

## Anthropometric Study of Pubic Tubercle and Its Clinical Implications

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### Abstract

- Background** Abdominal wall is the site of opposing physical forces that may eventually result in the appearance of the hernias. The external abdominal hernias are the most common forms, the inguinal hernia being the commonly encountered type [75% of the abdominal hernia]. Many factors are responsible for the formation of the inguinal hernia but, what makes a few people more susceptible to this situation is still clearly not proved. Few of the previous studies have concluded that the low lying pubic tubercle is associated with the development of the inguinal hernia.
- Objectives** This study was designed to investigate the distance between the anterior superior iliac spines and the perpendicular distance of the pubic tubercle from the interspinal line.
- Methods** 50 males with inguinal hernia compared with the control group comprising of 60 adult healthy males.
- Results** This study revealed that both parameters (interspinal SS distance and the pubic tubercle height ST) in the study group were significantly greater than that in the control group. The distance from mid inguinal point to the superficial inguinal ring was also measured in both the study and control groups and the results show that the distance is shorter in the individuals with the inguinal hernia. Identification of the structural characteristics of inguinal region enables the surgeon to perform the surgical technique appropriately.
- Conclusion** The low pubic tubercle group of cases has more tendencies for herniation. The unusual origin of internal oblique muscle in group II with low lying tubercle is far away, from the external half of the inguinal ligament, leaving the internal ring unprotected during abdominal muscle contraction, which is another causation of hernia development.
- Key words** Inguinal hernia, pubic tubercle, inguinal canal, anterior superior iliac spine

### Introduction

**S**ir Astley Paston Cooper in 1804 has said that "No disease of human body, belonging to the province of the surgeons, requires in its treatment a better combination of accurate anatomical knowledge with surgical skill than hernia in all its variety <sup>(1)</sup>. Among all spontaneous external abdominal hernias, inguinal hernia is the most commonly encountered type. The statistics show that the indirect inguinal hernia is the most common of all forms of the hernia, affecting the males seven times more than the females<sup>(2)</sup>. There are various defensive mechanisms of the

inguinal canal to prevent the formation of hernia which are based on anatomical factors. Anatomic variations of different structures facilitating herniation have been assessed by many authors. The origin of the internal oblique muscle from the inguinal ligament far away from the pubic tubercle and its lower fibers not covering the internal ring has been implicated in the indirect inguinal hernia<sup>(3)</sup>. The various degree of incompleteness of the internal oblique muscle in the inguinal region lead to the essential predisposition to direct inguinal hernia<sup>(4)</sup>. Other factors are an increase in the size of Hessert's triangle<sup>(5)</sup>. One

important factor that determines the probability of an individual to suffer from an inguinal hernia is the location of the pubic tubercle. Many authors have concluded that persons with low lying pubic tubercle are at a higher risk and more prone to hernia<sup>(6,7)</sup>. The aim of the present study is to measure the distance between the two anterior superior iliac spines and the perpendicular distance of the pubic tubercle from the interspinal line, in individuals with inguinal hernia and to compare them with normal healthy individuals. Also a comparative study of the length of the inguinal canal is done.

### Methods

The study group comprised of 50 males who were diagnosed with inguinal hernia and the control group consisted of 60 healthy male individuals. The age of individuals in both the groups was between 25 and 40years. A

detailed history was taken to rule out any fracture or anomaly and such persons were excluded from the study. The subjects were asked to lie down in relaxed supine position on a hard bed, keeping their lower limb straight so that both the anterior superior iliac spines were at the same level. The line joining the two anterior superior iliac spines was measured and was named as SS line. Then the pubic tubercle was marked and the vertical distance of the pubic tubercle from the SS line was measured and named as ST line (Figure 1). The mid point between the anterior superior iliac spine and the pubic symphysis was marked as the midinguinal point and the distance from it to the centre of the superficial inguinal ring was measured, the inguinal ligament length was measured as well. All these measurement thus obtained were tabulated and analyzed using Chi-square test and students't' test.

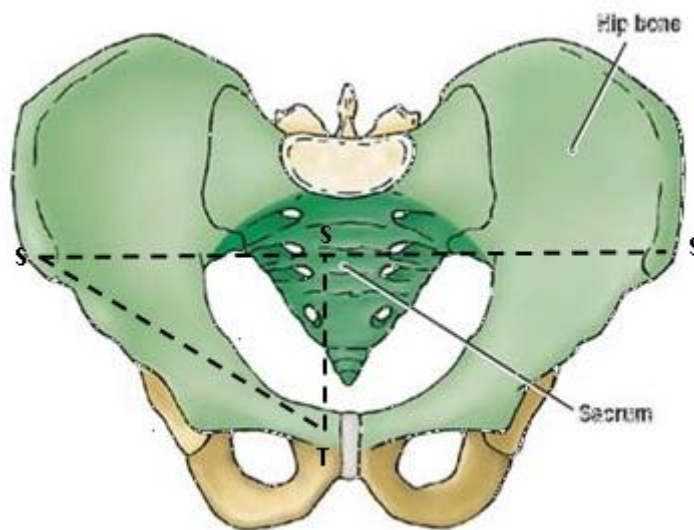


Figure 1. Graphic illustration for the measurement, SS, interspinal distance. ST, the pubic tubercle height

### Results

The following tables depict the various results [Table 1 and Table 2].

