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Clinical Outcome of First Stage in Two Stages Treatment of Cementless Chronic Infected THA

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Abstract

Total hip arthroplasty is one of the most affluent surgeries in Orthopedics. However, post-operative complications including the infection, remains one of the challenges, There are different ways treat the infection, one of them is the two stage surgeries first stage is to remove the implant and to put antibiotics handmade spacer and second stage for re implantation of cement less prosthesis. To evaluate the clinical outcome of using handmade mobile antibiotics spacer in first stage of two stages treatment chronic cement less THA. This is an intervention study, which was conducted, in Medical City teaching complex, in the period between October 2017 and August 2018. All the patients presented during the study period and was operated by the same surgical team. A total number of 11 patients were included in this study all of them had sinus of chronic infected THA. The patients were operated for removal of primary cement less total hip arthroplasty and use handmade antibiotics spacer through an old scar of postero-lateral approach to the hip. The functional outcome of this intervention was assessed by using Harris hip score to assess the functional outcome 6 weeks after spacer. There is significant increase in the functional outcome in comparison between pre-operative and 6weeks after, the pain, limping, distance of walking are the important variant got improved after spacer applied, some of the mechanical complication was happen during first stage, one case of dislocation treated by limited weight bearing till the second stage, three cases developed proximal fracture treated definitely during second stage. First stage in two-stage treatment of infected total hip arthroplasty is functionally effective in treatment according to the result of Harris hip score, pain and walking are the most clinical variant which are significantly improved after first stage, Limb lengths are maintained, and the patient has minimal discomfort between stages, At the second- stage procedure, soft-tissue planes are easier to identify and joint range of motion is maintained. However, larger study sample and this study could be the scope for further studies to follow in the future.

Keywords: THA; Cement Mixed Antibiotics Handmade Spacer; Harris Hip Score

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Introduction

Total Hip Arthroplasty (THA) is valued as one of the most successful orthopedics intervention in the 20th century, with one in four people at risk of developing symptomatic osteoarthritis in their lifespan [1]. Approximately 1–2% of hip arthroplasties become infected [2], this incidence is higher in patients with diabetes, rheumatological disease, obesity, coagulopathy, preoperative anemia or sickle cell disease [3]. Additional risk factors include prolonged operative time and previous hip surgery. Wound healing complications, such as skin necrosis and postoperative hematoma, also make infection more likely [2]. The incidence of infection in primary total hip arthroplasty (THA) is extremely low, but it remains a night mare for joint surgeons [4]. Because the reported cure rate ranges from 85% to 95%, two-stage revisions that use a spacer with antibiotic bone cement were once accepted as the gold standard for treating late chronic infected THAs [5]. The indications for THA are wide and ranging from: arthritis; rheumatoid; juvenile rheumatoid and ankylosing spondylitis, degenerative joint disease, avascular necrosis, pyogenic arthritis, tuberculosis, congenital subluxation or dislocation, hip fusion and pseudarthrosis, failed hip reconstruction, bone tumors, Hereditary disorders, femoral neck fractures and post-traumatic arthritis [6]. General classification on the basis of the approach to the capsule of the hip joint into anterior, anterolateral, lateral, posterior and medial approaches [7], has been used. The posterior approach is probably the most commonly used approach for total hip replacement. It was first described by Langenbeck and modified by Kocher in 1907. It is commonly used in total hip replacement because it does not disrupt the abductor mechanism thereby making rehabilitation rapid [8]. The anterior approach is also known as anterior iliofemoral or Smith-Petersen approach. It affords good exposure of the acetabulum and avoids disruption of the abductor mechanism. Another approach had been used for minimal invasive hip replacement which is the hueter approach [9]. Anterolateral approach, Watson-Jones popularized this approach, but it has been modified by Charnley, Harris and Muller. It exploits the intramuscular plane between the tensor fasciae latae and gluteus medius [9]. Direct lateral approaches are based on the observation that the gluteus medius and vastuslateralis can be regarded as being in direct functional continuity through the thick tendinous periosteum covering the greater trochanter. It was first introduced by McFarland and Osborne in 1954, and was modified by Hardinge in 1982. The main demerits of this approach is the post-operative

abductor weakness and potential for damage of the superior gluteal nerve and vessels [8]. The number of primary hip replacements performed continues to increase. The latest annual report of the National Joint Registry of England and Wales reported that 87,733 total hip replacements were performed in 2016 [10].

