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IMPLANTATION OF CEMENTLESS ACETABULAR CUP WITH USING OF THE NAVIGATION SYSTEM

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Abstract
The purpose of this study is to compare the clinical and roentgenographic results in patients who have had implanted acetabular cup of the THR with use of the Ortho-Pilot kinematic CT-free navigation system and without his using. Fifty patients, operated between april 2002 and september 2003, were divided into two groups. Twenty five patients in group 1. were operated by standart procedure and 25 patients in group 2. were operated with use of the kinematic navigation system.We evaluated both goups roentgenologically and clinically. The acetabular cup abduction angle was measured as the angle between the horizontal line drawn through the interteardrop line and the long axis of the cup ellipsoid. The acetabular cup anteversion was calculated. using the method of Ackland at al. Clinically evaluation was provided by Merle d'Aubigne and Postel. Both goups were compared statistically. Good acetabular cup position is one of important factor for the long term good results of THR. Using of the kinematic navigation CT-free system we see in implantation of acetabular cup in more accurate position.

Introduction

Optimal position of acetabular cup is one of most important factor affecting stability and lengths of survival of THR [9,12,13]. For optimal is regarded position in inclination 45° (± 10°) and anteversion 15° (± 5°) [2,3]. Out of this "safe zone" increase polyetehylene wear, higher risk of dislocation, decrease range of motion and rise impingement of components [6]. By standart maner of implantation is position of the cup afected by experience of the surgeon. We can use some instruments, which provides often inaccurate data, depending on patient position on surgical table and on his manipulation during surgery. During the last years increase using of computer engineer into orthopaedic surgery. On authors workplace is using of computer navigation system in implantation of cement-less acetabular cups standart method. which makes it possible safe control cup position during surgery. Purpose of submitted study was compare the position cup implanted with by the use of navigation system and without him.

Material and methods

Were compared 2 groups of patients with implanted cement-less press-fit acetabular cup Plasmacup (Aesculap, Germany) during 18 month from April 2002 into September 2003 on both workplace authors. The indications for THR were in 40 cases primary osteoartitis , in 6 cases posttraumatic osteoartritis, in 2 cases postdysplastic osteoartitis, and 2 patients had the femoral neck fracture .

In the first group was by random selection submited 25 patients (12 women and 13 men, 16 rigth and 9 left hips) operated without using of navigation system. Average age of patients was 57,2 years (range 32 - 64), time from surgery into last clinical control was on the average 15,8 month (range 6 – 31). Into 2. group was submited 25 patients (6 women and 19 man, 19 rightg and 6 left hips) average age 53,8 years (range 24 - 66) operate with use of the navigation system OrthoPilot (B/Braun, Aesculap) [8,12]. In all case was used anterolateral aproach. From the fist day after surgery was allowed stress only 1/3 weight of patients . Full stress 6 weeks after surgery. Results were evaluated by authors (V.Š, J.S.), without knowing way of implatation of the acetabular cup. Clinical results were evaluated according to Merle d'Aubigne and Postel [15]. The acetabular cup abduction angle was measured from AP radiograph performance like the angle between the horizontal line drawn through the interteardrop line and the long axis of the cup ellipsoid. The acetabular cup anteversion was calculated. using the method of Ackland at al. The Mann – Whitney U test was used for average comparison et the Bartlett test for standart deviation comparison.

Results

In the first group of patients , in early period after surgery, we had two cases of the hip dislocation. Once we solved the problem conservatively (inclination 52°, anteversion 6°) - fixation by spica cast for 6 weeks. In the second case , malposition of acetabular cup was olved by open reduction and replacement polyethylene inlay with 10 degree offset (inclination 62°, anteversion 8°). Other complications weren´t.

Clinical evaluation according to Merle d'Aubigne and Postel show table 1. Radiology analysis evidence average inclination 50,6° (38° - 62°) and average antevesion 9,4° (3° - 18°). In "safe inclination" 40° ± 10° was implanted 9 cups, in "safe anteversion" 15° ± 10° 21 cups and in "safe zone" at the same time in both plains 8 cups.

