

MORPHOLOGICAL STUDY OF ANTERIOR INFERIOR ILIAC SPINE IN A SAMPLE OF HEMIPELVIS FROM SOUTH INDIAN POPULATION

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Received: 10 January 2023, Revised and Accepted: 12 March 2023

ABSTRACT

Objective: Abnormal morphology of anterior inferior iliac spine (AIIS) contributing to repeated femoroacetabular impingement, leading to functional limitation at the hip joint and chronic groin pain has been reported recently. The present study examines the prevalence of the morphologically different AIIS in south Indian population.

Methods: This was an observational and cross-sectional study conducted by analyzing dry hemipelvises of South Indian population at the Department of Anatomy of a tertiary care teaching hospital between July 2022 and June 2023. The specimens were analyzed independently by first and second authors, to determine the prevalence of different morphologies of AIIS based on Morales-Avalos classification. Data were entered into Microsoft Excel and analyzed.

Results: A total of 150 hemipelvises were analyzed. Type 2A was observed in 46.42% (n=65/140). Abnormal morphology was seen more on the left side hemipelvises (41.42%, n=58/140).

Conclusions: Type 2A of AIIS was more prevalent in South Indian population and more prevalent on the left side hemipelvis. Demonstrating the different morphologies of AIIS helps in understanding their role in subspine hip impingement.

Keywords: Anatomy, Anterior inferior iliac spine, Hemipelvis, Hip impingement.

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INTRODUCTION

Femoroacetabular impingement is being currently recognized as one of the causes of hip pain and development of the early hip arthrosis. Abnormality in the morphology of the acetabulum and femoral head and neck junction causes repeated impingement and chronic groin pain. This leads to functional limitation at the hip [1,2]. While femoroacetabular syndrome has been described in extra articular causes such as trochanteric and ischiofemoral impingement, abnormal morphology of anterior inferior iliac spine (AIIS) has been described as subspace impingement [3-6].

As per the morphological classification of AIIS proposed by Hetsroni *et al.*, AIIS is classified into three types, based on three-dimensional computerized tomography (CT) reconstructions. They classified the three types based on the relationship between the AIIS and distal relationship of the acetabular rim [7]. Morales-Avalos *et al.*, in 2015, had described a new morphological classification of AIIS. The study described the presence of different morphologies according to age, sex, and laterality. They have described four different types of morphologies of AIIS in the dry hemipelvises of a Mexican population [8]. While type 1 was considered normal, all other types were considered abnormal.

The present study examines the prevalence of the morphologically different AIIS in south Indian population.

METHODS

This was an observational and cross-sectional study conducted by analyzing 150 dry hemipelvises of South Indian population at the Department of Anatomy, Government Villupuram Medical College and Hospital between July 2022 and June 2023. Dry hemipelvises were collected from Skeleton pelvises at the Department of Anatomy after obtaining clearance from the Institutional Ethics Committee.

All specimens were analyzed independently by the first and second authors and were blinded to each other's findings.

The classification of morphologies for AIIS as given by Morales-Avalos was given as Type 1: Presence of concave surface between AIIS and acetabular rim, Type 2A: Presence of flat surface between AIIS and acetabular rim, Type 2B: Presence of convex surface between AIIS and acetabular rim, and Type 3: AIIS protrudes inferiorly toward anterior acetabulum [5].

Statistical analysis

Data were entered into Excel spreadsheet (Microsoft Corporation, Washington, USA) and statistical analysis was completed. Descriptive data were given in summary statistics while interobserver agreement on AIIS morphology was determined by calculation of Cohen's Kappa coefficient.

RESULTS

The interobserver agreement for the application of the proposed morphological classification yielded an excellent concordance ($k=0.82$).

In the present study, Type 2 A was the most commonly observed morphology of AIIS (46.42%, n=65/140) (Table 1). Among the morphological types considered abnormal (Type 2A, 2B, 3), prevalence of these types was more common on the left side (41.42%, n=58/140) compared to right side (35.71%, n=50/140).