Methods

Study design

An intervention study (uncontrolled un-blinded clinical trial) that was conducted in Medical City Teaching complex (Ghazi Al-Hariri for specialized surgeries Teaching Hospital and Private Nursing Home Hospital) in Baghdad-Iraq, the collected cases in the period from October 2017 to August 2018. All of the patients involved presented with chronic late infected total hip arthroplasty done previously in different centers inside and outside the Iraq, as we are tertiary center receiving and treating such cases.

Inclusion Criteria

- Patients who agreed to be part of this study.
- Patients with chronic late infected cement less THA with discharging sinus.

Exclusion Criteria

- Infected Cemented THA.
- Patients with acute postoperative infections.
- Patient with sign of infection without discharging sinus.

According to the above, and the total number of antibiotic loaded acrylic cement spacer were eleven (N=11). All were performed by the same surgical team. Patients were three males and eight females, Study patient's age was ranging from 30 to 72 years with a mean of 46.5 years.

Pre-Operative Patient Evaluation and Planning

Detailed history was taken from each patient, and clinical examination including general physical examination and local examination of the affected hip and pre-operative evaluation of the patient by using Harris hip score and ask the patient to stop antibiotics two weeks before surgery. Full laboratory investigations were done including: CBC, FBS, RFT, Urinalysis, Bleeding profile, ESR, C-Reactive proteins titer, hepatitis and AIDS virology screening tests. Each patient was sent for preoperative anteroposterior and lateral pelvic radiograph. Patients were sent for medical and anesthetic consultations according to their medical conditions. Every patient has been told briefly about the surgery and a written consent was signed by them. All patient involve in the study they had discharging sinus.

Surgical Procedure

Under spinal or general anesthesia according to the senior anesthetist decision, patient condition and comorbidities. All of our patients received intravenous antibiotics 30-60 min before the skin incision was made in a form of third-generation cephalosporin (Ceftriaxone 1g) or Vancomycin 1g as in form of infusion completed 10 minute before surgery for patient with history of ceftriaxone allergy and continue on same antibiotics injection until the result of cultures and sensitivities of organisms from deep tissue samples obtained at the time of surgery are given for 6 weeks, cyclocaprone (tranexamic acid) in dose of 1500 mg as was given as intravenous infusion started just with skin incision). All the surgeries were performed by the same surgical team to overcome any technical issues and selection bias. The patient was positioned in a lateral decubitus position, stabilized with pubic and lumbar supports. The surgical site was prepped with 6% povidone iodine and draping was completed. Operations were performed through the previous scar of a postero-lateral approach starting 10 cm from the PSIS and extended to the greater trochanter and extended distally, then splitting the gluteus Maximus muscle with the direction of its fibers, joint content (fluid, pus) then taken and put on (blood tissue agar and brain heart tissue) for culture and sensitivity ,all the infected tissue removed and excision of the sinus and membrane developed around infected prosthesis, dislocation of the femoral stem and the starting to remove the head and femoral side prosthesis with debridement of the femoral canal and removing all the membrane inside the canal and sent for culture and sensitivity then starting with acetabular side removing of Poly then removing the cup of the acetabulum debridement of acetabular side and tissue taken for culture and sensitivity, wash the site with 6 litters of normal saline mixed with povidone iodine 10% (5 cc for every 500 ml normal saline) using lavage system. A total of 3 g of antibiotics (2 g vancomycine powder vial and 1g of gantamycine already in the cement) was mixed thoroughly with 1 batches (total, 40 g) of polymethyl methacrylate polymer before adding 1 ampule (20 mL) of the liquid monomer. During polymerization, the cement spacer was shaped into a unipolar hemiarthroplasty prosthesis according to the diameter of the acetabular cup and the size of the stem over kirschner wire of 2.5 mm size. The constructed cement spacer was snap-fitted into the femoral canal, and the head portion of the spacer was inserted in the acetabular cavity.

Irrigation of the surgical site, Closed suction drainage was inserted, and finally closure of the skin, cyclocaprone (tranexamic acid)in dose of 1000 mg injected through the drain to the wound ,dressing with gauze and plaster, and patient discharged from the theater with lower limbs in abduction.

