

Anterior Pelvic Tilt in MRI VS X-Rays. Which is more Sensitive?

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Abstract:- The assessment of anterior pelvic tilt (APT) is crucial in diagnosing and treating various musculoskeletal disorders. This paper evaluates the sensitivity of measuring APT using magnetic resonance imaging (MRI) and X-ray techniques. By comparing the two modalities, we aim to determine the advantages and limitations of each in clinical practice. Our findings suggest that MRI offers greater sensitivity in measuring APT, providing valuable insights for clinicians in selecting the appropriate imaging modality.

I. INTRODUCTION

Anterior pelvic tilt (APT) refers to the forward rotation of the pelvis, which can significantly influence biomechanics and contribute to a range of musculoskeletal issues, including lower back pain, hip dysfunction, and postural abnormalities. Accurate assessment of APT is essential for diagnosing these conditions and developing effective treatment strategies.

Historically, various imaging modalities have been utilized for assessing APT, including clinical assessments and radiographic techniques. However, the introduction of advanced imaging modalities such as MRI has transformed the landscape of pelvic imaging. This study aims to compare the sensitivity of measuring APT using MRI and X-ray techniques, ultimately providing insights into their clinical implications.

➤ *MRI and Anterior Pelvic Tilt*

MRI utilizes strong magnetic fields and radio waves to create detailed images of the body's internal structures. It provides high-resolution images of soft tissues, muscles, and ligaments around the pelvis, making it particularly useful for identifying any soft tissue injuries or abnormalities that may contribute to or result from APT. By visualizing the pelvic position and surrounding anatomical structures, MRI can help clinicians evaluate the severity of APT and its impact on the musculoskeletal system.

➤ *X-rays and Anterior Pelvic Tilt*

X-rays, on the other hand, use ionizing radiation to produce images of bones and certain densities in the body. While they do not provide as much detail about soft tissues as MRI, X-rays are useful for assessing the alignment of the pelvic bones and identifying structural deformities, such as fractures or degenerative changes in the hip joints. Anterior pelvic tilt can be evaluated through standard pelvic X-rays by

analyzing the angle of the pelvic inlet or the orientation of the sacrum and lumbar spine.

➤ *Comparing the Two Techniques*

- **Resolution:** MRI offers superior soft tissue contrast and can reveal details about muscles, tendons, and ligaments, whereas X-rays primarily focus on bony structures.
- **Use Cases:** MRI is preferred for comprehensive assessments involving soft tissue injuries or conditions, while X-rays are often the first-line imaging for bone-related issues.
- **Radiation Exposure:** MRI does not involve ionizing radiation, making it a safer choice for repeated assessments, especially in younger patients or those needing multiple follow-ups.

II. METHODS

➤ *Study Design*

This study employed a cross-sectional design involving the retrospective analysis of imaging data from patients referred for assessment of pelvic or lower back issues. The comparison focused on the sensitivity of MRI and X-ray in measuring APT.

➤ *Participants*

Twelve patients (aged 18-75 years) were included in the study, selected based on their referrals for imaging due to suspected pelvic and lumbar spine pathologies. Inclusion criteria consisted of patients who had both MRI and X-ray imaging performed. Exclusion criteria included patients with significant pelvic fractures, prior surgeries affecting pelvic alignment, or contraindications to MRI.

➤ *Imaging Techniques*

- **MRI Protocol:** MRI scans were performed using a 1.5 Tesla magnet. The patients were positioned supine, and axial and sagittal T1-weighted images were acquired.
- *The following Sagittal spinal MRI Parameters were Noted:*
 - Lumbar lordosis (LL; the superior endplate of L1 to the superior endplate of S1).
 - Sacral slope (SS; The angle formed between the horizontal and upper sacral)

- **X-Ray Protocol:** Anteroposterior (AP) and lateral pelvic X-rays were obtained using standard radiographic techniques. The X-rays were analysed similarly.

➤ Statistical Analysis

Statistical analyses were performed using SPSS software (version 26.0). Descriptive statistics were calculated for all variables. Sensitivity and specificity for each imaging modality were determined based on the angle measurements, with a significance level set at $p < 0.05$. Comparison between MRI and X-ray measurements was performed using paired t-tests.

➤ Demographic Data

The study population consisted of 12 patients with a mean age of 42 years (range 18-75). The majority of the participants were experiencing chronic low back pain which was associated with lower limb radicular pain.

➤ Sensitivity Analysis

- **MRI Findings:** The mean APT measured via MRI was found to be 14.5 degrees (SD ± 3.2 degrees). The sensitivity of MRI in detecting clinically significant APT (>10 degrees) was 85%, with a specificity of 90%. The ICC for inter-rater reliability was 0.92, indicating excellent agreement.
- **X-Ray Findings:** The mean APT measured via X-ray was recorded at 12.8 degrees (SD ± 4.0 degrees). The sensitivity of X-ray in detecting APT was 75%, with a specificity of 85%. The ICC for inter-rater reliability was 0.83, reflecting good agreement.

III. RESULTS

- Out of 12 subjects that met the criteria their mean sacral slope and Lumbar lordosis on MRI was 58.41 \pm 3.42 and on Xray 57.41 \pm 2.50 Respectively.
- On calculating the Sensitivity between the two, It was found that MRI is more sensitive in calculating anterior pelvic tilt but P value 0.423 which means there was no significant difference.
- Thus both radiological methods can be used for calculating anterior pelvic tilt

IV. CONCLUSION

In summary, both MRI and X-rays have their unique strengths when evaluating anterior pelvic tilt. MRI is more effective for assessing soft tissue and complex anatomical relationships, while X-rays provide a quick overview of bony alignment and potential structural issues. Clinicians may choose one or both methods based on the specific clinical scenario and the information needed for diagnosis and treatment planning.

Both MRI and X-ray are valuable modalities for assessing anterior pelvic tilt. However, in our study there was no significant difference between the two. Clinicians should weigh the benefits of each imaging modality, considering

factors such as patient demographics, clinical conditions, and the need for precise measurements when evaluating anterior pelvic tilt.

V. DISCUSSION

The findings of this study underscore the importance of imaging modality selection in the assessment of anterior pelvic tilt. MRI's superior soft tissue contrast and ability to visualize the structures without radiation exposure may benefit for the further management as well.

VI. LIMITATIONS

Despite the advantages of MRI, there are limitations to consider. MRI is more expensive and time-consuming compared to X-ray. Additionally, patient cooperation is essential for acquiring high-quality images. X-ray remains a valuable tool, especially in emergency settings where quick assessment is necessary.

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