



TO EVALUATE THE ACCURACY OF PRE-OPERATIVE DIGITAL TEMPLATING IN FINDING THE PROBABLE FEMORAL HEAD SIZE TO THAT OF ACTUAL INTRA-OPERATIVE SIZE IN BIPOLAR HEMIARTHROPLASTY OF HIP.

Orthopaedics

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ABSTRACT

Purpose: To evaluate the accuracy of pre-operative digital templating in finding the probable femoral head size to that of actual intra-operative size in bipolar hemiarthroplasty of hip. **Methods:** After obtaining ethical committee clearance, 33 patients were included in the study who met the Inclusion criteria. They were subjected to pre operative X rays using a 5 Rupee coin as a reference template. The actual Femoral head size calculated intra-operatively using the head ring template was then compared to that of the probable head size derived as per formula. The study period was for 1 year and it was a prospective study. **Results:** Pearson correlation r value is .755; $p < 0.05$ which indicates there is positive correlation between B1 Actual size of the Femoral head in cm with Formula value. Pearson correlation r value is .961; $p < 0.05$ which indicates there is highly positive correlation between B1 Actual size of the Femoral head in cm with B2 Radiographic size of Femoral head in cm. **Conclusion:** This method is a convenient and practical method of scaling magnification which can be applied in everyday X-ray procedures. The current results support the hypothesis that this method enables accurate templating with digital X-rays.

KEYWORDS

Hemiarthroplasty, Head of femur, X rays, Digital templating

INTRODUCTION

Bipolar Hemiarthroplasty of Hip is a commonly practised procedure for relieving pain and restoring function of the hip joint in patients presenting with displaced neck of Femur fracture, Avascular necrosis of Femoral head and post traumatic Arthritis of Hip.

To achieve optimal hip function and also in choosing the suitable implant size, Preoperative evaluation is essential. This includes the analysis of X-rays Antero-posterior view in digital templating to assess the appropriate size of components, the level of osteotomy, and the required postoperative neck length and femoral offset. The purpose is to restore the biomechanics of the Hip joint.

To obtain reliable data, the magnification of templates should correspond to that of preoperative X-rays. An object of known size such as a coin with known diameter is used as a marker to determine magnification. The Conn's method was modified in our institution by placing a coin by the side of the hip at the level of Greater trochanter by using a radiolucent object underneath the coin.

We hypothesized that the height, weight and BMI of each patient might be an influencing factor on distance and that, if this was correct, the correlation between them could be used to adjust the deviation of magnification and make it more accurate

The management of hip fractures is based on the location of the fracture: the two main categories being intra and extra-capsular fractures. Intra-capsular fractures comprise around 60% of all hip fractures, with up to 80% of these being displaced. Fracture displacement increases the risk of disruption to the femoral head blood supply, and so, is associated with increased rates of osteo-necrosis of femoral head, non-union, delayed union and failure of fracture fixation procedures. As such, the current treatment guidelines for hip fractures advise that "displaced intracapsular neck of femur fractures be treated with arthroplasty procedures". There are two main arthroplasty procedures available for the treatment of displaced intracapsular neck of femur fractures: Hip hemi-arthroplasty and total hip replacement. Hip hemi-arthroplasty is the recommended option in the frail, low mobility population as the large diameter hemi-arthroplasty "head" component reduces the risk of dislocation: total hip replacement is the recommended option in the more active population as it can provide a better functional outcome. The current guidelines from the "National Institute for Health and Care Excellence" (NICE) advice for orthopaedic surgeons to consider total hip arthroplasty over hip hemi-

arthroplasty as treatment of displaced neck of femur fractures in patients who are: independently mobile out-doors, requiring one stick or less for support; cognitively intact; and considered suitably healthy to undergo the operation by both the orthopaedic and anaesthetic teams. When such criteria are not met, a hip hemi-arthroplasty is indicated. The current registry data suggests that around 90% of displaced intra-capsular fractures are treated with hip hemi-arthroplasty, with 10% treated with total hip replacements.

MATERIALS AND METHODS

The study was conducted after obtaining Ethical committee clearance. 33 patients were prospectively included in the study.

Preoperative AP radiograph of the pelvis with both hips were taken after placing a 5 rupee coin by the side of the hip at the level of Greater trochanter by using a radiolucent object underneath the coin. The radiographs were taken at a distance of 1000 mm from the plate. The patient's patella was in a neutral position of rotation with regard to the plate. Intra operative Femur head size was measuring using the measuring ring.

