ORIGINAL RESEARCH PAPER
Volume - 12 | Issue - 03 | March - 2023 | PRINT ISSN No. 2277 - 8179 | DOI : 10.36106/ijsr
INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

ANALYSIS OF SPINOPELVIC AND HIP PARAMETERS RELATIONSHIP IN FUNCTIONING OF TOTAL HIP ARTHOPLASTY IN ADULTS IN TERTIARY CARE HOSPITAL-RETROSPECTIVE OBSERVATIONAL STUDY

Orthopaedics

Dr Nitin Chaudhary
Dr Parth Darji
Dr Priyank Shah
Dr Dinesh Suthar

ABSTRACT

Introduction: The spinopelvic parameters have been accepted as the significant measures representing the state of spinopelvic sagittal balance. Spinopelvic parameters include hip parameter sacral slope (SS), pelvic Tilt (PT), pelvic incidence (PI) and spinal parameter, lumbar lordosis (LL) & Acetabular inclination, Acetabular anterversion **Material & Methods:** In this retrospective observational study, a total of 25 patients who underwent total hip arthroplasty in all units of Department of Orthopaedics, New Civil Hospital, Surat, India between November 2021 and December 2022 were enrolled **Result:** The mean values for SS, PT, PI, LL and PI-LL in the standing and sitting positions were summarized. the values of SS and LL were reduced while changing position from standing to sited preoperatively. Moreover, the values of PT and PI-LL were increased while standing to sited position **Conclusion:** It has been postulated that a change in sacral slope of ≤10° between the standing and relaxed-seated positions (ΔSS) identifies a patient with a stiff lumbar spine. In the present study, spinal stiffness (ΔSS <10°) was present in 8.0% cases preoperatively Such patients need more anteversion. Target 30° anteversion on the standing AP pelvis. Note the higher target due to the stiff spine to protect from a posterior dislocation.

KEYWORDS

Pelvic incidence, Pelvic tilt, Lumbar lordosis, Sacral slope, Acetabular inclination, Acetabular anterversion

INTRODUCTION :

The spinopelvic parameters have been accepted as the significant measures representing the state of spinopelvic sagittal balance. Spinopelvic parameters include hip parameter [sacral slope (SS), pelvic Tilt (PT), pelvic incidence (PI)] and spinal parameter [lumbar lordosis (LL)].

The posterior PT decreases the SS to the same extent. Sagittal balance is maintained when changing position by bending the lumbar spine (1). Acetabular anteversion rises by 0.7° to 0.8° for each degree (1.0°) of posterior pelvic movement (2, 3). When changing position from sitting to standing, the pelvis moves anteriorly and contribute to reduction in acetabular anteversion

Spinopelvic mobility is required for acetabular functional orientation in THA surgery. Alteration in spinopelvic motion can affect the orientation of the acetabulum, and thus, implant positioning in THA, which can result in complications such as dislocation, impingement, aseptic loosening, and wear of components

Hence, spinopelvic mobility and implant position should be given special attention in the preoperative planning of THA in order to gain favourable results and prevent postoperative complications

Numerous studies have confirmed that a high proportion (75% to 92%) of THA that dislocate have spinopelvic abnormalities

Spinopelvic parameters are helpful assessment tools for evaluating balance in patients with spinal deformity. The spine and pelvis have compensatory mechanisms to maintain the hips' balance, whether natural or artificial hip joints. PI, a sum of PT and SS, is the primary entity that indicates the appropriate sagittal balance of the spine. Because PI is a particular anatomical characteristic with a fixed value, changes in PT and SS are in opposite directions intending to maintain body balance. Additionally, changes in SS are associated with LL changes (4). In this context, it has been demonstrated that the LL often lies within 10° of the PI, and that deviation from this range (PI-LL mismatch >10°) denotes deformity and sagittal unbalance (3, 4). PI minus LL>10° is indicative for the flatback spinal deformity

A better understanding of the spine-pelvis-hip relationship can aid in minimizing post-operative instability

MATERIAL AND METHODS :

In this retrospective observational study, a total of 25 patients who underwent total hip arthroplasty in all units of Department of Orthopaedics, New Civil Hospital, Surat, India between November 2021 and December 2022 were enrolled

Inclusion Criteria

- Patients who underwent total hip arthroplasty in our centre.
- Patients with age more than 18 years.

