Immediate Postoperative Radiographic Assessment of Hip Arthroplasty

Khitam Hamid Kamil[1], Safwan Saeed Mohammad[1], Mohammad Saeed Mohammad[2]

[1]Research Scholar, Middle Technical University (MTU), College of Health and Medical Technology, Radiology Technology , Baghdad, Iraq, [2]Research Scholar , Medical City Complex – Surgical Specialized Hospital, Baghdad, Iraq

Abstract

Radiograph is the keystone in the assessment of hip arthroplasty, as it is available with no metal artifact , at a low cost, and facilitating longitudinal comparison. Pelvic radiograph is significant to assess post-operative hip arthroplasty. So we aim to assess the outcome of the operation through immediate radiography for hip arthroplasty and to determine the different types of hip arthroplasty. This prospective study were conducted at surgical specialized hospital and nursing home hospital / medical city complex / Iraq-Baghdad at radiological departments by seimens x.ray machines , in the period between (October 2020 – march 2021) . Fifty patients were included . The results showed after radiographic evaluation of hip arthroplasty , 90.0% of cases was Equal Leg length. The higher percentage of vertical center was (90.0 %) for similar compared to lower percentage was(10.0%) non similar , (96.0%) of horizontal center was similar compared (4.0%) non similar .The higher percentage of acetabular inclination was (78.0%) for angle 45degree compared to lower percentage was(6.0%) for angle 50 degree , the higher percentage of acetabular anterversion was (30.0%) for angle 25 degree compared to lower percentage was(2.0%) for angle 30 degree. The percentage for femoral stem position was (100.0%) for neutral alignment . (90.0%) not used of cement mantle compared to (10.0%) used cement mantle , the thickness in range 2-3mm . (94.0%) was no any early complications compared to (6.0%) was Superficial infection.

Keywords: *Radiography, Hemiarthroplasty , Total Hip Arthroplasty, Femoral neck fracture.*

Introduction

The hip is a socket and a true ball joint surrounded by muscles, enabling a wide range of motion in several physical planes while also exhibiting remarkable stability [(1)] .The function of the hip joint is to provide dynamic support the weight of the body [(2)] .It is a complex anatomic structure composed of muscular ,osseous and ligamentous structures [(3)] .Avascular necrosis of the femoral head is due to disruption of blood supply to the proximal femur. There are approximately 10000 to 20000 new cases reported each year in the United States alone [(4)] . Hip fracture is common injury, especially in the elderly patient . It is also seen in young patients who perform in high energy trauma. Immediate diagnosis are required to prevent threatening joint complications [(5)] . Hip arthroplasty is described as one of the most successful orthopedic procedures, allowing for mobilization and early weight bearing, pain relief, and improved quality of life for many patients [(6)] . There are two major

Corresponding Author :
Khitam Hamid Kamil
e-mail: kitamhamid1987@gmail.com

types of hip arthroplasty , Total Hip Arthroplasty and Hemiarthroplasty. These major types can be identified from radiographs [7] . The term hemiarthroplasty refers to the replacement of only the femoral , while The term total arthroplasty is used when the femoral head and acetabulum are both replaced [8] . Radiography is the mainstay of imaging assessment of hip arthroplasty [9] . There are seven key elements which should be evaluated hiparthroplasty . These include the leg length, horizontal center of rotation, vertical center of rotation , acetabular inclination, acetabular antevertion, femoral stem position and assessment of the cement mantle [10] . The leg length is measured by drawing a line transversely connecting the inferior borders of the acetabular tear drops - the pelvic reference line , must be less than 1cm [11] . The vertical center of rotation is assessed by measuring the vertical distance between the center of the femoral head and the transischial tuberosity line ,this distance should be similar to that of the contralateral hip [12] . The horizontal center of rotation can be asessed by the measurement of the distance between the femoral head center and the bottom of the corresponding acetabular teardrop and comparison with the normal contralateral hip. The distances should be equal bilaterally [13] . The inclination is the angle calculated by the line, traced between the medial and lateral margins of the acetabular cup with the intersection of a transverse pelvic reference line [14] . The inclination should measure between 30–50° [15] . Greater angles with greater risk of hip dislocation and Smaller angles are associated with reduced abduction [11] . Femoral stem positioning should be noted in a neutral alignment of the longitudinal axis of the femoral shaft [13]. The acetabular anteversion is assessed on lateral views. It is the angle between the acetabular axis and the coronal plane [14] .Normal ranges from 5° to 25° anteversion as this allows adequate flexion of the hip [10]. The optimal thickness of the femoral cement mantles should ideally be 2–3 mm thick and the acetabular cement mantle is 3 mm as this thickness has been proven to bear good long term radiographic and clinical outcomes [16] .

Patients and Methods

This prospective study were conducted at surgical specialized hospital and nursing home hospital/ medical city complex / Iraq-Baghdad at radiological departments by seimens x.ray machines , in the period between (October 2020 – march 2021) . 50 patients were included (31 male and 19 female), their age ranged from 25 – 75 years. The surgery done for them by one surgical team . The surgery done for them due to, avascular necrosis and femoral neck fracture . All patients undergo pelvic radiography during their stay and before discharge from the hospital , through AP supine, AP standing , lateral (cross table supine) to manually measure the leg length , vertical and horizontal center of rotation , lateral acetabular inclination , acetabular antevertion, femoral stem position , cement mantle if used and if there are immediate complications (fracture or dislocation or early infection).

