Study of bilateral simultaneous cementless total hip arthroplasty in ankylose spondylitis

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Abstract: Objective: to investigate the therapeutic effect of ankylosing spondylitis(AS) bilateral total hip arthroplasty(THA). Methods: A total of 15 patients (28 hips) with ankylosing spondylitis were followed up. A comparative study was conducted on the improvement of joint pain, range of motion, deformity correction, loosening and overall function of patients before and after operation. The clinical follow-up was scored and compared according to Harris system. Results: There was no pain in 22 hips, mild pain in 5 thighs and pain in 1 hip, but no medication was needed. Only 2 hips had obvious thigh pain, and nonsteroidal anti-inflammatory drugs should be taken frequently. Postoperatively, the range of motion of the hip was significantly improved, and the total range of motion of flexion, extension, adduction and abduction, and internal and external rotation of the hip was increased from the preoperative average of 30.8° (0°–95°) to the postoperative average. The postoperative X-ray films showed that no ossification occurred in any position in all patients, and no deep vein thrombosis occurred in all patients. No loosening or shift occurred during the X-ray examination. The mean anterior inclination of the prosthesis was 16.08±6.71 and the mean abduction angle was 40.07±10.122. Fifteen patients were followed up at 3 months, half a year, and 1 year after operation, with an average follow-up period of 15.5 months (12–24 months). The Harris score, VAS score, and the range of motion of the joints were significantly improved three months, half a year, and one year after the operation, and there were statistical differences. Conclusion: Bilateral simultaneous uncemented THA for the treatment of AS complicated with hip joint lesion has significant clinical efficacy, in that it can significantly relieve pain, reconstruct joint function, and improve quality of life.

1. Introduction

Ankylosing spondylitis (AS) is an unknown primary inflammatory disease, which mainly affects the medial axis joint, sacroiliac joint and hip joint, and often leads to chronic ankylosis of the affected joint, which is more common in adolescent males [1]. Total hip arthroplasty(THA) has become an effective measure for the treatment of AS complicated with hip joint dysfunction. Although there have been some reports on hip joint surgery for AS, the cases in these reports generally did not cause hip joint osseous ankylosis, and the condition was relatively mild. The deformity of hip joint flexion contracture was also mild, so the surgery was relatively simple and the patient recovered quickly after surgery. THA is an effective surgical treatment for hip joint involvement in patients with AS, which can improve joint range of motion, relieve joint pain and maximize the reconstruction of the hip joint function [2–3].

From January 2019 to December 2020, a total of 15 patients (28 hips) were treated with bilateral simultaneous uncemented THA for the treatment of AS hip joint disease.

2. Materials and methods

2.1. Clinical data

A total of 15 cases (28 hips) of bilateral simultaneous uncemented THA15 in AS patients were treated in our hospital from January 2019 to December 2020. There were 13 males (25 hips) and 2

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females (3 hips), aged from 22 to 62 years old, with an average of 38.4 years old. There were 4 cases with right hip, 2 cases with left hip, and 10 cases with double hip. AS medical history ranged from 6 to 4 years, with an average of 17.5 years. Hip involvement ranged from 3 to 46 years, with an average of 14.8 years. All surgeries were performed as THA, including bilateral simultaneous displacement of 7 cases (15 hips), revision of one side, bilateral replacement of 2 cases (4 hips), right hip replacement of 3 cases, left hip replacement of 2 cases, bilateral non-simultaneous displacement of 1 case (2 hips). Type of prosthesis used: All patients had uncemented hips.

2.2. Perioperative management

Preoperative evaluation of patients with AS, whether to take steroids for a long time, if necessary, should be standardized use of hormones before and after surgery. A frontal and lateral radiograph of the cervical spine was taken in preparation for intubation under general anesthesia. For severe spinal deformity, respiratory and cardiovascular system functions are evaluated preoperatively. Preoperative through x-ray, understand the femoral bone marrow cavity morphology, joint fusion, femoral neck osteotomy site, the approximate location of the acetabulum and the length of the femoral neck, template measurement, to determine the type of prosthesis and design surgery. Postoperative rehabilitation and functional exercise guidance.

2.3. Surgical methods

For three cases with hip flexion deformity, the anterolateral approach to the hip joint was used, while the others were treated by posterolateral approach. First, the soft tissues around the joint contracture, including iliopsoas muscle, rectus femoris, iliotibial band and sartorius muscle, were fully released, and the adductor femoris amputation was performed when necessary.