Exclusion Criteria

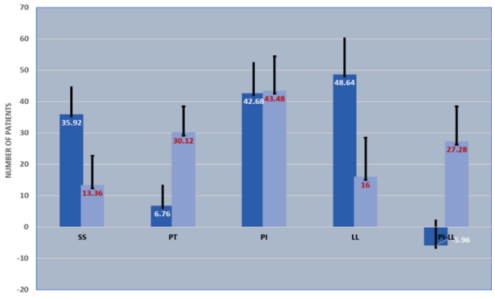
- Patients who underwent he
- mi-arthroplasty.
- Patients who underwent revision arthroplasty.
- Old malunited acetabular fracture
- Neuromuscular disorders

Radiological investigations (x-rays of LS spine + pelvis + upper femur, pelvis with both hips, cross table lateral view to obtain acetabular version) were also performed. Sitting and standing radiographs were measured for lumbar lordosis (LL), pelvic incidence (PI), sacral slope (SS_{stand} and SS_{sit}), and pelvic tilt.

Hip parameters (sacral slope, pelvic incidence, pelvic tilt, pelvic inclination or pelvis sacral angle, acetabular anteversion) and spinal parameters (lumbar lordosis) will be utilised to measure the assessment of chances of post operative hip dislocation thereby providing insight on required acetabular version, hence reducing post operative complications.

RESULT

The majority of the patients belonged to the 41-50 (36%) years age group, followed by 21-30 (24%) years, 31-40 (16%) years, 61-70 (12%) years, and 51-60 (12%) years our study cohort constituted 76% males and 24% females.



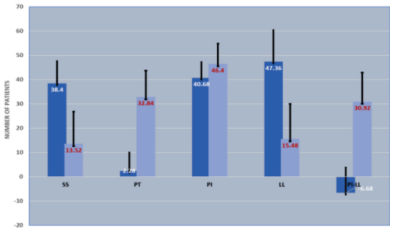
Mean Values Of Pre-operative Radiographic Measurements On Standing And Sitting

Comparison Of Pre-operative Radiographic Measurements On Standing And Sitting

The mean values for SS, PT, PI, LL and PI-LL in the standing and sitting positions, it is clearly apparent that the values of SS and LL were reduced preoperatively while changing position from standing to sited preoperatively. Moreover, the values of PT and PI-LL were increased while standing to sited position preoperatively. The value of PI remains constant while changing position from standing to sited.

Comparison of postoperative radiographic measurements on standing and sitting

The mean values for SS, PT, PI, LL and PI-LL in the standing and sitting positions. Once again, the values of SS, LL, and PI were reduced while changing position from standing to sited postoperatively. Also, the values of PT and PI-LL were increased while standing to sited position postoperatively. The values of PI remain constant while standing to sited position postoperatively.



Mean Values Of Postoperative Radiographic Measurements On Standing And Sitting

Comparison Of Preoperative And Postoperative Radiographic Measurements

When comparing various radiographical measurements for the standing to seated position from preoperatively to postoperatively, we found significant decrease in standing PT and AI after THA.

Incidence Of Spinopelvic Imbalance, Spinal Stiffness And Hypermobile

Spinopelvic imbalance (PI-LL >10°) was present in none of the cases in standing position postoperatively. Spinal stiffness (ΔSS) <10° was present in 2 of 25 patients (8%) preoperatively. Three patients (12%) were hypermobile (SS >30°) preoperatively.

DISCUSSION :

Abnormal spinopelvic relationships are becoming increasingly recognized as a potential source of instability after primary THA. The present study aims to assess the spine-pelvis-hip relationship and evaluate its impact on modern total hip arthroplasty. Key findings that emerged from the study were: (a) There was a significant change in spinal alignment parameters preoperatively, including SS, PT, LL, and PI-LL mismatch, except for PI, while changing posture from sitting to standing. However, postoperatively all the stated parameters showed significant changes while changing posture from sitting to standing spinal stiffness (ΔSS <10°) was present in 9.5% cases preoperatively, and e) two patients (9.5%) were hypermobile (SS >30°) preoperatively.