Follow-up

Post-operatively the patient is given intravenous antibiotics for additional three days in a form of third-generation cephalosporin (Ceftriaxone 1g) till culture and sensitivity result appear (parenteral antibiotics were administered for 6 weeks). These antibiotics were selected on the basis of the sensitivities of the organisms identified in culture, drain removed when the amount of daily drainage was, 50 mL. Starting anti-coagulant therapy (Low-molecular weight heparin 4000 iu) after 8 hours and continued for at least 21 days, according to the American college of chest physicians Evidence-based clinical practice Guidelines. Physiotherapy is started day-1 post-operatively, walking with partial weight-bearing by the use of walker if the patient condition allows,

The functional outcome after surgical intervention was assessed by Harris hip score after 6 weeks of the surgery, and was expressed as good, fair or poor. When the infection was controlled. The second stage of the operation was done after clinical improvement and investigations returned to normal 2 weeks after stopping the antibiotics.

Statistical Analysis

The data analyzed using Statistical Package for Social Sciences (SPSS) version 25. The data presented as mean, standard deviation and ranges. Categorical data presented by frequencies and percentages. Paired t-test (two-tailed) was used to compare different scores pre and postoperatively among study groups. A level of P – value less than 0.05 was considered significant.

Figure 1: X-ray preoperative of infected hip.

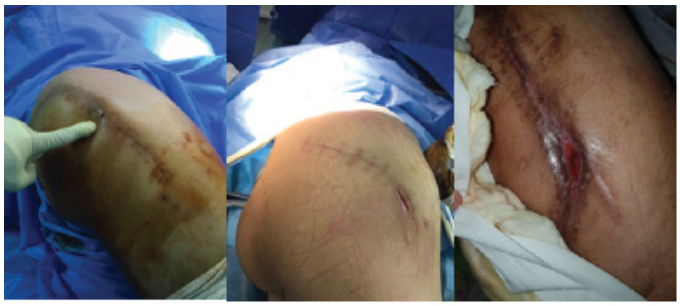

Figure 2: Show sinus over old scar of THA.

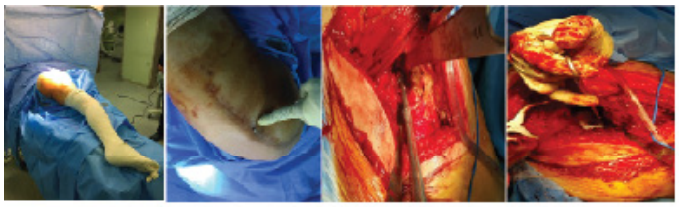

Figure 3: Posterolateral approach to the hip skin (A) incision and (B) sinus, (C) debridement of sinus and drainage of pus exposure and debridement of acetabular fossa, and (D) loss infected prosthesis.

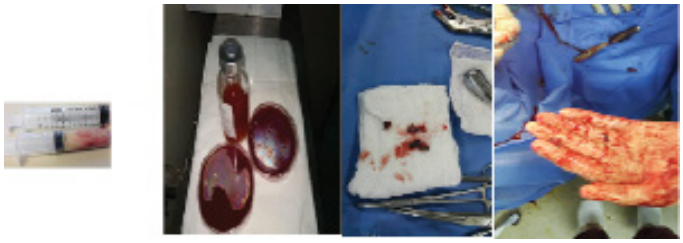

Figure 4: (A) Pus sample from surgical site (B) 2 agars and brain heart tissue for culture (C) sinus tract, and (D) dead tissue.

Results

The distribution of study patients by age is shown in figure 7. Study patient's age was ranging from 30 to 72 years with a mean of 46.5 years and standard deviation SD ± 14.23 years. The highest proportion of study patients was aged <50 years (45.5%). Regarding gender, proportion of females was higher than males (63.6% versus 36.4%) with a female to male ratio of 1.74:1, as shown in figure 8.

Figure 5: Antero-posterior pelvic radiograph post-operative x-ray show handmade spacer.

Figure 6: Post-operative radiograph anterio-posteriore view of pelvis showing use of long stem cement less in the second stage and with treatment of fractures by different methods.

