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## Heterotopic ossification after total hip arthroplasty in Indian scenario: A radiographic retrospective study

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### Abstract

**Background:** The study aims at providing Incidence rates with the use of posterior approach and the role of gender in development of HO after total hip arthroplasty in an Indian scenario.

**Methods:** 401 patients who had underwent total hip arthroplasty using posterior approach were studied retrospectively with the help of X-rays after a stipulated period of 12 weeks from the hospital database. The X-rays which were studied for any evidence of Heterotopic ossification and if present HO was classified using Brookers classification. The incidence rates were thus calculated along with incidence of each of the subtypes of HO with the use of posterior approach. The predisposition of sex for development of HO were noted.

**Results:** Evidence of HO was found in 32.9 percent of cases (132/401) with the incidence of type 1 - 24.4 % (98/401), type 2 - 6.4% (26/401), type 3 - 1.9% (8/401), type 4- Nil.

The male to female ratio of total hip arthroplasty was found to be 65.08 % percent (261/401) males as compared to 34.92 percent females (140/401). Among males 35.63 % (93/261) percent of patients developed HO and among females 27.85 percent (39/140) of patients developed HO. Also out of the 401 hips replaced 370 were uncemented THRs and 31 were cemented THRS. 36.67 % (136/370) developed HO in uncemented implants and 29.03 % (9/31) developed HO in cemented implants.

**Conclusion:** The study demonstrated an incidence of 32.9% HO after primary THA in Indian population after using posterior approach with its incidence being higher in males.

**Keywords:** Heterotopic ossification, posterior approach, Indian scenario, total hip arthroplasty

### Introduction

Heterotopic ossification (HO) is the formation of compact lamellar bone tissue outside the skeleton or more specifically in the soft tissues. Heterotrophic ossification after total hip arthroplasty is a recognised phenomenon with incidence ranging from 0.6 to 90 % depending upon various studies the mean being 53 % <sup>[1, 2, 3]</sup>. But the incidence of symptomatic ossification is comparatively less ranging from 2% to 7 % with only 1% requiring any surgical intervention <sup>[4, 5, 6, 7, 8, 9]</sup>

Risk factors for heterotopic ossification include old age, gender (M>F) <sup>[7]</sup>, a preexisting HO in contralateral hip or previous history of HO, ankylosing spondylitis, post traumatic arthritis, osteonecrosis and rheumatoid arthritis <sup>[10, 11]</sup>. Risk factors related to surgical technique include the presence of haematoma, surgical dissection, approach used, amount of soft tissue damage, persistence of local debris in the form of cement, bone marrow bone dust <sup>[12]</sup>.

Majority of the studies available today are based on the western population and no consensus is available for the incidence of HO after hip arthroplasty in Indian patients. This study aims at providing these incidence rates with the effect of approach used, the role of gender in development of HO along with comparison of HO in cemented and uncemented implants.

### Material and Methods

Collection and analysis of data was done at a tertiary care centre. All patients who had underwent total hip replacement for any of the standard indications, predominantly avascular necrosis of femoral head, rheumatoid arthritis and ankylosing spondylitis, during the time period of January 2013 to June 2016 were included in the study. All the surgeries were performed by specialised senior joint replacement surgeons using the posterior approach.

The uncemented implants used were Smith and Nephew, Tennessee, Reflection and synergy-porus coated, Reflection and polar - HA coated. The cemented implants used were Exeter or CPCS plus cemented cups.

The study was retrospective in nature with serial X-rays observed from the hospital database. The database used was Impacts bytes version 1.2. Patients were included in the study on the basis of the presence in our computerised database of a minimum follow-up control at 12 weeks from the surgical intervention.

Data such as patients age at time of developing HO, sex of patient, and time at follow up along with the type of implantation (cemented or uncemented) were obtained from the database and the hospital records.

