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PROFESSIONAL PAPER

The Experince with Anterior Minimally Invasive Hip Surgery

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Introduction. When total hip arthroplasty (THA) is performed, the surgeon has to make a decision about the correct approach. **Goals.** In this research we will show our first experince with the implantation of endoprothesis for hip, using the method of anterior minimally invasive surgery. **Methods.** At the Traumatology clinic in Banja Luka, General hospital in Travnik, General hospital „Medicus" in Jelaha during the period between March 30th 2005 and June 1st 2009 53 hip prosthesis were implanted using minimally invasive Hueter approach, with the average length of incision of 7.3 cm. Subjects were 28 females and 25 males, with an average age of 56.8 years old. The reason for the surgery was hip arthrosis III i IV degree with 48 patients, while two patients had displastic arthrosis. One patient had arthritic changes following non-dislocated fracture of the acetabulum. One patient had arthritic changes of the femur. We implanted 50 non-cemented prosthesis, and tri comined (hybrid) prosthesis. **Results.** The orthopedic surgery was done with the use of two assistents and operating nurse, within 68 minutes on average while using on average 436 mL of transfused blood. Movements in an upright position with full weight bearing was done on post operative day one with 50 patients. Acute rehabilitation lasted 8.9 days on average. Full recovery was at 50 days on average, with achieved full range of motion and no use of assistive devices. The average Harris Hip Score (HHS) preoperativelly was 56, and three months postoperativelly it was 93. Five patients had complications: two with anterior displocation of the hip, one sealing of the shaft of the femur, and two infections; one superficial and the other deep. Superficial infection was treated with conservative therapy and the other patient had a removal of the prosthesis. **Conslusion.** Anterior minimally invasive surgery with THA is a method which gives a number of advantages for the patients, such as: lesser extent of operative trauma, shorter hospital stay, and quicker return to activities of daily living. **Key words:** anterior minimally invasive surgery, aloplasty of the hip.

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1. INTRODUCTION

A classical approach to hip surgery in orthopedics is: medial (Ludolf), anterio-medial or ilioingvinal (Langeu Beck), anterior direct approach (Murphy), anterior, iliofemoral (Hueter-Smith-Peterson), anterolateral (Watson-Jones-Harding), direct lateral, transtrochanteric or transfemoral (Ollier-Mercat), and a posterior (Gibson, Moore). In order to perform the hip surgery, the knowledge of the mentioned approaches is necessary. The correct choice of the surgical approach allows for easier healing.

When total hip arthroplasty (THA) is performed, the surgeon makes a decisioon about the appropriate approach. The approach depends on: the experience of the operating team, available instruments, the type of prosthesis available, if the hip joint is centralized, sublaxed, luxed, etc.

The preffered choice over the last 10-20 years has been Watson-Jones and Moor approach, where the incision is approximatelly 15 cm long. The preference is minimizing of surgical trauma, which has been clinically evident in endoscopic surgery. The fast technological evolution and the introduciton of highly sophisticated equipment in the operating room has allowed conditions for minimal surgical trauma, technically without mistakes.

What is anterior minimally invasive surgery when reffering to total hip prosthesis? It reffers to the THA done through an incision of 6 cm, instead of performing muscle tenotomy. Darzi states that the minimally imvasive surgery represents „the most important resolution in surgical technology since the 1900's (1).

2. THE AIM

The aim for this research was to find the advantages and disadvantages for implantation of endoprosthesis of the hip, with the method of minimally invasive surgery using Hueter approach (2), versus classic Moor approach used by these practitioners for the last 15 years.

Assessment of treatment outcome is done by the same criteria for all patients.

The criteria consisted of: individual assessment of the patient and objective clinical testing while calculat-

ing for the Harris hip score (HHS) preoperatively and postoperatively, as well as the length of the surgery, time before upright activities and independent ambulation, length of stay in the hospital, the amount of transfused blood and blood derivatives, as well as complete rehabilitation.

Clinically assumed doubts for infection, luxation, were made objective with the use of laboratory and radiological findings.

3. THE METHODS

At the Traumatology clinic in Banja Luka, The Department of Orthopedics of the Cantonal hospital in Travnik, and General hospital in Jelah, between March 30th 2007 and June 30th 2009, 73 noncemented hip prosthesis were implanted, using Moor's posterior approach with the approximate length of the incision of 23 cm.