Three patients with hip ankylosis and pelvic tilt underwent greater trochanter osteotomy to expose the hip joint cavity. For the others, an osteotomy was performed at 1 cm above the trochanter of the femur, and the femoral neck was excised along the acetabular rim or the femoral head-neck junction. Then the femoral head was ground with an acetabular file to completely remove the residual part in the acetabulum and expose the bony edge of the acetabulum.

After the acetabulum is polished with appropriate anteversion and abduction angle, the prosthesis with the diameter 1–2 mm larger than that of the bony acetabulum is selected. The placement direction of the prosthesis is consistent with that of the acetabulum polishing, and it is in close contact with the bone around the acetabulum. The prosthesis is installed in accordance with the principle of pressure matching, and screws can be used for auxiliary fixation during the operation. The proximal femur was exposed and the medullary canal of the femoral shaft was enlarged with a medullary canal drill until a firm cortical bone was felt. A preliminary osteotomy of the upper femur was performed based on preoperative measurements. After the soft tissues in the acetabulum were cleaned (for example, acetabular file and osteotome were required to remove the hyperplastic bone for osteotonia), the lower pole of the true acetabulum, i.e., the transverse ligament, was used as the lower edge for placing the artificial acetabulum after the location of the true acetabulum was found. An appropriate acetabular cup and liner were placed with an valgus angle of 45 and an anterior inclination angle of 0–10. After further osteotomy of the upper femur, reaming, driving into the femoral prosthesis test model and installing the femoral head test model, the joint was tried for reduction and movement, and the prosthesis was placed after satisfaction. After reduction, a drainage tube was placed in the joint cavity to close the wound.

During the operation, different fixation methods of femoral prosthesis were adopted according to the morphology and bone condition of the proximal femur. Functional settings were adopted for both acetabulum and femoral prosthesis. In this statistical analysis, all the patients adopted the biological fixed mortar cup and femoral prosthesis. After hip reduction, hip joint stability, range of motion and length of both lower limbs were examined. After the incision was rinsed with normal saline and the drainage tube was placed, the incision was sutured layer by layer. The same method was used for contralateral surgery.

2.4. Observation index

The correction effect of kyphosis was evaluated by measuring the Cobb angle of the lateral X-ray film of the spine, and the artificial THA effect was evaluated by Harris joint function score at preoperative and 3 months after surgery, respectively. X-ray of spine was taken during the follow-up visit to observe the bone fusion at the osteotomy site.

2.5. Statistical treatment

SPSS17.0 was used for statistical analysis, and the data were described using mean ± variance (x ± s), and the comparison between groups was determined by t-test, and $P < 0.05$ was considered statistically significant.

3. Result

3.1. Arthrodynia

In this group, except for the bony ankylosis in three of the 28 hips, all the others had obvious pain before operation and needed to take various anti-rheumatic drugs frequently. Eleven patients required intermittent corticosteroid therapy, two of which were as long as 12 years old. Six patients had the history of taking Tripterygium preparations. There was no pain in 22 hips, mild pain in 5 thighs and pain in 1 hip, but no medication was required. Only 2 hips had obvious thigh pain, and nonsteroidal anti-inflammatory drugs should be taken frequently.

3.2. Joint range of motion

The range of motion of the hip was significantly improved after surgery. The total range of motion of flexion, extension, retraction and extension, as well as internal and external rotation of the hip was increased from the preoperative average of 30.8° (0°–95°) to the postoperative average.

3.3. X ray film

Postoperative radiographs showed that no ossification occurred in all patients, no deep vein thrombosis occurred in all patients, and radiographs showed no loosening or shift. The mean anterior inclination of the prosthesis was 16.08± 6.71, and the mean abduction angle was 40.07 ±10.122. Among the 2 patients who underwent revision surgery on one side and hip replacement on the other side, 1 patient underwent revision surgery due to prosthesis loosening on the acetabular and femoral sides and 1 patient underwent revision surgery due to acetabular dislocation.