The exclusion criteria encompassed

1. Any previous surgery on the same hip.
2. Use of any other approach other than posterior approach.
3. Revision THRs

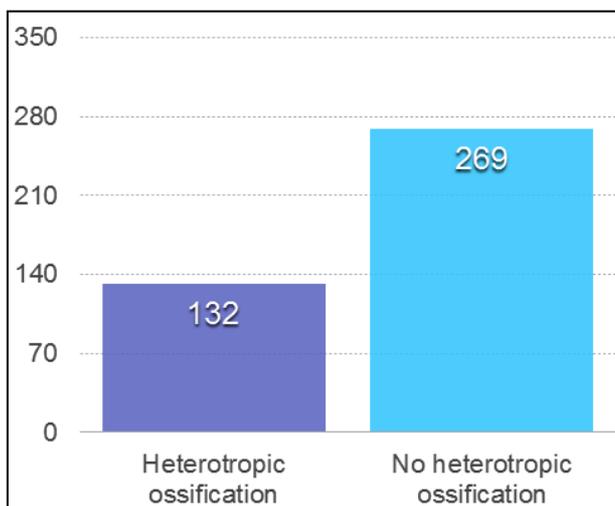
Database of 491 hips was found and the surgical approach used was posterior Southern Moore approach and no prophylactic measures were taken specifically to avoid heterotopic ossification. The X-rays which were done at subsequent follow ups were studied for any evidence of HO and were classified using the Brookers classification [13].

- Grade 1:** The presence of isolated bone fragments of any size within periarticular soft tissue
- Grade 2:** The presence of bone spurs from the pelvis or femur with at least 1 cm between opposing bone surfaces
- Grade 3:** The presence of bone spurs reducing space between opposing bone surfaces to less than 1 cm
- Grade 4:** Ossification with apparent ankylosis of the hip.

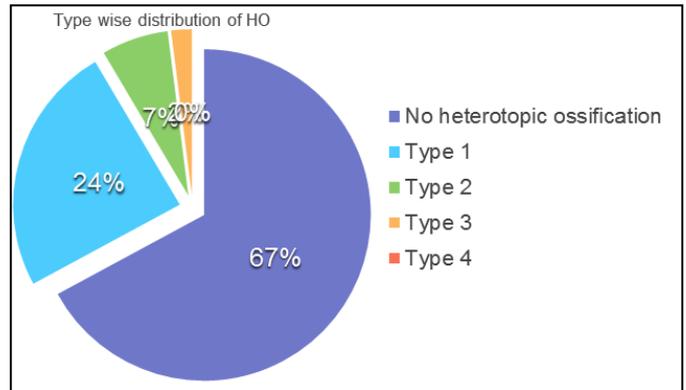
The incidence rates were thus calculated along with incidence of each of the subtypes of HO with the use of posterior approach. The predispositions of sex for development of HO were noted. Also the incidence of HO between cemented and uncemented implants were compared.

**Results**

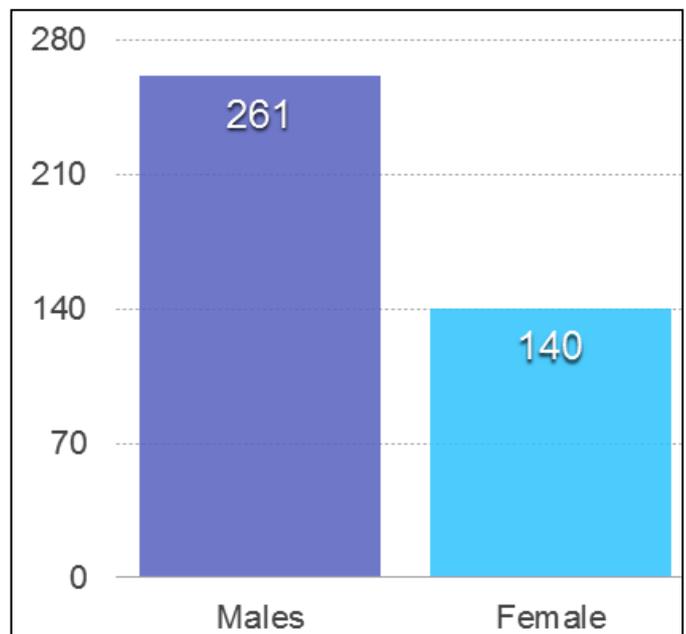
A cohort of 491 patients was obtained from the database out of which 90 patients were lost to follow up. The main indication for total hip arthroplasty appeared to be avascular necrosis with other indications being hip arthritis, Rheumatoid arthritis, Ankylosing spondylitis, post traumatic arthritis, Perthes disease and developmental dysplasia of hip.



Out of the remaining 401 hips evidence of heterotopic ossification was found in 32.9 % of cases (132/401) with the incidence of type 1 - 24.4 % (98/401), type 2 - 6.4% (26/401), type 3 - 1.9% (8/401), type 4 —No evidence of type 4 HO was observed.



The mean follow up at which patients developed HO was observed to be 24 weeks.