We assessed various spinopelvic factors during postural changes pre- and post-operatively from standing to sitting in patients who were candidates for THA. Data from the current study demonstrated a significant change in all stated spinal alignment parameters pre (except for PI) and post-operatively. While changing posture from standing to sitting, there was a significant decline in values of SS (36.62 ± 9.12 vs. 13.95 ± 9.70; p=0.000) and LL (49.43 ± 12.39 vs. 16.81 ± 12.99; p=0.000), while there was a significant increase in values of PT (6.29 ± 6.84 vs. 29.67 ± 8.94; p=0.000), and PI-LL (-6.52 ± 8.55 vs. 26.81 ± 11.89; p=0.000) mismatch preoperatively

Due to increased hip flexion, pathologic stiffness poses the greatest risk for impingement [15]. It has been postulated that a change in sacral slope of ≤10° between the standing and relaxed-seated positions ($\Delta SS_{standing \rightarrow relaxed\text{-}seated}$) identifies a patient with a stiff lumbar spine. In the present study, spinal stiffness (ΔSS <10°) was present in 8.0% cases preoperatively Such patients need more anteversion. Target 30° anteversion on the standing AP pelvis. Note the higher target due to the stiff spine to protect from a posterior dislocation.

A stiff pelvis fixed in either anterior or posterior tilt is unable to functionally antevert its acetabulum upon sitting, therefore the authors recommend increasing inclination, anteversion, and combined anteversion within a narrower range of 45°–50° (50° reserved for elderly patients), 20°–25°, and 35°–40° respectively. Phan et al, present a particular challenge because they require increased functional acetabular anteversion to avoid anterior impingement while sitting, but that places them at risk for dropout dislocation while standing

Table 11: Ideal Cup Position By Spinopelvic Mobility

	Inclination	Anteversion	Combined Anteversion
Normal	35 o -45o	15 o- 25 o	25 o-45 o
Stiff	45 o -50 o	20 o-25 o	35 o -45 o
Hypermobile	35 o -40 o	12 o -20 o	25 o -35 o

Patients were not followed up for longer duration; hence, those patients who are not showing dislocation at this stage, they might have chance of dislocation in future. Studies with long-term follow up is warranted in future

CONCLUSION :

A significant change in spinal alignment parameters were noted for SS, PT, LL, and PI-LL mismatch, except for PI, preoperatively, while changing posture from sitting to standing. We found a modest reduction in standing PT and AI after THA surgery.

Abnormal spinopelvic relationships have been demonstrated to be a crucial factor in instability after primary THA. Patients with concomitant hip and spine pathology must be appropriately evaluated for the presence of deformity and abnormal spinopelvic mobility while planning for THA. Most hip surgeons are highly likelihood to encounter patients with abnormal spinopelvic relationships and should be aware of techniques to maximize stability in this patient population.

REFERENCES :

1. Legaye J, Duval-Beaupère G, Hecquet J, Marty C. Pelvic incidence: a fundamental pelvic parameter for three-dimensional regulation of spinal sagittal curves. Eur Spine J. 1998;7(2):99-103.
2. Maratt JD, Esposito CI, McLawhorn AS, Jerabek SA, Padgett DE, Mayman DJ. Pelvic tilt in patients undergoing total hip arthroplasty: when does it matter? The Journal of arthroplasty. 2015;30(3):387-91.
3. Öztürk A, Avcı Ö, Çetin O. Letter to the editor : Homma Y, Ishii S, Yanagisawa N, Ochi H, Baba T, Nojiri H, Okuda T, Kaneko K. Pelvic mobility before and after total hip arthroplasty. Int Orthop. 2020 Nov;44(11):2267-2274. doi: 10.1007/s00264-020-04688-6. Epub 2020 Jul 4. PMID: 32623495. Int Orthop. 2021;45(3):797-8.
4. Louette S, Wignall A, Pandit H. Spinopelvic Relationship and Its Impact on Total Hip Arthroplasty. Arthroplast Today. 2022;17:87-93
5. Phan D, Bederman SS, Schwarzkopf R. The influence of sagittal spinal deformity on anteversion of the acetabular component in total hip arthroplasty. Bone Joint J. 2015;97-b(8):1017-23.
6. Zhu W, Liu Z, Sha S, Guo J, Bao H, Xu L, et al. Postoperative changes in sagittal spinopelvic alignment in sitting position in adolescents with idiopathic thoracic scoliosis treated with posterior fusion: an initial analysis. J Neurosurg Pediatr. 2018;22(1):74-80.
7. Lee ES, Ko CW, Suh SW, Kumar S, Kang IK, Yang JH. The effect of age on sagittal plane profile of the lumbar spine according to standing, supine, and various sitting positions. Journal of orthopaedic surgery and research. 2014;9(1):1-10.