Table 1. Comparison of the SS line and ST line in the study and control group

Group		N	Mean(cm)± SD	' t' value
SS line	Study	50	23.3040±1.28176	2.04400
	Control	60	22.6462±1.00568	p= .046
ST line	Study	50	7.8115±0.82526	5.56400
	Control	60	6.5440±0.80056	p= .001

Table 2. Comparison of the distance from the mid inguinal point to the superficial inguinal ring

Group	N	Mean± SD	' t' Value
Study	50	5.640±0.635	1.41000
Control	60	6.089±0.607	P=0.173

Table 3. Position of the pubic tubercle in the two groups.

Group	<7.5 Count (%) Group I	>7.5 Count (%) Group II
Study	13 (26%)	37 (74%)
Control	55 (91.5%)	5 (8.3%)

### Discussion

The causation of inguinal hernia is multifactorial with evolutionary, congenital, environmental, genetic factors and also the general state of health all contributing to its development. The low lying pubic tubercle predisposes to the development of inguinal hernia. Africans have much higher incidence of inguinal hernia as compared to Europeans since the Africans has comparatively more oblique pelvis (low lying pubic tubercle ) than the Europeans<sup>(8)</sup>.

Sehgal et al (2000) in their study have classified the subjects as (Group I) "High lying pubic tubercle" i.e. those with ST line less than or equal to 7.5 cm and (Group II) "Low lying pubic tubercle" i.e. those with ST line more than 7.5 cm. They observed that in 73.6 % of cases and only 16% of controls belonged to Group II and concluded that the low lying pubic tubercle was a predisposing factor for inguinal hernia<sup>(6)</sup>. The change in posture from pronograde to upright has caused reduction in efficiency of shutter mechanism of inguinal canal leading to the development of inguinal<sup>(9)</sup>

In the present study 74% of cases belonged to the Group II whereas 91.5% of controls belonged to Group I [Table 3]. The mean value of ST line in our study group is 7.8115+0.82526 which is significantly greater (p=0.001) than the controls the mean value being 6.5440+0.80056. Lopez- Cano et al (2005) have stated that the low pubic arch group showed a significantly longer inguinal ligament and a greater angle made by the superior border of the suprainguinal space and inguinal ligament at its medial insertion. The lower the pubic tubercles are located, the more often morphological alterations are found in the external oblique, internal oblique, transversus, cremastic muscles and the fascia transversalis<sup>(7, 10)</sup>.

The shutter-like mechanism at the internal inguinal ring is provided by contraction of the arching fibers of the internal oblique muscle, which, when shortened, approximate themselves to the inguinal ligament and compress the spermatic cord<sup>(11)</sup>.

The unusual origin and insertion of internal oblique and transverses abdominis muscle, results in an ineffective shutter mechanism of the inguinal canal<sup>(10)</sup>.

The low pubic tubercle group showed a significantly longer inguinal ligament than the high pubic tubercle group. The greater length of inguinal ligament and a larger suprainguinal angle may account for a greater area of suprainguinal space which may account for a deficient function of the shutter mechanism<sup>(1)</sup>. Harris and White associated a greater length of inguinal ligament with a higher tendency to develop inguinal hernia<sup>(13)</sup>.

Ajmani and Ajmani (1983) have noticed that in the inguinal hernia patients, the origin of internal oblique from the inguinal ligament was away from the pubic tubercle and its lower fibers did not cover the deep inguinal ring leaving it unprotected, allowing the hernial sac to push out when the intra-abdominal pressure is raised<sup>(3)</sup>.

In addition to above mentioned pathophysiological factors, the inguinal canal in that study group with low lying pubic tubercle being more longer and more oblique so the hernia sac will push out easier through the canal as the more gravitational effect than when the canal is more or less horizontal or oblique in normal group. So we can state that the functional significance of the inguinal region is modified by bony, ligament and muscular variations and therefore the identification of the structural characteristics enables the surgeon to perform the surgical technique appropriately, be it classical hernia repair or laparoscopic approach for prosthetic mesh implantation.

This anthropometric study of pelvis will enable the surgeons to categorize people with low lying pubic tubercle as liable for hernia development so they should be precautious in doing their daily activities.

On the other hand those patients with low lying pubic tubercle developed inguinal hernia preferably to make hernioraphy for the posterior wall and do reinforcement for the deep ring by mesh for example since they have unprotected deep ring and weak shutter mechanism.

## Conclusion

The low pubic tubercle group of cases has more tendencies for herniation. The longer the inguinal ligament, the larger the suprainguinal region and the larger Hessert's triangle. Which leads to less efficient shutter mechanism.

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