The male to female ratio who had undergone total hip arthroplasty was found to be 65.08 % (261/401) males as compared to 34.92 % females (140/401) (Refer Graph 2). Among males 35.63 % (93/261) of patients developed HO and among females 27.85 % (39/140) of patients developed HO (Refer Graph 4).

Also out of the 401 hips replaced 370 were uncemented THRs and 31 were cemented THRS. 36.67 % (136/370) developed HO in uncemented implants and 29.03 % (9/31) developed HO in cemented implants.

**Discussion**

Heterotopic ossification is a well-known phenomenon after total hip arthroplasty. It causes severe pain and reduces mobility of the patient leading to deterioration of functional outcome. Various clinical studies have shown the incidence of HO ranging from 0.6 to 90 % [4, 5, 6]. The causes of HO can be broadly divided into traumatic, genetic and neurological. HO following hip arthroplasty can be considered due to traumatic cause, due to damage to the soft tissues and wear and tear of

the implant used. According to a study by Chalmers *et al.* the development of HO was due to the interplay between three essential factors: osteogenic precursor cell, inducing agents and a permissive environment [14]. The pluripotent mesenchymal cells in stromal tissue of bone marrow have osteogenic potential and have been termed as “Determined osteogenic precursor cells” (DOPC). These cells when released from medullary cavity and deposited into the periarticular tissues during the THA, may initiate heterotopic bone formation [15, 16]. The stimulus for activation of the stem cells is considered to be the demineralized bone matrix which could induce bone formation with the help of BMP [17, 18]. Recently the role of Prostaglandin E2 is also considered in the development of HO [19, 20]. This study reports retrospective data from a radiological cohort of 401 patients with an aim of providing incidence rates of heterotopic ossification in Indian population using the posterior approach, the gender predisposition for HO and the role of cemented and uncemented implants in development of HO.



1 year post-operative CT scan showing type 2 Heterotopic ossification after total hip arthroplasty.

Of all the studied patients the incidence of heterotopic ossification was found to be 32.9 % which is lesser as compared to the average incidence of 53% reported by several publications. [4, 5, 6, 7, 8, 9], this can be attributed to the approach used (posterior approach) which causes less traumatic dissection and soft tissue damage along with less handling of the gluteus medius muscle. Studies have reported the incidence rates of HO following anterior and anterolateral approaches to be significantly higher ranged at around 60 %, also various other studies point out towards lower incidence rates of HO in posterior approach. So we can safely conclude that posterior approach leads to lower incidence rates of HO.



Xray images showing post-operative day 1 (above left) and post-operative month 4 follow up (above middle and right) in a case of cemented hip prosthesis.

Also 35.63 % of males and 27.85% of females developed periarticular HO which points towards higher incidence of HO in males as compared to females this is in agreement with literature the reasons for such findings should be investigated further [1, 22].

The findings of this study suggest comparatively higher incidence of HO in uncemented implants as compared with that of cemented implants. Most of the implants used were HA coated implants so it was difficult to compare HO rates between the HA and porous coated implants.

Also a wide meta-analysis published in cochrane library hints at reduction in the incidence of heterotopic ossification by 54-64 % with an adequate NSAID cover for 7- 14 days, if these results were applied to this study the incidence rates would have dropped down to 20 percent which is surely lesser than the mean incidence of 53 % signifying that use of NSAIDs might decrease the risk of HO.

Also the rate of HO which is 32.9 percent is still on the higher side which means that almost 1 in every 3 patient will develop HO. Based on literature review HO rates have been shown to decrease on use of preventive measures like radiation therapy and pharmacological prophylaxis with NSAIDs for a period of 10-14 days. Based on cochrane metaanalysis the incidence of HO reduces by 54 to 64 % on use of prophylactic NSAIDs cover which would lead to the incidence to reduce to 16 % in our study which is comparable with other studies signifying the fact that preventive measures should be undertaken to reduce HO.



Type 3 Heterotopic ossification in a 8 month follow up case of THA above left showing Post op day 1 image.

However the study has its limitations like the sample size used was smaller, and being a retrospective radiographic study we were not able to assess the functional outcomes associated with severe HO (type 3, 4) and whether any surgical intervention was required for the same. Also the mean follow up was 12 weeks which might have underestimated the actual incidence of HO. Although HO can be observed on plain radiographs by 6 weeks it takes almost 6 months for its complete maturation which can lead to underestimation. Also the number of uncemented implants was much higher than the cemented ones so the comparison was not legit.

## Conclusion

The study demonstrated an incidence of 32.9% HO after primary total hip arthroplasty in Indian population after using posterior approach with its incidence being higher in males as compared to the females.

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