a</td>
<td>0</td>
<td>291 cc</td>
<td>101</td>
<td>&lt; 1 day</td>
<td>n/a</td>
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<tr>
<td>Duwelius</td>
<td>100</td>
<td>~162.5 lb</td>
<td>n/a</td>
<td>2 (2%)</td>
<td>n/a</td>
<td>90</td>
<td>&lt; 1 day</td>
<td>90</td>
</tr>
<tr>
<td>Hartzband</td>
<td>100</td>
<td>~174 lb</td>
<td>n/a</td>
<td>0</td>
<td>n/a</td>
<td>62</td>
<td>&lt; 1 day</td>
<td>n/a</td>
</tr>
<tr>
<td>Mears</td>
<td>75</td>
<td>~205 lb</td>
<td>n/a</td>
<td>0</td>
<td>n/a</td>
<td>85</td>
<td>&lt; 1 day</td>
<td>n/a</td>
</tr>
<tr>
<td>Archibeck</td>
<td>851</td>
<td>26</td>
<td>9.5 cm</td>
<td>8 (0.9%)</td>
<td>496 cc</td>
<td>148</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>Totals</td>
<td>1226</td>
<td>~178 lb</td>
<td>9.5 cm</td>
<td>10 (0.8%)</td>
<td>474 cc</td>
<td>129</td>
<td>&lt; 1 day</td>
<td>90</td>
</tr>
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</table>
Posterior Approach
Posterior Approach

- Most frequently used
- High rate of postoperative dislocation (1% to 9%)
- Greater number of publications
## MIS Posterior Approach

<table>
<thead>
<tr>
<th></th>
<th>Number of Cases</th>
<th>Average BMI</th>
<th>Incision Length</th>
<th>Dislocations</th>
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<th>Surgical Time (minutes)</th>
<th>Length of Stay</th>
<th>HHS</th>
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<tbody>
<tr>
<td>Posterior</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hartzband</td>
<td>100</td>
<td>28.3</td>
<td>7.26 cm</td>
<td>0</td>
<td>n/a</td>
<td>37.4</td>
<td>2.89 days</td>
<td>n/a</td>
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<tr>
<td>Wright</td>
<td>42</td>
<td>24.4</td>
<td>8.8 cm</td>
<td>0</td>
<td>151.8 cc</td>
<td>71.4</td>
<td>6.12 days</td>
<td>86.9</td>
</tr>
<tr>
<td>Sculco‡</td>
<td>28</td>
<td>25.2</td>
<td>8 cm</td>
<td>0</td>
<td>127 cc*</td>
<td>71</td>
<td>5.8 days</td>
<td>n/a</td>
</tr>
<tr>
<td>Sculco</td>
<td>254</td>
<td>27.5</td>
<td>8.9 cm</td>
<td>0</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>Dorr</td>
<td>105</td>
<td>26.2</td>
<td>8.2 cm</td>
<td>0</td>
<td>n/a</td>
<td>62</td>
<td>3.6 days</td>
<td>n/a</td>
</tr>
<tr>
<td>Nakamura</td>
<td>50</td>
<td>23.2</td>
<td>10.3 cm</td>
<td>0</td>
<td>339 cc*</td>
<td>99*</td>
<td>n/a</td>
<td>n/a</td>
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<tr>
<td>Wenz</td>
<td>124</td>
<td>29*</td>
<td>7.8 cm</td>
<td>1 (0.8%)</td>
<td>598 cc*</td>
<td>124*</td>
<td>3.8 days</td>
<td>n/a</td>
</tr>
<tr>
<td>Goldstein</td>
<td>85</td>
<td>27*</td>
<td>13 cm</td>
<td>1 (1.1%)</td>
<td>273 cc*</td>
<td>57</td>
<td>n/a</td>
<td>85</td>
</tr>
<tr>
<td>Woolson</td>
<td>50</td>
<td>25.1*</td>
<td>&lt;10 cm</td>
<td>0</td>
<td>603 cc</td>
<td>97</td>
<td>4.3 days</td>
<td>n/a</td>
</tr>
<tr>
<td>Lester</td>
<td>102</td>
<td>n/a</td>
<td>10-15 cm</td>
<td>1 (1.0%)</td>
<td>347 cc</td>
<td>37</td>
<td>3.5 days</td>
<td>95</td>
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<tr>
<td>Waldman</td>
<td>32</td>
<td>28.2</td>
<td>~8 cm</td>
<td>0</td>
<td>n/a</td>
<td>n/a</td>
<td>2.8 days</td>
<td>94</td>
</tr>
<tr>
<td>Ogonda‡</td>
<td>109</td>
<td>28.2</td>
<td>9.5 cm</td>
<td>1 (0.9%)</td>
<td>314 cc*</td>
<td>60.3</td>
<td>3.65 days</td>
<td>84.2</td>
</tr>
<tr>
<td>Chung</td>
<td>60</td>
<td>n/a</td>
<td>9.2 cm</td>
<td>0</td>
<td>136 cc</td>
<td>49</td>
<td>4.41 days</td>
<td>95.5</td>
</tr>
<tr>
<td>Totals</td>
<td>1141</td>
<td>27</td>
<td>~9.3 cm</td>
<td>4 (0.3%)</td>
<td>357 cc</td>
<td>72.9</td>
<td>3.9 days</td>
<td>89.5</td>
</tr>
</tbody>
</table>