The Formula used was,

$$A1/A2=B1/B2,$$

$$B1=A1 \times B2/A2$$

A1 - Actual size of the coin in cm

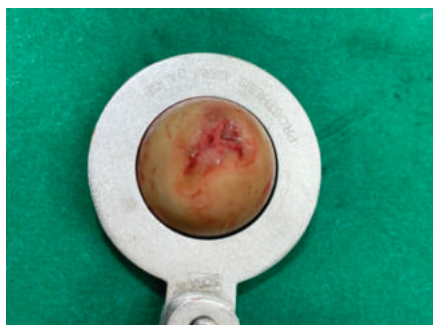
A2 - Radiographic measurement of the coin in cm

B1 - Actual size of the Femoral head in cm

B2 - Radiographic size of Femoral head in cm



Figure 1: Radiographic Measurement Of Coin And Head Of

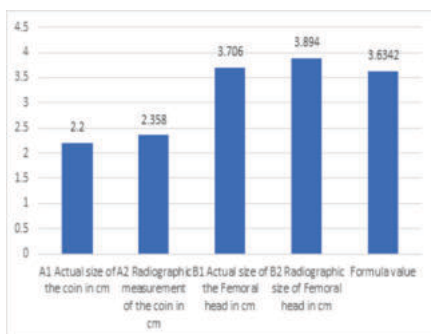
Femur Diameter In Cms**Figure 2: Intra-operative Size Measurement Of Head Of Femur****Figure 3: Post Operative X Ray After Hemiarthroplasty****RESULTS**

Pearson correlation r value is .755; $p < 0.05$ which indicates there is positive correlation between B1 Actual size of the Femoral head in cm with Formula value. Pearson correlation r value is .961; $p < 0.05$ which indicates there is highly positive correlation between B1 Actual size of the Femoral head in cm with B2 Radiographic size of Femoral head in cm.

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
AGE	33	45	88	70.27	10.774
Valid N (listwise)	33				

Mean $\pm$ SD = 70.27 $\pm$ 10.774 (45-88)

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
A1 Actual size of the coin in cm	33	2.2	2.2	2.200	.0000
A2 Radiographic measurement of the coin in cm	33	2.2	2.5	2.358	.0708
B1 Actual size of the Femoral head in cm	33	3.5	3.9	3.706	.1540
B2 Radiographic size of Femoral head in cm	33	3.6	4.2	3.894	.1819
Formula value	33	3.30	4.01	3.6342	.17943
Valid N (listwise)	33				



Correlations			
		B1 Actual size of the Femoral head in cm	Formula value
B1 Actual size of the Femoral head in cm	Pearson Correlation	1	.755**
	Sig. (2-tailed)		.000
	N	33	33
Formula value	Pearson Correlation	.755**	1
	Sig. (2-tailed)	.000	
	N	33	33

** . Correlation is significant at the 0.01 level (2-tailed).

Pearson correlation r value is .755; $p < 0.05$ which indicates there is positive correlation between B1 Actual size of the Femoral head in cm with

Formula value.

Correlations			
		B1 Actual size of the Femoral head in cm	B2 Radiographic size of Femoral head in cm
B1 Actual size of the Femoral head in cm	Pearson Correlation	1	.961**
	Sig. (2-tailed)		.000
	N	33	33
B2 Radiographic size of Femoral head in cm	Pearson Correlation	.961**	1
	Sig. (2-tailed)	.000	
	N	33	33

** . Correlation is significant at the 0.01 level (2-tailed).

Pearson correlation r value is .961; $p < 0.05$ which indicates there is highly positive correlation between B1 Actual size of the Femoral head in cm with B2 Radiographic size of Femoral head in cm

DISCUSSION

The greater the distance of the bone from the plate, the greater the magnification. In order to eliminate the influence of variant distance and scale the magnification, Conn chose a point of reference on the greater trochanter. His study had an accuracy of 68.8%.³ However, it was a challenge for radiographers to find the correct position of the point of reference on the hip only by touching the greater trochanter. The outcome was especially inaccurate in cases where the legs were rotated or presented deformities of the proximal femur, or in cases in which the patients were obese. This was also a finding in our study.

CONCLUSION

This method is a practicable and convenient way of scaling magnification which can be applied in everyday X-ray procedures. The current results support the hypothesis that this method enables accurate templating with digital X-rays.

REFERENCES

- Skoldenberg OG, Boden HS, Salemyr MO, et al. Periprosthetic proximal bone loss after uncemented hip arthroplasty is related to stem size: DXA measurements in 138 patients followed for 2-7 years. *Acta Orthop* 2006;77:386-92.
- Maloney WJ, Keeney JA. Leg length discrepancy after total hip arthroplasty. *J Arthroplasty* 2004;19:108-10.
- Conn KS, Clarke MT, Hallett JP. A simple guide to determine the magnification of radiographs and to improve the accuracy of preoperative templating. *J Bone Joint Surg Br* 2002; 84-B:269-72.
- Oddy MJ, Jones MJ, Pendegrass CJ, et al. Assessment of reproducibility and accuracy in templating hybrid total hip arthroplasty using digital radiographs. *J Bone Joint Surg Br* 2006;88:581-5.
- Bono JV. Digital templating in total hip arthroplasty. *J Bone Joint Surg Am* 2004; 86-A:118-22.
- Wimsey S, Pickard R, Shaw G. Accurate scaling of digital radiographs of the pelvis. A prospective trial of two methods. *J Bone Joint Surg Br* 2006;88:1508-12.