DISCUSSION

The present study was conducted to determine the prevalence of AIIS morphological types using a cadaveric collection of hemipelvises, based on the study by Morales-Avalos *et al.* As the pelvises were not catalogued, the authors could not ascertain age and sex of the hemipelvises.

Table 1: Prevalence of morphological classification of anterior inferior iliac spine

Types	Present study
1	22.85% (32/140)
2a	46.42% (65/140)
2b	22.14% (31/140)
3	8.57% (12/140)

Table 2: Comparison of morphological types of AIIS between present study and Morales-Avalos *et al.*

Types	Morales-Avalos, <i>et al.</i>	Present study
1	69.87% (320/458)	22.85% (32/140)
2a	17.90% (82/458)	46.42% (65/140)
2b	3.71% (17/458)	22.14% (31/140)
3	8.52% (39/458)	8.57% (12/140)

AIIS: Anterior inferior iliac spine

Table 3: Comparison of dysmorphology classification based on laterality

Study	Right side % and (No. of specimen)	Left side % and (No. of specimen)
Rodolfo	55.07% (76/138)	44.93% (62/138)
Morales-Avalos		
Present study	46.19% (50/108)	53.70% (58/108)

In the study by Knapik *et al.* in 1797 cadaveric specimens, there was no significant difference between age and AIIS dysmorphology. Similar results were obtained in the study by Wong *et al.* (p=0.42). While there was no difference in prevalence in AIIS dysmorphology between sexes in the study by Wong *et al.* and Hetsroni *et al.*, there was increased prevalence among males in the study by Knapik *et al.* [6,7,9].

The most common classification system for AIIS dysmorphology was given by Hetsroni *et al.* who described three variants based on 3-D CT reconstructions of hip. Type 1, with a smooth wall between AIIS and acetabular rim, was not associated with hip impingement. Type 2, with AIIS extending to the level of acetabular rim and Type 3, with AIIS extending distally to the acetabular rim were associated with hip impingement and pain [7]. Knapik *et al.*, proposed a new morphological classification, namely, columnar type (the common type, 67%), bulbous type (30%), and hook type. They had utilized 1797 dry complete pelvis specimens, which were catalogued previously [9].

In the study by Morales-Avalos *et al.*, the normal morphology and the most prevalent class was Type 1 morphology and Types 2A, 2B, and 3 were associated with hip impingement [8]. This was because extra-articular impingement as a cause of hip pain has been noticed more in recent times [10-12]. However, in the present study, Type 2A was the most prevalent morphology observed (46.42%, n=65/140) (Table 2). It is still not known whether this was a normal morphological type in the south Indian population or it is associated with hip impingement and symptoms in individuals. This warrants further study in general population.

While studying the laterality of AIIS with abnormal morphology, it was found that abnormal AIIS morphology according to Morales-Avalos *et al.*, was more on left side compared to right side hemipelvis (Table 3). This was in contrast to Morales-Avalos *et al.* who found a right sided predominance in dysmorphology. In the study by Knapik *et al.*, there was no predominance to laterality in the hemipelvises (p=0.19).

CONCLUSIONS

As per the morphological types suggested by Morales-Avalos *et al.*, AIIS Type 2 A was more prevalent in South Indian hemipelvises. It is

to be studied further if this was the normal type in South India or a predisposing factor for hip impingement. Further, clinical studies are needed to ascertain if this variation in hip dysmorphology in Indian population has significance in patients with hip pain and whether treatment options can address this dysmorphology.

AUTHORS' CONTRIBUTIONS

SA conceptualized study, collected data, and analyzed the data. AP interpreted data and prepared manuscript.

CONFLICTS OF INTEREST

None declared.

FUNDING

None.

ETHICAL APPROVAL

Obtained from the Institutional Ethical Committee of Government Villupuram Medical College and Hospital, Mundiampakkam, Villupuram, Tamil Nadu, India.

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