At the Traumatology clinic in Banja Luka, the Department of Orthopedics of the Cantonal hospital in Travnik, and General hospital "Medicus" from Jelah between March 30th, 2005 and June 1st, 2009 53 THA's, with anterior minimally invasive approach were completed using Hueter approach (Figure 1). An average incision size was 7.3 cm. Hueter approach is the most medial access to the hip joint (1). It was used in the first part of the 19th century by Hueter. The patient is positioned supine on the table without any additional support for the back or the legs. The surgical table needs to have an additional table, in order to assist during specific parts of the surgery in terms of a support for traction, external or internal rotation, or lowering or rising of the operated leg. If there is no adequate table, this can be done by an assistant, who can during the surgery, hold onto the leg and move it, as needed, into a desired position. Modified Muler table can be used as well.

An incision of 6-8cm is started at one finger lateral to anterior-superior iliac spine (ASIS) and it follows the line which connects ASIS and the head of caput fibulae. The simplest orientation is made by palpating the groove between tensor fascia lata and sartorius muscles. Upon incision through the skin and the next layer, a surgeon makes a longitudinal incidiration through tensor fascia lata, which than needs to be separated from the muscle (3). In this way one can enter the space between the muscles tensor fascia lata and sartorius. Very carefully the surgeon longitudinally incidirates fascia from sartorius, so that there will be no damage to femoral cutaneous nerve, or his gluteal branch. Upon separation of these two muscles retractors are placed between the muscles and one comes to an exposed aponeurosis of rectus femoris. It is important to identify and ligate anterior circumflex artery, which sits on the muscle next to the distal femoral neck, usually in the fat layer. Upon ligation of the artery a longitudinal incision of fascia from rectus femoris is done. The last muscle before joint capsule is iliopsoas. With the use of Lambot iliopsoas is separated from the anterior joint capsule which is now completely visible. Ekarters are moved and one can see the entire capsule (3). The capsule is cut with the use of an electric knife in a V shape. One branch of the letter V is toward acetabulum, and the other is toward the vertex of the intratrochanteric line, and the lines are joined in the distal part of the neck of femur. This is where support stitch is made and the complete joint becomes visible (3).

Upon capsulectomy two Hofman hooks are placed between the neck and the capsule and osteotomy is performed at the cervicotrochanteric angle at the neck of the femur, with initial check that the patella is in neutral. Upon completed osteotomy, traction of the leg is done in order to allow for an easier approach with the corkscrew at the place of the osteotomy and the same one is removed. The surgical leg needs to be slightly rotated, and Hofman retractor placed at the distal part of anterior inferior iliac spine, which is when the complete joint surface of the acetabulum is exposed (4).

For the implantation of the prosthesis with this approach one must have adequate instruments. Modified handle for tilling of the acetabulum and handle for application of prosthesis modified to enable the preparation of the acetabulum and the placement of acetabular part of the prosthesis through this approach to the hip. Instruments modified in this way allow setting of the acetabular component of the prosthesis without increased risk to the inclination or antiversion, and without compromising the outcome of the arthroplasty (4).

Upon implantation of the acetabular component of the prosthesis, the leg traction is released and the same is placed in the external rotation to 90 degrees and the leg is lowered toward the floor so that the osteomized femoral neck "floats to the surface". Rasps made for this approach are used for preparation of the femoral prosthesis component and the same is inserted. Next, the repositioning is done, hemostasis control and assessment of the need for drainage. Supporting suture for the capsule is used for the reconstruction of the capsule, two to three sutures for the attachment of the fascia of tensor fascia lata and sartorius, subcutaneous sutures, and the skin sutures (5).

With this surgical approach the muscles are not tenomized nor disattached and the gluteal musculature is out of surgical field. Only the capsulotomy is performed, which is at the end of the procedure sutured, which rules out the muscle insufficiency therefore allowing the stability for the prosthesis, as well as for fast recovery.

Preoperatively all patients received medicated thromboembolitic prophylactic treatment, and for mechanical prophylaxis we used elastic bandaging.

4. RESULTS

At the Traumatology clinic in Banja Luka, The Department of Orthopedics of the Cantonal hospital in Travnik, and General hospital in Jelah, between March 30th 2007 and June 30th 2009, 73 noncemented hip prosthesis were implanted, using Moor's posterior approach with the approximate length of the incision of 23 cm. Patients consisted of 45 females and 28 men, with the mean age of 54.2. The reason for total hip replacement in 43 patients was a hip arthrosis grade III and IV, while seven patients had dysplastic arthrosis. Three patients had arthritic nondislocated changes after acetabular fracture, and twenty patients had femoral neck fractures. We implanted 50 non-