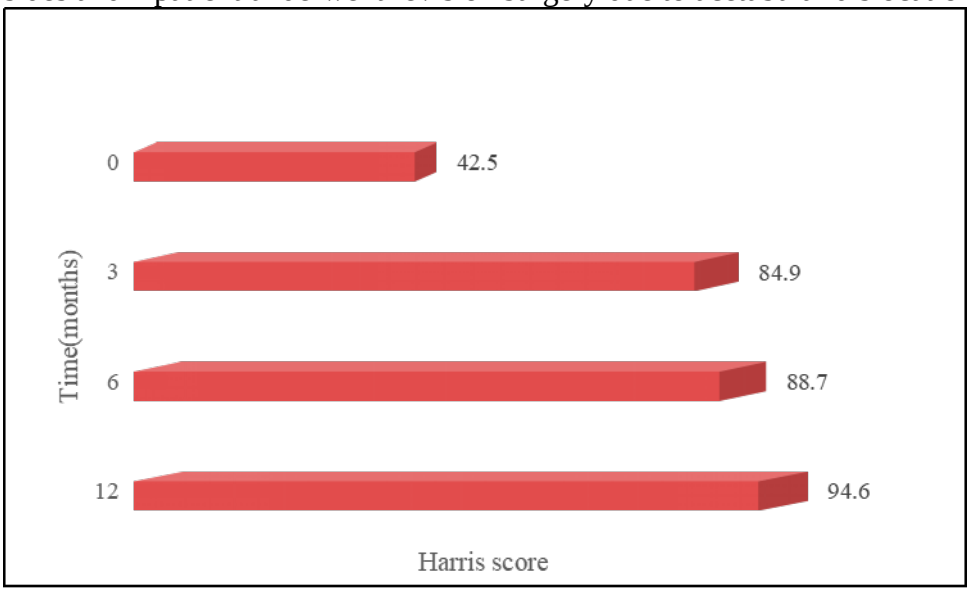

Figure 1 Comparison of Harris scores between preoperative and postoperative 3months, 6 months and 1 year

3.4. Overall function of patient

Fifteen patients were followed up for 3 months, 6 months and 1 year after operation, with an average follow-up period of 15.5 months (12-24 months). Harris score was significantly improved in 3 months, 6 months and 1 year after operation, with statistical differences (Figure 1). Harris score was significantly different after 3 months, 6 months and 1 year compared with that before operation. Compared with 3 months after operation, 1 year after operation was significantly improved.

4. Discussion

4.1. Selection of prosthesis

Artificial prosthesis affects the stability and function of hip joint. For young patients, due to the relatively large range of motion and reduction of spine range of motion, the stress on the hip joint is relatively increased, and a suitable prosthesis is needed to maintain these functions. In recent years, there has been controversy over the use of cemented or bilateral simultaneous cementless prostheses for patients with AS. Patients with AS who are bedridden for long periods of time due to metabolic abnormalities and loss of activity of bone often have concomitant osteoporosis, resulting in difficulties in integration between the bone tissue and the prosthesis. Although the cemented prosthesis has good stability in the early stage, it is more difficult to renovate.

Some patients have good acetabular bone mass but severe femoral osteoporosis with "chimney" changes in the medullary cavity. In this group of patients, a combination of bilateral simultaneous uncemented acetabular prosthesis and cemented femoral prosthesis can be used [4]. In this study, 15 patients (28 hips) were all treated with bilateral simultaneous uncemented prostheses. In the follow-up period of one year on average, none of them sunk or loosened, which also indicates the good application effect of bilateral simultaneous uncemented prostheses in these patients. However, this is also related to the fact that the patients are relatively young, the bone quality is good, and the follow-up time is relatively short. The long-term results need to be further investigated and studied.

4.2. Patient selection and surgical indications

Although young patients with severe hip joint lesions have a risk of high wear rate and high loosening rate when receiving THA, it has been clinically found that the younger the patient is, the more severe the lesion will tend to be, resulting in greater pain and movement disorder. To prevent the development of the disease course and save the joint function, THA must be performed. Literature [5] has followed up 1 120 cases of THA patients and compared their pre-operative and post-operative conditions one year. The results showed that among the patients with pre-operative walking pain, 21% had residual pain after operation, and among the patients without pre-operative pain, only 9% had pain after operation. 38% of patients requiring walkers preoperatively still need walkers postoperatively, and only 15% of patients without walkers preoperatively need walkers postoperatively.

Literatures [6] also found that the more severe the preoperative pain and dysfunction, the worse the postoperative effect. Once the joint stiffness occurs, the postoperative recovery is poorer. Therefore, THA should be performed early in patients with AS complicated with hip joint lesions. The youngest patient in our group was 34 years old, with an average age of 42.4 years old. The indications for preoperative surgery were clear, and the severe respiratory dysfunction and the active stage of inflammatory response were excluded. The postoperative pain relief and functional improvement were significant with satisfactory results.

4.3. Problems to be paid attention to during operation

4.3.1. Anesthesia method

For most patients with AS, routine epidural puncture is difficult due to joint ankylosis, calcification and ossification of ligamentum flavum and interspinous ligament, and tracheal intubation general anesthesia is also difficult for patients with lesions involving cervical vertebra. In

this group of cases, 28 hips from 16 cases were all intubated under general anesthesia, and no severe lesion affecting cervical vertebra was found, all of which achieved satisfactory results.