Inclusion Criteria : Patients who undergone to surgery due to avascular necrosis of hip and femoral neck fracture.

Exclusion Criteria : We exclude patients with complex trauma involving acetabular fracture, patients with revision total hip, infected hip arthroplasty and congenital displastic hip.

Results

Fifty patients have been included in the study age group ranging between 25 and 75 years. In table(1) and Figure (1) show distribution of type of hip arthroplasty by type of fixating techniques . The highest percentage of cases was (84.0%) total hip arthroplasty was Cement less according to fixating techniques , while (10.0%) of Bipolar was Cemented according to fixating techniques . The association between Type of hip arthroplasty and Type of fixating techniques was high significantly (P=0.000).

Table(1): Distribution of Type of hip arthroplasty by Type of fixating techniques

Type of fixating techniques		Type of hip arthroplasty		Total
		Bipolar	Total hip arthroplasty	
Cement less	No.	3	42	45
	%	6.0%	84.0%	90.0%
Cemented	No.	5	0	5
	%	10.0%	0.0%	10.0%
Total	No.	8	42	50
	%	16.0%	84.0%	100.0%

P=0.000 MCP< 0.01 : (HS)

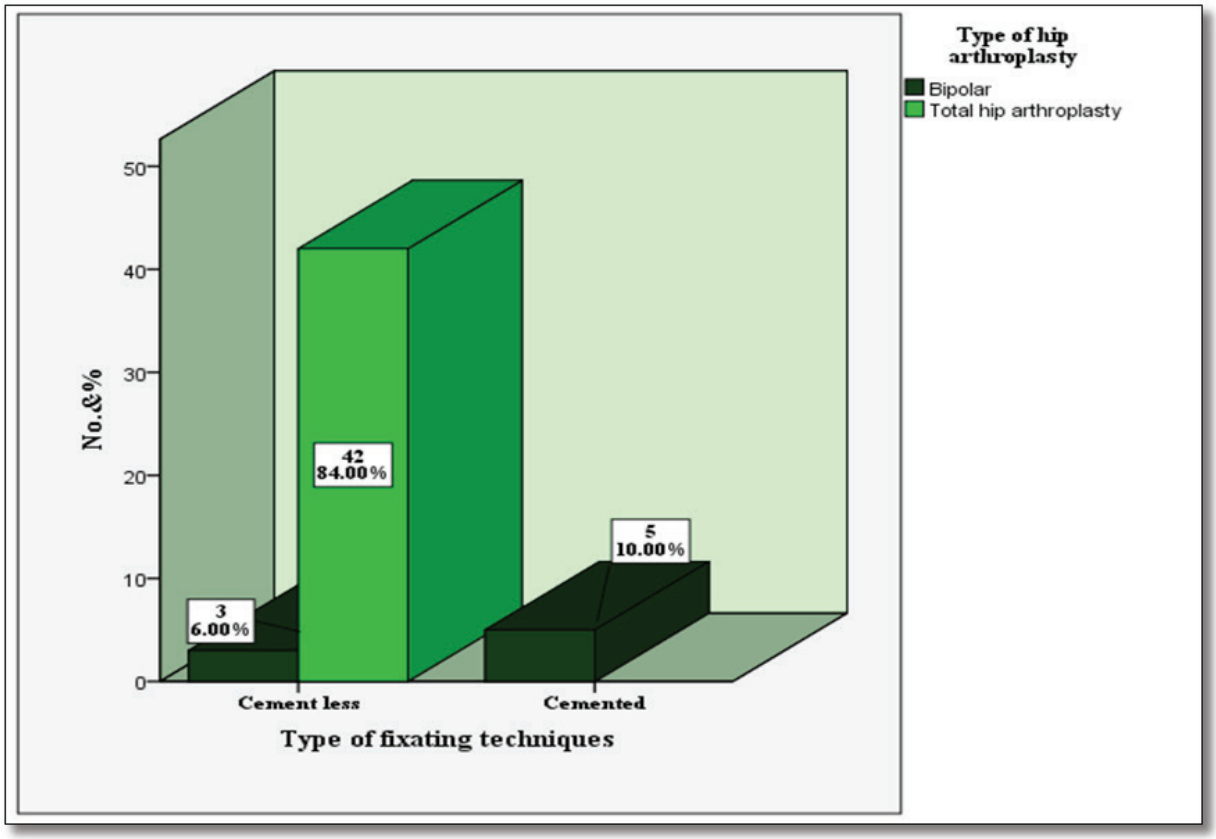

Figure 1: Distribution of Type of hip arthroplasty by Type of fixating techniques

Table (2) Show distribution of total hip arthroplasty by cement mantle. The higher percentage of cement mantle was(84.0%) among Total hip arthroplasty cases was no Cement mantle use, while (10.0%) of bipolar was 2-3mm compared to lower percentage was (6.0%) for bipolar was no Cement mantle use . The association between type of hip arthroplasty and cement mantle was high significantly (P=0.000).