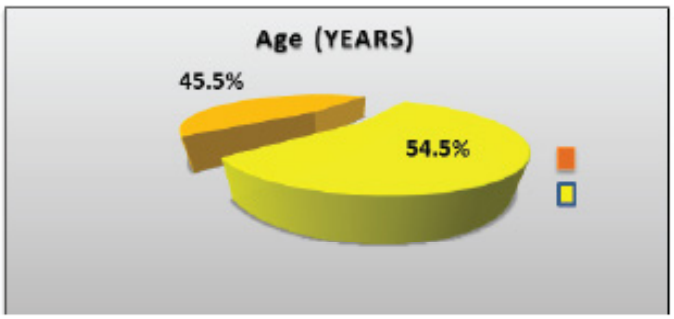

Figure 7: Distribution of study patients by age.

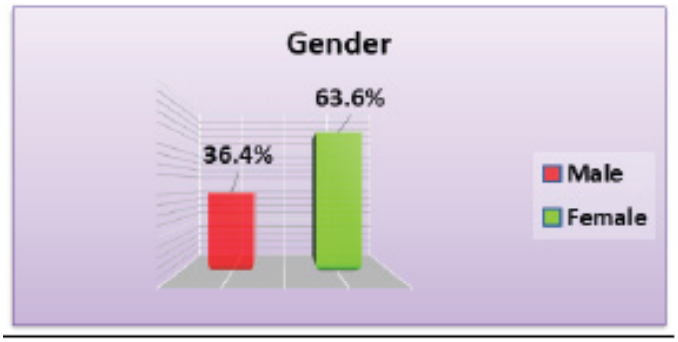

Figure 8: Distribution of study patients by gender.

The distribution of study patients by clinical information is shown in table 2. In this study, the most common cause for primary THA was fracture neck femur (72.7%). Regarding duration from THA to chronic infection, the majority of study patients was complicated by chronic infection after less than two years since THA (60.0%). Concerning side, left side was complicated more than the right side (54.5%). Comparison in mean of Harris Hip Score before with six weeks after operation is shown in table 3. It was obvious that the mean of Harris Hip Score was significantly increased six weeks after operation compared to the mean

Table 1: Patient information: prior procedures, pre-and intraoperative investigations and follow-up.

Duration till second stage	**8 week**	**6 weeks**	**10 weeks**	**3 months**	**8 weeks**	**3 months**	**8 weeks**	**8 weeks**	**6 weeks**	**8weeks**	10 weeks
Harris hip score after	74	71	72	52	75	72	74	75	76	70	71
Harris hip score before	29	28	26	13	45	23	23	27	35	30	19
Antibiotic treatment	ceftriaxone	Vancomycin	Ceftriaxone+ rifampcine	Vancomycin	Vancomycin	Vancomycin	Levofloxacillin	Ceftriaxone +amikacin	Vancomycin	Ceftriaxone +amikacin	meronem
Intraoperative organism	Staphylococcus aureus	No growth	MRSA	S.epidermidis	No growth	MRSA	Staphylococcus aureus	Staphylococcus aureus	No growth	Enterobacter aero genes	MRSA, S.aureus, Enterococcus
Other Ix	WBC 9,552	WBC 14.500 (90% polLY)	WBC, 8,276	WBC 19,500	WBC 4,340	WBC 12.250 (90% PLOYS)	WBC :79,250 (93%Polys)	WBC 11,680	WBC 17,630	WBC 5,380	WBC :18,300 (86%Polys)
ESR/ CRP(mg/L)	62-24	80-96	50-48	75-96	40-13	115-96	55-24	30-24	60-96	45-6	100-96
Surgery before	THA (before 2y)	THA (before 6m)	THA (before 1.5 y)	THA (before 9m)	THA (before5y)	THA (before 7 m)	THA (before 2 y)	THA (before 3 y)	THA (before 9y)	THA (before 1.3 y)	THA (before 9 m)
Presenting criteria	Sinus infection	Sinus infection	Sinus infection	Sinus infection	Sinus infection	Sinus infection	Sinus infection	Sinus infection	Sinus infection	Sinus infection	Sinus infection
case	Case1	Case2	Case 3	Case 4	Case 5	Case 6	Case 7	Case 8	Case 9	Case 10	Case 11

Table 2: Distribution of study patients by clinical information.

Clinical Information	**No. (n= 11)**	**%**
Cause		
Fracture neck femur	8	72.7
AVN (SLE)	2	18.2
AVN (Sickle Cell Anemia)	1	9.1
Duration from THR to infection (Years) No. (n=10)		
< 2	6	60.0
2 - 5	3	30.0
> 5	2	10.0
Side		
Left	6	54.5
Right	5	45.5

Table 3: Comparison in mean of Harris Hip Score pre with after six weeks of operation.

