

The Accuracy of Preoperative Templating of Total Hip Arthroplasty.

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Each author of this article fulfilled ALL 04 Criteria of Authorship:

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ABSTRACT

Objective: To determine the accuracy of digital radiographic templating of total hip arthroplasty implants when compared with actual intra operative sizes used.

Methods: This cross-sectional study was conducted in Orthopedics and Spine Surgery Department Hayatabad Medical Complex Peshawar from 23rd January 2020 to 23rd January 2021. Preoperative templating was done on anteroposterior pelvic radiographs followed by cemented total hip arthroplasty (THA). The templating measurements were compared with actual sizes of implants used based upon actual intra operative anatomical measurements.

Results: In this study 60 patients were included. Male patients were 38(63.3%) and females were 22(36.7%). The mean age was 61.9±3.40 years. The preoperative templating perfectly matched with the intraoperative stem sizes actually used in 42(70 %). Plus minus one size error variation was noted in 13(21.7 %) patients while in 5(8.3%) patients there was gross variation error in size. The preoperative templating perfectly matched with the intraoperative cup sizes used in 42(70%). Plus minus one error size variation was documented in 10(16.7%) while gross error in variation in size was noted in 8(13.3%) patients.

Conclusion: The preoperative radiographic templating of stem and cup size perfectly matched with intraoperative implants used in total hip arthroplasty in majority of our patients. We recommend pre operative templating a mandatory step in all patients with total hip arthroplasty.

Keywords: Hip Joint, Implant, Radiograph, Templating, Total hip arthroplasty.

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INTRODUCTION

Total hip arthroplasty is more frequently performed for alleviating pain and restoring function and normal hip biomechanics.¹ Accurate pre operative planning can reduce complications like femoral fractures by selecting appropriate size implant.^{2,3} Total hip arthroplasty is a safe, reliable and durable procedure and because of the improvements in the design and better composition of the implants high rate of success can be achieved.⁴ Pre-operative radiographic templating is an authentic and accurate process for establishing proper component sizes.⁵ Prior to digital radiographic facility planning was used to be done

with hard copy radiographic films with a proper magnification factor.^{6,7} In digital radiographic templating the template and radiograph are scaled for obtaining similar magnifications. The ability of accurately determining magnification of the hip on digital radiograph and then application of similar magnification to the radiographs and templates result in improvement of accuracy of the preoperative templating for total hip arthroplasty.⁸ Modern Orthopaedic units however use Picture Archiving and Communications Systems (PACS) instead of digital radiographs for pre operative templating.^{9,10} Accurate pre operative templating avoids problems like

underestimation or overestimation of implant sizes leading to either loosening or fractures.^{5,8} Preoperative planning and accurate implants ensure improve range of motions, stability, decrease operative time and wear rate by mal-positioning of implant.⁵

The objective of our study was to determine the accuracy of digital radiographic templating of total hip arthroplasty implants when compared with actual intra operative sizes used.

METHODS

We conducted this cross sectional study in Orthopedics and spine surgery department Hayatabad Medical Complex Peshawar from 23rd January 2020 to 23rd January 2021. All adults patients of both gender with unilateral Osteoarthritis, neck of femur fracture and avascular necrosis of head of femur requiring cemented total hip arthroplasty were included in this study. Patients with pathological fractures and revision arthroplasty were excluded. The study was approved by the Ethical committee of our hospital. Informed written consent was obtained from all study participants. In the included patients complete history was taken. Clinical examination was performed and findings were documented. A proper 115 % Anteroposterior Pelvis with both hip joints with the x-rays centered over the pubic symphysis and the x-rays source situated above the detection plate was ensured. The pelvis radiograph had symmetrical imaging of the pelvic

overview (Obturator foramen), central adjustment of coccyx over the symphysis and rotation free imaging of the femoral neck (15° internal rotation of the lower limb). Preoperative templating was done on radiographs assessing the acetabular and femur implants sizes to be used. A single senior surgeon(not involved in surgical cases) calculated the stem and cup sizes. We used of Zimmer and U2 Hip systems. Per operatively the implants sizes were noted and compared with preoperative templating findings.