In the second group of the patients we didn't see any dislocation and other complications after THR. The navigated implantation of THR lasted 7 to 15 minutes longer as the standart insertion; longer time was at the beginning introduction of navigation system into everyday practice. Clinical results show table 2. Radiology analysis evidence average inclination 43,0° (32° - 55°) and average anteversion 10,4° (8° - 16°). In the zone of "safe inclination" 40° ± 10° was implanted 22 cups , in the zone of "safe anteversion" 15° ± 10° 25 cups and in "safe zone" at the same time in both plains 22 cups.

In statistical evaluation of both groups by Mann - Whitney U test, we find statistically significant difference between twoo groups in inclination of cups ($p < 0,004$);

Table 1

Very good	16
Good	4
Medium	3
Fair	2
Poor	0

Table 2

Very good	14
Good	5
Medium	4
Fair	1
Poor	1

With using of navigation system was implantation more accurately. Difference in anteversion of cups wasn't between both groups statistically significant. With application Bartlett test for comparison of standard deviation was found statistically significant difference ($p < 0,003$) in placing of cups in "safe inclination" and outside of "safe inclination". After surgery with using of navigation systemon was cups inserted in "safe inclination" in 22 cases, without using of navigation sytem only 9 cups was implanted in "safe inclination". There were no statistically significant difference between both groups in clinical evaluation

Discussion

There is a lot of studies interested in orientation of the acetabular component.[2,5,6,8,12]. Barrack et al. [2,3] consider as acceptable cup position in 45°+/- 10° inclination and 15° +/- 10° anteversion . He made computerised simulation of the component position and stability.He found 45° inclination and 20° anteversion of the cup and 15° anteversion of the femoral component as optimal .Lewinek et al. [12] defined the inclination 40° +/- 10°and 15° +/- 10°anteversion as a „safe zone".In case of cup positioning out of this area, he found 4x higher risk of the dislocations. If we use the anterolateral approach, we try to implant the cup in 42°- 43° inclination and 15°anteversion . We are afraid of the inclination 45°and more due to decreasing of the contact area between primar surfaces and consequently for bigger polyethylene wearing.[8]. McCollum and Gray [13] reccommand the cup anteversion 20°- 40°, especially during the posterior approach for the THR. In case of using the Kocher-Langenbeck approach we prefer higher (20°-25°) cup anteversion too. We use this approach especially for postraumatic situations, when reconstruction of acetabular posterior edge is often necessary .Coventry et al.[4] reports on 50% of the posterior displacement combined with 7° retroversion of the cup. In the opposite Paterno et al. (15) analysed 32 THR dislocations without the relation between the cup position and the incidence of the displacement. Pollard and Pierchon [17] obtained the same results. Authors consider the tonus of pelvifemoral muscles more important than the position of acetabular component.

Kennedy et al.[10] examined 75 total hip replacemets.He concluded that in case of the cup inclination about 40° and more is smaller polyethylen wearing there and the osteolysis is not too often. Longterm results are better than in the case of inclination 45° and more. Hirakawa et al.[8] analysed the dependence of the acetabular component position and polyethylene wearing in the group of 94 THR. He found no important difference in inclination 35°- 45°. But 90% of the cups with the inclination more than 45° failed after 15 years. D'Lima [5] compared the cup position and the mobility range. He performed a kinematic analysis and proved that there is maximal range of the hip mobility in 35°-55° cup inclination and 0°-30° anteversion.

Conclusions

Clinical results of both group are comparable . We agree with thesis, that for stability THR, are very important, together with position of the cup, also tension surroundings muscles and good cooperation of the patient in early surgical period. Benefit of using of navigation system for implantation of the cups we see in more accurately orientation in frontal plane . It is interferenced not only stability of THR endoprotezy, but espesially size of polyethylene wear on prime surfaces. In longer time period can be supposed long time better results of THR.

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