Variable	**Harris Hip Score Mean ± SD**	**P-Value**
Preoperatively	25.9 ± 8.21	0.001
6 Weeks Postoperatively	70.27 ± 6.21	

preoperatively (25.9 versus 70.27, P=0.001). The comparison in means of pain score pre with six weeks postoperatively is shown in table 4. In this study, mean of pain score after six weeks of operation were significantly increased than that before operation (10.9 versus 39.09, P= 0.001). The comparison in means of limp score pre with six weeks postoperatively is shown in table 5. Mean of limp score six weeks of operation were significantly increased than that before operation (6.9 versus 3.18, P= 0.001).

Table 6 showed comparison in means of support score pre with six weeks postoperatively. We noticed that there were no significant differences (P ≥ 0.05) in mean of support score six weeks postoperatively compared to that before operation. The comparison in means of distance walked score pre with six weeks postoperatively is shown in table 7. In this study, means of distance walked score after six weeks of operation were significantly increased than that before operation (3.18 versus 7.72, P= 0.001). The comparison in means of sitting score pre with six weeks postoperatively is shown in table 8. In this study, there were no significant differences (P ≥ 0.05) in means of sitting score six weeks postoperatively compared to that before operation. The comparison in means of climbing stairs pre with six weeks postoperatively is shown

Table 4: Comparison in mean of pain score pre with six weeks postoperatively.

Variable	**Pain Score Mean ± SD**	**P-Value**
Preoperatively	10.9 ± 0.3	0.001
6 Weeks Postoperatively	39.09 ± 3.01	

Table 5: Comparison in mean of limp score pre with after six weeks of operation.

Variable	**Limp Score Mean ± SD**	**P-Value**
Preoperatively	3.18 ± 2.52	0.001
6 Weeks Postoperatively	6.9 ± 1.51	

Table 6: Comparison in mean of support score pre with after six weeks after operation.

Variable	**Support Score Mean ± SD**	**P-Value**
Preoperatively	2.63 ± 2.94	0.45
6 Weeks Postoperatively	3.54 ± 1.5	

Table 7: Comparison in mean of distance walked score pre with after six weeks after operation.

Variable	**Distance walked Score Mean ± SD**	**P-Value**
Preoperatively	3.18 ± 1.83	0.001
6 Weeks Postoperatively	7.72 ± 0.9	

Table 8: Comparison in mean of sitting score pre with after six weeks after operation.

Variable	**Sitting Score Mean ± SD**	**P-Value**
Preoperatively	3.09 ± 1.3	0.172
6 Weeks Postoperatively	3.72 ± 0.1	

in table 9. In this study, there were no significant differences (P ≥ 0.05) in means of stairs score six weeks postoperatively compared to that before operation. The comparison in means of put on shoes and socks pre with six weeks postoperatively is shown in table 10. There were no significant differences (P ≥ 0.05) in means of put on shoes and socks score six weeks postoperatively compared to that before operation. The comparison in means of absence of deformity score pre with six weeks postoperatively is shown in table 11. Means of absence of deformity

Table 9: Comparison in mean of climbing stairs score pre with after six weeks after operation.

Variable	Climbing Stairs Score Mean ± SD	P-Value
Preoperatively	0.36 ± 0.8	0.553
6 Weeks Postoperatively	0.18 ± 0.4	

Table 10: Comparison in mean of put on shoes and socks score pre with after six weeks after operation.

Variable	Put on Shoes And Socks Score Mean ± SD	P-Value
Preoperatively	1.45 ± 0.93	0.167
6 Weeks Postoperatively	1.81 ± 0.60	

Table 11: Comparison in mean of absence of deformity score pre with after six weeks after operation.

Variable	Absence of Deformity Mean ± SD	P-Value
Preoperatively	0	0.001
6 Weeks Postoperatively	3.63 ± 1.2	

Table 12: Comparison in mean of range of motion score pre with after six weeks after operation.

Variable	Range of Motion Score Mean ± SD	P-Value
Preoperatively	1.27 ± 0.9	0.024
6 Weeks Postoperatively	2.18 ± 0.6	

score after six weeks of operation were significantly higher than that before operation (0.0 versus 3.63, P= 0.001).