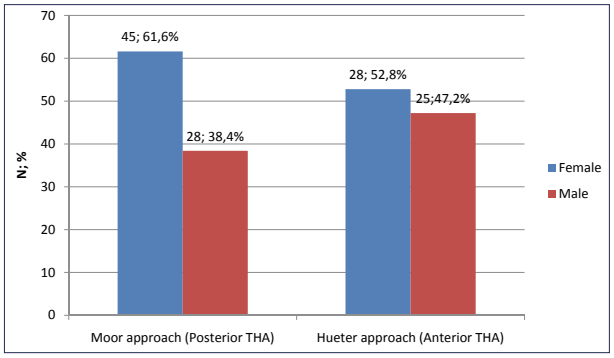

FIGURE 1. Gender comparison by method used

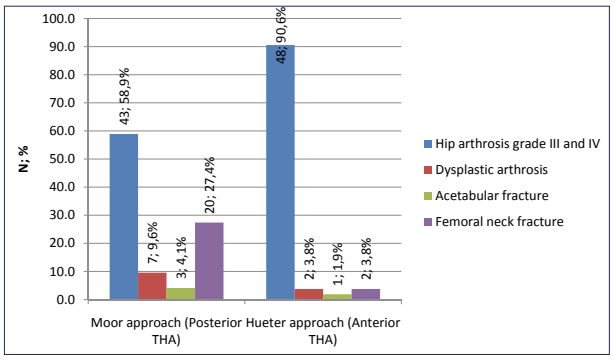

FIGURE 2. Indications for treatment

cemented and 23 cemented prosthesis.

The surgical procedures were performed with three assistants and a surgical nurse with an average of 97 minutes with the need for transfusion during surgery averaging at 744 ml. Out of bed activities with the movement in full weight bearing were performed on the third postoperative day in 50 patients and in 23 on the seventh postoperative day. The length of acute hospital stay was 16.8 days. The full recovery was at approximately 120 days with full range of motion and ambulation without assistive devices.

The average value of the Harris hip score was 50 preoperatively and 92 three months after. From the 73 surgical patients, three died first day postoperatively, two had postoperative fractures, three had dislocations that were immediately reduced by repositioning and continued physical therapy, and 3 had infections. Two infections were repaired with surgical debridement, while one had removal of the prosthesis 5 months after surgery (Figure 2).

At the Traumatology clinic in Banja Luka, The Department of Orthopedics of the Cantonal hospital in Travnik, and General hospital in Jelah, between March 30th 2007 and June 30th 2009, 53 THA's were completed using Hueter approach (Figure 1), operating on 28 women and 25 men, with the mean age of 56.8, withouth statistically significant diferences in gender ($\chi 2=0,651$; $p=0,4199$) and age ($t=0,257$; $p=0,842$).

The reason for THA's in 48 patients was a hip arthrosis grade III and IV, while two patients had dysplastic arthrosis. One patient had arthritic changes after acetabular fracture, and two patients had femoral neck fractures with statistically significant differnce compared to Moor's approach ($\chi 2=7,253$; $p=0,001$) (Figure 2). We implanted 50 cementless prostheses Medacta and three combined (hybrid) prosthesis.

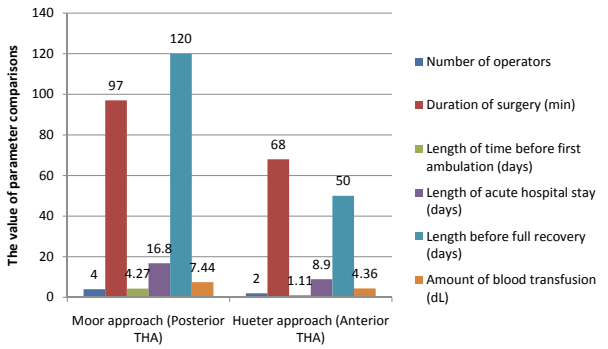

FIGURE 3. Average parameters during surgery and recovery

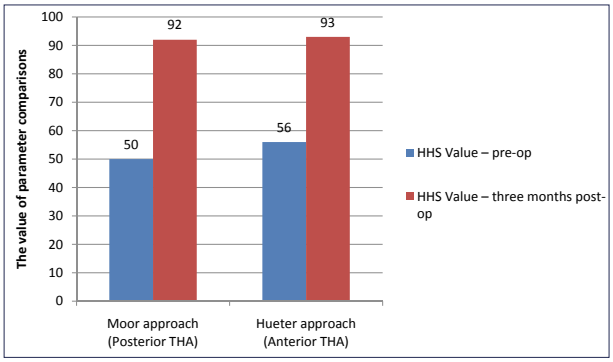

FIGURE 4. Average HSS value before and three months after the surgery

The surgical procedure was performed by the orthopedic surgeon with one assistant and a surgical nurse, on average, for 68 minutes with the need for blood transfusion for surgery on average of 436 ml. Out of bed activities with full weight bearing were done on the first postoperative day with 50 patients. Length of acute hospital stay was 8.9 days. Complete recovery was after an average of 50 days with a full range of motion and movement without assistive devices (Figure 3). All parameters observed were statistically significantly lower in case of Hueter approach ($p<0,05$).

