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Short stem for total hip replacement: An experience from a tertiary level care hospital in Shimla

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Abstract
Introduction: Total hip replacement (THR) is a procedure whereby the diseased articular surfaces are replaced with synthetic materials, thus relieving pain and improving joint kinematics and function. We aimed to describe our experience of using a short anatomical metaphyseal loading stem femoral implant for THR at our hospital.
Methodology: This prospective study was conducted in the Department of Orthopaedic Surgery, Indira Gandhi Medical College, Shimla, in which 20 hips underwent THR using a short anatomical metaphyseal loading stem femoral implant. Baseline demographic, pre- and intra- and post-operative findings were noted and analysed.
Results: Mean age was 40.93 years (standard deviation 11.29), the most common age group of patients was 41 to 50 years (65%) and majority of them were males (80%). Most common indication for undergoing surgery in our patient population was avascular necrosis head of femur with secondary osteoarthritis (70%). Average blood loss during surgery was about 500 ml with average drainage of about 200 ml. Pre-operatively all patients had modified Harris Hip score (HHS) of less than 70, while post-operatively 80% of the patients had an excellent modified HHS and rest had a good modified HHS
Conclusions: THR using small anatomical metaphyseal loading stem is an ideal procedure in younger patients, who present late beyond the scope of surface replacement and who will need revision surgeries in future.

Keywords: Arthroplasty; replacement; hip; treatment outcome

Introduction
Total hip replacement (THR) is a procedure whereby the diseased articular surfaces are replaced with synthetic materials, thus relieving pain and improving joint kinematics and function. THR is an elective procedure and should be considered as an option among other alternatives. A thorough understanding of both the procedure and the anticipated outcome is an important part of the decision-making process. All total hip arthroplasties consist of a femoral component, an acetabular component, and a bearing surface. Most systems are modular with a separate femoral stem, femoral head, acetabular liner, and acetabular shell. This modularity gives the operating surgeon tremendous flexibility in dealing with any intraoperative situation or anatomical variation. Short stems for cementless THR was designed to preserve the bone stock through proximal load transfer and the absence of distal fixation. Moreover, a metaphyseal filling prosthesis preserves the diaphyseal integrity for later surgery, should a re-vision be required in the future. Albanese *et al*. suggested that a short stem with complete proximal load transmission might promote a more physiological stress distribution and allow preservation of proximal periprosthetic bone stock [1]. Munting *et al*. observed that a stemless, proximally fixed femoral implant might effectively prevent proximal bone resorption by reducing the risk of stress shielding [2]. In this study we aimed to describe our experience of using a short anatomical metaphyseal loading stem femoral implant for THR at our hospital.

Methodology
Study Design and Sampling
The prospective study was conducted in the Department of Orthopaedic Surgery, Indira Gandhi Medical College, Shimla.

Over a period of one year, 20 hips underwent THR at our surgical centre. We included patients with good bone stock, longer life expectancy and those who needed THR for painful disabling hip. Patients who were old with life expectancy less than 15 years, soft osteoporotic bones, those needing a revision or conversion surgery, those who had fracture neck femur beyond sub-capital region, active infection of hip joint, insufficiency of abductor mechanism and with hips unsuitable for short anatomical metaphyseal loading stem on templating were excluded from the study. Patients who had a mismatch between expectations and outcome and those with an intraoperative change of plan were excluded from the final analysis. The study was approved by the institutional ethics committee and a separate informed consent was obtained from all patients before being included in the study.

Surgical technique

All patients underwent routine and specific laboratory and radiological investigations. Computerized Tomography (CT Scan) of both hips was required in some patients to get more information regarding hip joint space, ankylosis, fibrous or bony ankylosis, cystic lesions in femoral heads, thickness of medial wall of acetabulum, defects in acetabular wall particularly in fracture dislocations. Pre-anesthestic assessment was obtained and an informed consent for surgery was taken from the patient or their first degree relative. A short anatomical metaphyseal loading stem femoral implant (Hip Proxima, Johnson and Johnson) was used for uncemented THR with bone conservation principle. Templating was done to choose appropriate implants and anticipating unusual needs during surgery. Acetabular template that corresponded most closely to subchondral bone plate with adequate lateral coverage was placed in appropriate position, and hip's new center of rotation was marked. Femoral template that most closely matched proximal and distal size and contour of femoral metaphysis was placed in correct orientation. Femoral size was confirmed on Lowenstein lateral view. Postoperatively, prophylactic intravenous antibiotics were used for two days, followed by oral antibiotics for another five days. Suction drains were removed 24 hours after surgery. Physiotherapy in the postoperative period involved static exercises in bed on the first postoperative day. Partial weight bearing with walker was started from the second post-operative day and was continued for the next six weeks. Progression to full weight bearing was done gradually after six weeks following a clinical and radiological examination. Active hip mobilization, muscle strengthening exercises were continued. All patients were followed up at six week interval for at least 6 months post-operatively.