The comparison in means of range of motion pre with six weeks postoperatively is shown in table 12. In this study, means of range of motion score after six weeks of operation were significantly increased than that before operation (1.27 versus 2.18, P= 0.024).

Discussion

Infected total hip is a devastating complication .historically, there have been a number of methods and protocols used to deal with this complication [11,12]. Two-stage reimplantations have been found to successfully eradicate infection in 90–100% of cases when local antibiotic cement beads or spacers are used [13]. Additional advantages of a cement spacer are maintenance of a functional joint and ease of re-implantation of the final prosthesis. Two stage treatment allow the use of a cement less reconstruction and allografts, as suggested by Berry et al. and Gustillo et al., which is an advantage when dealing with large osseous defects such as those frequently encountered after an infected hip arthroplasty [14,15]. Operative treatment of a chronically infected total hip replacement remains a controversial issue (11). A literature review by Jackson et al. reported an 83% infection eradication rate after one-stage revision arthroplasty with the use of almost exclusively cemented implants [11]. However, Hanssen AD, et al. (1998). reported higher incidences of recurrent infection after single-stage revisions without antibiotic-loaded cement [13]. For these reasons, two-stage revision with local antibiotic delivery has been recommended by a number of authors as the preferred treatment for late infection of a total hip prosthesis [16]. Cement spacers provide greater patient comfort during the interim period and allow ambulation, which facilitates their discharge from hospital, in our study group, 11 patients were able to leave hospital between the two stages, decreasing the costs of treatment. Most of them were independent and able to walk with partial weight bearing on walkers, the comparison in means of limp

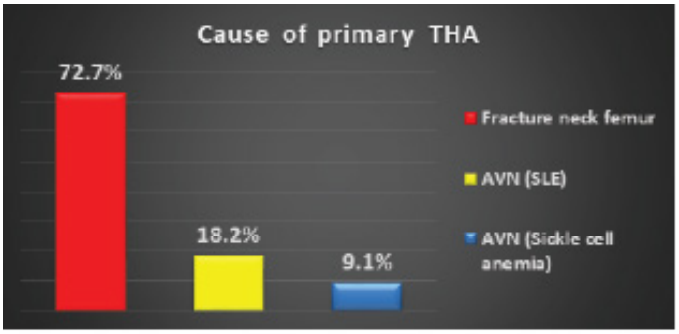

Figure 9: Distribution of study patients by cause of primary THA.

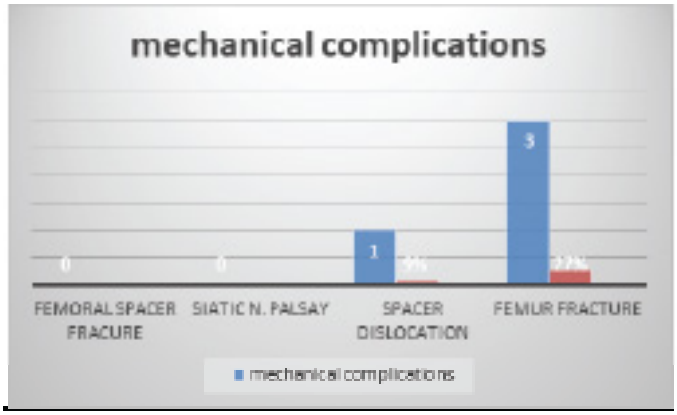

Figure 10: Mechanical complications post-operatively.

Figure 11: (A) one of Mechanical complications spacer dislocation (B) treatment in the second stage.

score preoperatively with six weeks postoperatively. Mean of limp score six weeks of operation (6.9) were significantly increased than that before operation [3.18]. To our knowledge, Hsieh et al. are authors to compare the Girdle stone procedure with the use of antibiotic-loaded beads and cement spacer implantation and to study functional results during the interim period of a two-stage protocol [17]. They found that antibiotic-loaded cement prosthesis was associated with better functional results in the interim period, a lower complication rate and less problems at the time of re implantation. With the PROSTALAC articulated spacer, Haddad et al., reported an average Harris Hip Score of 56 (improved from (32.4) during study of patients with infected total hip treated with 2 stage cement spacer and specially they show significant response to pain [18]. In this study; the mean of pain after six weeks from the operation (39.09) were significantly improved than that before operation(10.9), due to the patients are already will get rid of infection and inflammation less so the pain will be less, which mean use of medication and cost effect better to the patients. Despite these obvious functional advantages, several mechanical complications may occur when cement spacers are used. Spacer fractures, dislocations and