Table (2) : Distribution of Type of hip arthroplasty by Cement mantle

Cement mantle		Type of hip arthroplasty		Total
		Bipolar	Total hip arthroplasty	
2-3mm	No.	5	0	5
	%	10.0%	0.0%	10.0%
NO	No.	3	42	45
	%	6.0%	84.0%	90.0%
Total	No.	8	42	50
	%	16.0%	84.0%	100.0%

P=0.000 MCP< 0.01 : (HS)

Table (3) Show distribution of of total hip arthroplasty by acetabular inclination. The higher percentage was(92.9 %) of angle at 45degree compared to lower percentage was(7.1%) of angle 50 degree.

Table(3):Distribution of Total hip arthroplasty by Acetabular inclination

Acetabular inclination	Total hip arthroplasty	
	No.	%
45	39	92.9
50	3	7.1
Total	42	100.0

Table(4) Show distribution of of total hip arthroplasty by acetabular anterversion . The higher percentage was(35.7%) of angle at 25 degree compared to lower percentage was(2.4%) of angle at 30 degree.

Table(4):Distribution of Total hip arthroplasty by Acetabular anterversion

Acetabular anterversion	Total hip arthroplasty	
	No.	%
10	4	9.5
15	10	23.8
20	12	28.6
25	15	35.7
30	1	2.4
Total	42	100.0

In table (5) Show distribution type of hip arthroplasty and type of fixating techniques for Femoral Neck fracture. 63.6% from cases was Total hip arthroplasty with cement less as type for fixating techniques , while (22.7%) of bipolar was cemented as type of fixating techniques. Association between type of hip arthroplasty and type of fixating techniques of neck fracture was high significantly (P=0.002).

Table(5): Distribution of Type of hip arthroplasty by Type of fixating techniques for Femoral Neck fracture

Type of hip arthroplasty		Type of fixating techniques		Total
		Cement less	Cemented	
Bipolar	No.	3	5	8
	%	13.6%	22.7%	36.4%
Total hip arthroplasty	No.	14	0	14
	%	63.6%	0.0%	63.6%
Total	No.	17	5	22
	%	77.3%	22.7%	100.0%

P=0.002 MCP<0.01 (HS)

Discussion

Several previous studies discussed the approach that used to radiographic assessment after hiparthroplasty . But the current study is one of the first study in Iraq that discussed immediate radiographic assessment after hiparthroplasty during staying and before hospital discharge by pelvic radiograph through AP supine, AP standing , lateral (cross table supine) , although in our study different variables such as age , gender and indication of hiparthroplasty were included. In our study ,all cases of Total hip arthroplasty was Cement less according to fixating techniques. In some studies, Cement less was performed with THA type [17] this is similar to our study . In our study, the cases of bipolar type was cemented more than cement less according to fixating techniques . In some studies, Cement less was performed with bipolar was more than cemented [18] and this was opposite to ours. The reason may be,cemented type make prostheses more stable , a spatially in elderly patient and because may be due to osteoporosis . In our study the association between type of hip arthroplasty and cement mantle was high significantly (P=0.000) . For the cement thickness in our study , the measurement was in the range (2-3mm) . In other studies , their measurement was in the range 2-5 [19] .According to most studies the acetabular inclination should be approximately 45degree [20] .In our study the higher percentage was(92.9 %) of angle at 45degree compared to lower percentage was (7.1%) of angle 50 degree. In some studies, radiographs reviewed within a range of 33.6 – 56.9 degrees [21] .This difference is due to some Variables such as surgical positioning, patient anatomy and surgical technique. In our study the range of angle between (10-30) degrees. In some studies, radiographs reviewed within a range of (8-28) degrees [22] . This difference is mostly due to some Variables such as patient anatomy specifically. In our study the association between type of hip arthroplasty and type of fixating techniques of neck fracture was high significantly , bipolar type was cemented more than cement less .Also some studies were cemented larger than cement less [23] .

This similar to our study because cemented is mostly used in elderly patient who have osteoporosis due to diabetes .In our study ,all THA type was cement less . But in some studies THA cemented was larger than cement less [24] . They note that elderly patients with FNFs treated with Cemented total arthroplasty show greater improvements in functional outcomes .

Conclusions

Through our study , we showed and high light the importance of radiograph in assessment of hip arthroplasty despite the spread of modern devices such as MRI,CT,US . Through our research , we provide the radiologist systematic frame work which he can accurately assess the hip arthroplasty . Based on our study, we can explain three main things, namely, first the radiologist can read and evaluate the artificial hip joint, as well as the radiologist can criticize the surgeon in case there is any error in the operation and finally the surgeon can perform the operation accurately by depending on accurate measurements in order to extend the life of the artificial hip joint for a longer period possible.

Ethical Clearance: Taken from Middle Technical University ethical committee

Source of Funding : Self

Conflict of Interest : Nil

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