Data Collection and Data Analysis

A pre-designed semi-structured questionnaire was filled for all patients to note patient related data. Baseline demographic and clinical data were obtained from the patient or their hospital clinical records. Indication for surgery was noted for all patients and its relation to intra-operative findings like type of anesthesia, additional soft tissue release and suction drainage were analysed. Modified Harris Hip Score (HHS), which has demonstrated validity and responsiveness in cohort of patients with proximal femur fracture, were assessed for all patients pre-operatively and at their final follow up. Quantitative variables were described as mean and standard deviation and qualitative variables as frequency and percentages. All analysis were performed in Epi Info [3].

Results

During the study period we operated on 20 hips. Mean age was 40.93 years (standard deviation 11.29), the most common age group of patients was 41 to 50 years (65%) and majority of them were males (80%). Eleven hips were right sided, seven were left sided and one patient had bilateral hip surgeries. Most common indication for undergoing surgery in our patient population was avascular necrosis head of femur with secondary osteoarthritis (70%). Less common indications were polyarticular rheumatoid (20%), fracture neck femur with ankylosing spondylitis (5%) and Perthes' disease (5%). Hypertension was the most common past medical history finding in our study population. Table 2 describes the intra-operative findings of patients who underwent surgery for different indications. All patients underwent general anesthesia. Adductor tenotomy and partial capsulotomy was done in eight of the 14 cases of avascular necrosis and one case of perthes disease. Adductor tenotomy, partial capsulotomy and partial release of gluteus maximus tendon was required in six cases of avascular necrosis and two cases of polyarticular rheumatoid disease. One case of fracture neck femur required additional soft tissue release in the form of release of tensor fascia latae was required owing to associated ankylosing spondylitis. Average blood loss during surgery was about 500 ml with average drainage of about 200 ml. Blood loss was about 1300 ml in one patient and drainage of 1200 ml due to associated liver disease. Modified Harris Hip score was assessed pre-operatively and at final follow up. Pre-operatively all patients had modified HHS of less than 70, while post-operatively 80% of the patients had an excellent modified HHS and rest had a good modified HHS.

Discussion

For patients with hip pain due to a variety of conditions, THA can relieve pain, can restore function, and can improve quality of life. There is a number of femoral and acetabular implants available for use in THR. The multitude of choices reflects different philosophies regarding the type of fixation, design features, and materials. Femoral components can be either cementless or cemented. Cemented femoral components were the gold standard until the late 1980s and early 1990s when published results of cementless implants demonstrated excellent results and durability. In the present study, cementless short anatomical metaphyseal loading stem femoral implant was used in 20 total hip replacements. Our study population comprised mainly of patients from 20 to 60 years age group. This being a relatively young group of patients, preservation of bone is critical. In addition, to present stress shielding of bone, remodeling should be good. The short metaphyseal stem design aims to bridge the gap between conventional straight design and hip resurfacing. Preservation of the femoral neck reduces micro motion and increases torsional stability; this prevents loosening of the femoral component [4]. During the last follow up, 80% of the patients were assessed as excellent on modified HHS and rest as good. One major concern among operating surgeons is about the stability of fixation without the use of diaphyseal fixation. Proximally fixed cementless femoral implant has been demonstrated to achieve stability initially, which is important for long term stability through early bone regrowth [5]. Good bone quality, Specially in young patients, has been shown to achieve adequate stability with short metaphyseal stem as well [6]. Santori *et al.* validated that torsional loads can

be controlled without diaphyseal fixation by femoral-neck preservation and lateral flare of the stem [7].