femoral fractures have frequently been reported, although their exact incidence is still unknown. The reasons for mechanical problems are multifactorial. Some are related to the spacer itself (manually formed vs. preformed, spacer geometry, femoral fixation); others are patient-related (bone quality, femoral and acetabular defects, soft-tissue insufficiency and compliance with the partial weight bearing regimen .Widely divergent dislocation rates have been report in the literatures. Some authors encountered >20% dislocation rate, whereas others observed none [19]. In general, hip-spacer dislocation rates are higher if the patient is noncompliant or cannot tolerate partial weight bearing, if the size of the spacer is too small, if muscular insufficiency is present and if large osseous defects of the acetabulum do not allow for normal spacer articulation [20]. The average dislocation rate is estimated to be between 10% and 20 %. The dislocation rate was significantly higher in patients with large acetabular bone defects, Anagnostakos et al. suggested that a spacer cup should be implanted in these unstable cases so that the hip spacer would act as a total arthroplasty rather than as a hemi arthroplasty [20]. Femoral fractures are a common finding when dealing with hip-joint infections. Most patients have poor bone quality due to bone resorption, osteoporosis, disuse of the affected limb and previous operations. The majority of femoral fractures occur at the time of implant removal and are not related to the use of a cement spacer In a study by Leunig and colleagues, 22 patients were treated during the interval period with a homemade antibiotic-impregnated cement spacer in a shape similar to a hemiarthroplasty, six of seven femoral fractures were observed at the first stage. These fractures do not require immediate treatment and are usually managed at the second stage with the use of modular revision stems and cable wires [21]. In this study we access the mechanical complication which can occur during period of 6 weeks follow up after first stage ; no femoral spacer fracture, one case develop dislocation of spacer (9%) during the first stage and the cause of dislocation was due to large osseous defect of acetabulum and treated conservatively with restricted weight bearing till next stage of replacement, three femoral fractures (27.7 %) were encountered in our series; three were of the proximal femur that occurred during the first stage and were successfully treated by fixation with cable wires and cerclage wire at the time of hip prosthesis implantation during the second stage; no sciatic nerve palsy. Charfenberger et al. 23 Articulating spacer after Periprosthetic hip infection and show the Harris hip score was 40 before and became 62.3 after surgery and show a mechanical compilations of dislocation (1) and periprosthetic fracture (2) followed over 13.2 months (2.5 -50.5 months) [22]. Articulating spacer after Periprosthetic hip infection and show the Harris hip score was 38(15.5-77.5) before and became 70(40-100) after surgery and show a mechanical compilations of dislocation (2) (7%) and reinfection of 3(10.3%) followed over 47months (24 months) [23]. Articulating spacer after Periprosthetic hip infection and show the Harris hip score was 34 before and became 56 after surgery and show a mechanical compilations of dislocation (5) (10.4%) and reinfection of 3(6%) followed over 43months (24 -63 months). Articulating spacer after Periprosthetic hip infection and show the Harris hip score was 11 before and became 67 after surgery and show a mechanical compilations of dislocation 0 and no reinfection followed over 20months (7-65 months).

Conclusions

The first stage in two-stage treatment of infected total hip arthroplasty is functionally effective. Pain and walking are the most clinical variant which are significantly improved after first stage. Limb lengths are maintained, and the patient has minimal discomfort between stages. At the second- stage procedure, soft-tissue planes are easier to identify as joint range of motion is maintained. All patients stated they were satisfied with the outcome of the procedure. The selection of antibiotics in the first stage has the advantage to be change in the second stage if the organism changed or resisted. Patients with infected total hip arthroplasty need specialist advanced center for management and for researches. We recommend to do comparative study between handmade mobile spacer and girdle stone In first stage treatment of infected total hip regarding the functional outcome. We recommend to do comparative study between handmade mobile spacer and single stage after infected total hip regarding the reinfection rate. Long term follow-up after second stage to assess the reinfection rate after treatment with handmade spacer is recommended and to view the clinical outcome. In addition, this study should be the scope for others in the coming future.

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