The average value of the Harris hip score (HHS) was 56 preoperatively and three months after surgery it was 93 (Figure 4) withouth significant difference between approaches ($p>0,05$).

X-ray position of the implants showed no difference compared to the last approach practiced in our institutions for the past 15 years.

Complications occurred in 5 patients: an anterior dislocation of the hip on the first postoperative day, which we solved by closed reduction and cast butterfly immobilization for 8 days, one anterior dislocation on the 17th postoperative day, which was repaired using reduction and the continuation of physical therapy, one fissure of the femur which was repaired without any treatment, and two infections. One infection was surgically repaired by debriding while in the other removal of the prosthesis was done 4 months after surgery which is significantly less than in case of Moor's approach ($\chi 2=8,523$; $p=0,004$).

5. DISCUSSION

There are only a few articles that discuss the comparison of the minimally invasive technique with conventional surgical technique. The reason for this may be this technique has been used the last 5-6 years (6).

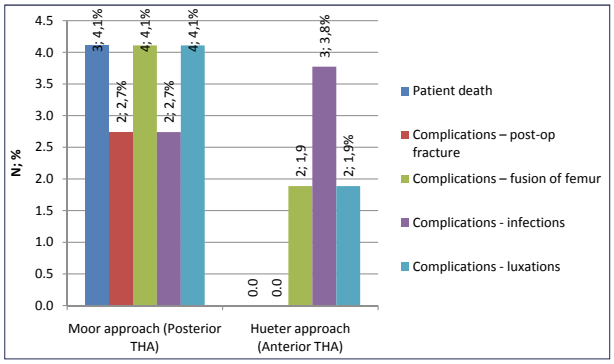

Figure 5. Lethal outcome and complications after the surgery

In recent years we have witnessed the development of new techniques in orthopedic surgery known as minimally invasive procedures (7). The advantage of this surgical technique is reflected in the reduction of operative treatment and work with one assistant, less blood loss, shortened hospital stay and quicker return to activities of daily living (8).

Conventionally used technique for hip arthroplasty, complications such as poor fixation, instability, dislocations, and infections are documented in the 18-20% of patients (6).

Wenz and colleagues have presented the comparative results on 111 patients treated using a minimally invasive technique and 62 patients operated by conventional methods. Comparing these two groups clearly demonstrated that the minimally invasive procedure significantly reduces operating time, reduced blood loss and need for transfusion of blood and its derivatives. 94% of patients had well-positioned implants, considering that the correct position of inclination of 33 degrees to 55 degrees was taken into account. Dorr in his study defined the optimal angle of inclination of 25 degrees to 45 degrees, and anteversion of 15 degrees to 30 degrees. The technique used an incision length of 10 cm. In 19% of cases the expected position of the implant was not achieved (9, 10).

Mears and colleagues using different minimally invasive surgery with an incision of 5 cm showed 28% of complications in terms of fractures of the femur, which is almost three times more than standard approach. Berger and colleagues examined the results of 100 patients treated using a minimally invasive technique with 2 incisions and had 1% of femur fractures, but without dislocation, poor fixation, or dislocation (11).

Goldstein et al used comparative studies for 85 patients treated using a minimally invasive technique and 85 with standard procedures, showing an average value of the inclination of the acetabulum to be 47 degrees (11).

6. CONCLUSION

This surgical technique does not affect the blood flow, and rapid mobilization establishes a mechanical thromboembolitic prophylaxis which significantly reduces the likelihood of thromboembolism. During the anterior minimally invasive surgery of the hip only one assistant is needed. This reduces the time duration of the surgical procedure and conditions to the decreased compensation with blood and blood products. Also, there is a reduction of surgical trauma and reduction of local complications.

THA with anterior minimally invasive surgery reduces the number of acute hospital days postoperatively, need for rehabilitation and the amount of time for the postoperative recovery. This is also a less expensive option for those requiring THA.

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