Conflicting publications
Lateral Approach
MIS Lateral Approach

Several studies show an increase limp (10% to 26% of cases) and significant denervation of the abductors (23% decrease in abductor strength).

However, very low rates of hip dislocation (typically less than 1%) have been documented when using this approach.
MIS Lateral Approach

No real difference with standard lateral

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<tbody>
<tr>
<td>Direct Lateral</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Higuchi</td>
<td>115</td>
<td>23*</td>
<td>&lt; 10 cm</td>
<td>3 (2.4%)</td>
<td>184 cc*</td>
<td>69.7*</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>Howell</td>
<td>50</td>
<td>26.2*</td>
<td>&lt;10 cm</td>
<td>0</td>
<td>387 cc*</td>
<td>97†</td>
<td>4.4 days*</td>
<td>n/a</td>
</tr>
<tr>
<td>Ilizaliturri</td>
<td>40</td>
<td>28.19</td>
<td>8.2 cm</td>
<td>0</td>
<td>584 cc</td>
<td>n/a</td>
<td>2.31 days*</td>
<td>n/a</td>
</tr>
<tr>
<td>Berger</td>
<td>99</td>
<td>n/a</td>
<td>7.2 cm</td>
<td>0</td>
<td>154 cc*</td>
<td>72</td>
<td>1.9 days*</td>
<td>n/a</td>
</tr>
<tr>
<td>de Beer</td>
<td>30</td>
<td>32.4</td>
<td>7.7 cm</td>
<td>0</td>
<td>180 cc*</td>
<td>46.6</td>
<td>5.1 days</td>
<td>77.1</td>
</tr>
<tr>
<td>Totals</td>
<td>334</td>
<td>25.7</td>
<td>~7.75 cm</td>
<td>3 (0.9%)</td>
<td>253 cc</td>
<td>72.8</td>
<td>3.0 days</td>
<td>77.1</td>
</tr>
</tbody>
</table>
Which is the best minimally invasive approach?

The lack of negative publications regarding the anterior access and the two important series having used this access suggest the superiority of this technique.

However, the insufficient number of publications and the lack of postoperative clinical evaluation diminish its scientific credibility.

No real series of antero-lateral access exist as yet.

Minimally invasive surgery does not provide any additional benefit to lateral access in comparison to the classical procedure.

Uncertainty is attached to the posterior access since there are conflicting publications regarding its minimally invasive application.
Should we keep developing minimally invasive surgery? Is it reproducible?

Of course, publications that promote this surgery are optimistic and consider minimally invasive surgery to be the technique of the future.

It is interesting also to notice that a lot of articles, although recommending cautiousness, and even negative regarding this technique, agree with the fact that it may present some interest and that its development is ineluctable.

All authors agree with the fact that until this surgery clearly demonstrates its harmlessness and advantages, it should be performed only by a limited number of adequately trained surgical teams.

In fact, it is very rare to find those who are strictly against it.
Does it induce any danger for the patients?

catastrophic results:

- important acetabular defect
- cross-sectional fracture of the acetabulum
- comminuted fracture of the greater trochanter
- implant malpositions
Perfect Approach

Such a technique should be:

Easy to understand, teach, and perform, while allowing precise, reproducible implantation of various prosthetic options.

Long-term results ultimately need to be equal or better than the current gold standard.

In order to be universally accepted, the approach must require a minimal number of assistants and afford only a nominal risk to the surrounding neurovascular structures.

The overall goals should be to decrease pain, length of hospital stay, and time to ambulatory independence, while yielding negligible risk for concomitant morbidities.
• Training programs
• Adapted instrumentation
• Navigation
• Sharing experience
Thank You