4.3.2. Surgical approach

Literature [7] for AS patients with severe hip flexion deformity, it is suggested to adopt the improved anterolateral and lateral approach of hip joint in hip replacement surgery, which makes it easier to release the contracture soft tissue in front of the joint; There are also reports of hip replacement in AS patients by posterolateral approach [8]. All patients have adopted lateral approach of hip joint, which is simple in operation and clear in anatomical level, and it is easy to operate on acetabulum and femur. After revealing the femoral neck, the femoral neck should be excised firstly and the joint capsule tissue should be completely removed. Acetabular side surgery can be performed without greater trochanter osteotomy. Meanwhile, the soft tissue of anterior contracture of hip joint and its contracture degree can be determined by flexion and extension of lower limbs.

4.3.3. Intraoperative localization and treatment

Because patients generally have severe kyphosis, which needs to be compensated by excessive posterior extension of the hip joint, if the anterior inclination of the acetabular prosthesis is still placed at the normal 10–20 during hip replacement surgery, anterior dislocation of the hip joint is easy to occur after surgery, so the size of the anterior inclination is the key to successful surgery. The acetabular fossa should be extensively cleaned to identify the true acetabular position. Then the acetabulum was ground at the proper pitch angle (45±5)° and anteversion angle (5±5)°at this true acetabular position, and a suitable acetabular cup was implanted after model test.

During the operation, the lower margin of the true acetabulum should be taken as the baseline, and the acetabulum should be enlarged to the required size at the upper margin, so that the bone of the acetabulum can be preserved to the maximum extent, the prosthesis can be placed firmly, and a foundation for future repair can be laid. The extent of the acetabular protrusion from the bone bed should not exceed 25%. In the case of osseous ankylosis, it is very difficult to distinguish the true boundary between the femoral head and the acetabulum during the operation, which brings great difficulties for osteotomy and acetabular plasty. For the size of the cleaning range, appropriate adjustments should be made based on the degree of tissue contracture to keep it in a slightly loose state to avoid reoccurrence of postoperative skeletal rigidity and affect the function of the artificial joint.

4.3.4. Soft tissue release and nerve and blood vessel protection during operation

For patients with hip joint ankylosis in the unbend position, soft tissue release can not be performed, while for ankylosis in the flexion position, the soft tissue in front of the joint must be released, otherwise the postoperative recovery will be affected. The tissues that need to be released include the iliopsoas muscle, rectus femoris, iliotibial band, sartorius muscle and sometimes adductor muscles. For patients with severe flexion deformity above 60°, we will carefully stretch the affected hip after loosening the above tissues during the operation, so that it is not necessary to completely straighten the hip, so as to avoid causing traction and strain of femoral artery, vein and nerve. After anesthesia is restored, the hip will be gradually straightened according to the feeling of the patient's traction. There was no injury to femoral artery, vein and nerve due to traction in this group of cases.

4.4. Prevention of complications

The early complications after THA in AS patients are mainly infection, while the late ones include prosthesis loosening, shift, dislocation, peripheral fracture and heterotopic ossification. To avoid early complications were strict aseptic manipulation, long operation time, addition of antibacterial drugs during the operation and routine postoperative infection prevention treatment. The occurrence of prosthesis loosening, displacement and dislocation in late complications is related to the operation technology. The position of the prosthesis must be placed correctly during

the operation. The stability of the prosthesis follows the principle of relying on pressure in the early stage and on bone ingrowth in the late stage.

Literature [9] reported that the incidence of heterotopic ossification is high, and the specific pathogenesis is still unclear. To prevent the occurrence of heterotopic ossification, it is necessary to wash the wound clean during operation, and to take nonsteroidal anti-inflammatory analgesics routinely before and after operation, which can relieve pain and prevent heterotopic ossification. The incidence of heterotopic ossification in this group was 17.4%, which also showed that non-steroidal anti-inflammatory analgesics had a certain effect in preventing heterotopic ossification.

5. Conclusions

Hip joint dysfunction in AS patients not only affects their physical function, but also has a significant impact on their psychological and social life. At present, there are few reports on the long-term effect of hip rehabilitation exercise, and patients with AS receiving special rehabilitation exercise after THA surgery need further research. Sound preoperative examination and detailed preoperative evaluation have an important impact on surgery. Patients with AS are more likely to develop complications such as heterotopic ossification, aseptic loosening, infection, postoperative pain, and vascular and nerve damage. There is some controversy about the effect of medication on patients with AS before and after surgery.

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