We analyzed our data with SPSS version 27. Frequency and percentage was calculated for qualitative variables. Mean and standard deviation was calculated for quantitative variables. Data was presented in tables where necessary.

RESULTS

The total number of patients in our study was 60. The mean age of our study participants were 61.9±3.40 years (range 40 to 70 years). Male patients were 38(63.3%) and female patients were 22(36.7%). Right sided total hip arthroplasty was performed in 39(65%) patients and left sided in 21(35%). Preoperative stem templating perfectly matched with the intraoperative sizes used in 42(70 %) patients as shown in table I. Similarly on the acetabular side the preoperative cup templating perfectly matched with the intraoperative sizes used in 42(70%) as shown in table II.

Table I: Size matching results of stem of total hip arthroplasty.

Matching of Preoperative templating with intraoperative measurements	Number (%) of patients
Accurately Matched	42(70%)
Difference of ±1 error	13(21.7%)
Difference of >±1 error	5(8.3%)

Table II: Size matching results of cup of total hip arthroplasty.

Matching of Preoperative templating with intraoperative measurements	Number (%) of patients
Accurately Matched	42(70%)
Difference of ±1 error	10(16.7%)
Difference of >±1 error	8(13.3%)

DISCUSSION

In our study the perfect match of stems were documented in 42 (70%), one plus minus size match was noted in 13 (21.7%) and more than one mismatch was noted in 5 (8.3%) cases. The cup sizes were perfectly matched in 42 (70%), one plus minus size mismatch was noted in 10 (16.7%), and the difference in sizes more than was noted in 8

(13.3%) patients. Unnanuntana¹¹ accurately predicted femoral component in 75(68.8%) patients and acetabular component in 46(42.2%) in cementless total hip arthroplasty. Whiddon and colleagues¹² noted that preoperative templating was accurate in 78% cases of acetabular measurements within 1 size and 90% accurate for femoral components within 1 size difference. Dammerer and

Keiler¹³ reviewed the record of 620 uncemented total hip arthroplasty and documented that pre operative digital templating was accurate in 90% of stems and 85% of cups while templating was exact in 52% of stems and 51% of cups. These authors also observed that the type of cup had significant influenced the accuracy of preoperative templating and female patients had significant accuracy of femoral implants than male patients. We had not documented such results in our study. Iorio¹⁴ calculated pre operative digital templating and acetate templating and concluded that digital templating is a safe procedure for accurate prediction of total hip implant sizes. Wong¹⁵ noted that pre operative templating can restore leg length discrepancy of <5mm and prevent lengthening of >10 mm. The femoral offset can also be restored accurately with pre operative templating. Sariali¹⁶ compared conventional digital templating with 3D CT templating and concluded that 3D templating is more accurate for the prediction of stem and cup of cementless total hip arthroplasty. Bishi¹⁷ is also of the same opinion that 3D templating is more accurate than 2D digital templating but further research is needed to prove its clinical benefits.

Digital preoperative templating is useful for both cemented and uncemented total hip arthroplasty. Smith and his colleagues¹⁸ documented that pre operative templating is more accurate for cemented total hip arthroplasty but high agreement of the inter-observer and inter-observer reliability was noted for uncemented prosthesis. Holzer¹⁹ assessed 632 primary un cemented total hip arthroplasties and noted that femoral component was accurate in 42% cases while acetabular component was accurate in 37% cases. Preoperative templating was not reliable in obese patients. Gender and implant design had no influence on pre operative templating. Experienced surgeons more accurately calculated preoperative femoral templating than junior surgeons. Mirghaderi et al²⁰ advocated the use of mediCAD software for preoperative templating of total hip arthroplasty. These authors concluded that this software had acceptable accuracy rate. It is user friendly and has short learning curve.

Our study had small sample size. We did not include the functional outcome in our study. Further studies are required to verify our results.

CONCLUSION

The preoperative radiographic templating of stem and cup size perfectly matched with intraoperative

implants used in total hip arthroplasty in majority of our patients. We recommend pre operative templating a mandatory step in all patients with total hip arthroplasty.

Conflict of Interest: None

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