The most common indication for surgery in our patient population was avascular necrosis of femoral head. Between 5-12% of the total hip replacements are performed in patients who have avascular necrosis of femoral head [8]. Though, osteotomy is a viable treatment option, the results can be inconsistent. Arthrodesis may be considered for unilateral disease, but it has a limited role since the incidence of bilaterality in non-traumatic avascular necrosis of hip has been reported to range from 40-70% cases [9]. Furthermore, general anaesthesia was used in all cases. Regional anaesthesia in lateral position resulted in the patient getting tired early, due to which it attempted to change their position. Due to persistent muscle action, the intra-operative bleeding was more and the true lateral position was difficult to maintain, ultimately affecting position of the cup.

Mean modified Harris Hip score improved from 32 pre-operatively to 91 at the final follow up. The patients were able to squat and sit cross-legged, which made the patients feel more satisfied with surgery. Though, very essential in Indian set up, this item does not feature in modified Harris hip score. Kumar *et al*. assessed the reliability of modified HHS as a tool for outcome evaluation of THR in Indian population and found a strong validity for usage in such patients with significant reliability [10]. In addition, the authors commented that used of modified HHS is beneficial as the actual presence of the patient is not needed and assessment can be done over a phone call or by correspondence [11].

There are a few limitations of the study. The sample size was small and follow-up duration was short. A long- term study randomized study is needed to verify the stability of fixation.

Conclusion

The functional outcome of the patients assessed using the modified HHS improved significantly with the use of a short stem femoral implant. THR using small anatomical metaphyseal loading stem is an ideal procedure in younger patients, who present late beyond the scope of surface replacement and who will need revision surgeries in future.

Table 1: Distribution of patients according to their baseline characteristics

Age distribution (in years)	
20 to 30	02 (10%)
31 to 40	02 (10%)
41 to 50	13 (65%)
51 to 60	03 (15%)
Gender distribution	
Males	16 (80%)
Females	04 (20%)
Side of surgery	
Right	11 (58%)
Left	07 (37%)
Bilateral	01 (05%)
Indications of surgery	
Fracture neck femur with ankylosing spondylitis	01 (05%)
Polyarticular rheumatoid	04 (20%)
Avascular necrosis head of femur with secondary osteoarthritis	14 (70%)
Perthes' disease	01 (05%)
Past medical history	
Hypertension	10 (50%)
Anemia	03 (15%)
Liver disease	01 (05%)
Dilated cardiomyopathy	01 (05%)
Ankylosing spondylitis with epilepsy	01 (05%)
Hypertension with diabetes mellitus	01 (05%)

Table 2: Intra-operative findings in relation to indication for surgery

	Fracture neck femur with ankylosing spondylitis (n=1)	**Avascular necrosis head of femur with secondary osteoarthritis (n=14)**	**Polyarticular rheumatoid (n=4)**	**Perthes' disease (n=1)**
Type of anesthesia				
General anesthesia	01	14	04	01
Regional anesthesia	0	0	0	0
Additional soft tissue release				
Adductor tenotomy + release of TFL & soft tissue from ASIS + Pan Capsulotomy+ release of flexors (Iliopsoas) + Partial releas of Gluteus Maximus tendon	0	0	2	0
Adductor tenotomy + release of TFL+ Partial release of Gluteus Maximus tendon + Partial Capsulotomy	01	0	0	0
Adductor tenotomy + Partial Capsulotomy	0	08	0	01
Adductor tenotomy + Partial Capsulotomy+ Partial release of Gluteus Maximus tendon	0	06	02	08
Negative suction drainage (in ml)				
100 to 250	0	12	03	0
251 to 500	01	01	01	01
501 to 750	0	0	0	0
751 to 1000	0	0	0	0
More than 1000	0	01	0	0

TFL: tensor fascia latae; ASIS: anterior superior iliac spine

Table 3: Comparing modified Harris Hip Score (HHS) pre-operatively and at the final follow up

Modified HHS	**Pre-operative**	**At final follow up**
90 to 100 (excellent)	0 (0)	16 (80%)
80 to 89 (good)	0 (0)	04 (20%)
70 to 79 (fair)	0 (0)	0 (0)
Less than 70 (poor)	20 (100%)	0 (0)

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