

# Prevalence of Low-Lying Pubic Tubercle in Patients Undergoing Inguinal Hernia Repair in a Tertiary Care Center

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## ABSTRACT

**Introduction:** Delayed diagnosis of inguinal hernia can present directly as an emergency and result in high morbidity and mortality. Hence, surgical tradition advocates timely detection and elective repair wherever possible.

Throughout history, researchers have been searching for identifiable predisposing factors associated with inguinal hernia development, trying to answer an age-old question: ‘Can inguinal hernia development be predicted?’ for its early identification and tailored management.

Studies have shown a definite relationship between the occurrence of inguinal hernia and pelvic anatomy. Low-lying pubic tubercle is reported as an important and measurable risk factor.

**Objective:** The objectives were to detect the prevalence of low-lying pubic tubercle in patients with Inguinal Hernia and analyze the risk factors.

**Methodology:** This study was a prospective observational study done in Tribhuvan University Teaching Hospital (TUTH) for one year after ethics committee clearance. About 71 patients who met the inclusion criteria were enrolled in the trial after providing written informed consent in accordance with the Institution Review Board’s format. Statistical Package for Social Sciences (SPSS) software version 25 was used for data analysis

**Results:** In our study, the prevalence of low-lying pubic tubercles was high among patients with inguinal hernia.

**Conclusion:** Anthropometric measurements like low-lying pubic tubercle can be a predisposing for inguinal hernia development.

**Keywords:** Inguinal hernia, Low-lying pubic tubercle, Spino-tubercular distance, SS (Inter-spinous) distance.

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## INTRODUCTION

A hernia can be defined as an abnormal protrusion of a portion or whole of the viscus through a normal or abnormal opening in the cavity that contains it.<sup>1</sup>

Throughout history, researchers have been searching for identifiable predisposing factors associated with inguinal hernia development, trying to answer an age-old question: ‘Can inguinal hernia development be predicted?’ for its early identification and tailored management.

The abdominal wall is the site of opposing physical forces. Any imbalance may eventually result in the appearance of hernias; hence, the etiology of inguinal hernia<sup>2</sup> is multifactorial and can be divided into modifiable and non-modifiable risk factors. The anatomic structure (Figure 1) of the pelvis is a widely researched non-modifiable risk factor. Alterations in pelvic dimensions have been shown to influence the functioning of the abdominal defense mechanisms, hence facilitating herniation.

Widely researched pelvic dimensions<sup>3,4</sup> are the inter-spinous distance, length of the inguinal ligament,<sup>3</sup> the position of the pubic tubercle (Ami’s line), and Radoievitch’s angle, which are measurable entities.<sup>5</sup>

A low-lying pubic tubercle is defined as a spino-tubercular (ST) distance of more than 7.5 cm in most studies, where spino-tubercular distance is the vertical distance between inter-spinous and trans-tubercle lines. It predisposes to hernia formation.<sup>5-9</sup> There are a few scenarios where finding an identifiable risk factor might help in patient selection and timely intervention (Figure 2).

Investigators discovered that the pubis in females is higher than in males, which explains why females have a lower incidence of inguinal hernia.

The incidence of emergency admissions in groin hernias is as high as 10%.<sup>10</sup> Finding a predisposing factor even in asymptomatic patients can alert the physician for early, elective

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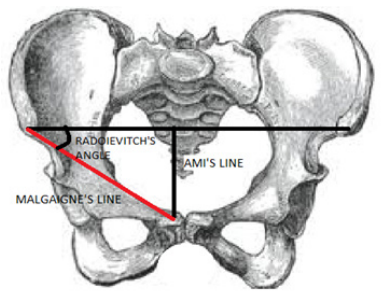


Figure 1: Various pelvic measurements

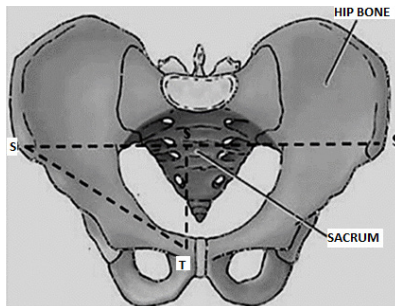


Figure 2: Illustration of the inter-spinous line (SS), spino-tubercular line (ST)

and/or bilateral treatment, preventing patients from directly presenting with complications.

With laparoscopic TEP offering exploration of the contralateral side, the presence of OCH (Occult contralateral Hernia) is anywhere between 11.2 to 50%, with 9 to 36% incidence of a contralateral hernia developing in the near or distant future,<sup>11,12</sup> more so in predisposed patients. Experienced surgeons in high-volume centers can provide bilateral hernia repair options, especially for young patients and patients with multiple co-morbidities. This is supposed to benefit in cost-containment and decrease anesthesia exposure. However, this concept is still under debate in low socio-economic areas like ours.

Patients predisposed to the development of inguinal hernia are likely more prone to recurrence and complications, and hence, there can be subgroups among patients with inguinal hernia, one who vigilantly requires mesh hernia repair and another who would do equally well without mesh repair as they are not inherently predisposed.<sup>13</sup>

All these factors necessitate correct patient selection. As a result, the question arises as to which factor(s) should properly guide surgical decision-making in a patient. Can inguinal hernia treatment be standardized, or should it be individualized based on the patient's Requirement? The most likely answer is that surgical treatment for inguinal hernias should be adapted to the surgeon's expertise, patient and hernia characteristics, and local/national resources. Moreover, patient health, lifestyle, and social aspects should all be included in the shared decision-making process.

If a non-invasive, easily measurable anatomical parameter like the height of the pubic tubercle can frequently indicate a

patient's predisposition to developing inguinal Hernia, Such a tool can be helpful in patient counseling regarding the cause of Hernia formation, the degree of associated risks of recurrence, OCH, and resultant complications, which is a topic for further research. This study also aimed to evaluate the clinical profile of patients developing Inguinal Hernia in our region.

**Methods**

A Quantitative, Observational, cross-sectional study was conducted on 71 patients, for a period of 1 year. It included all patients >16 years of age undergoing elective Inguinal Hernia repair (Children below the age of 16 years have relatively underdeveloped pelvis & the exact position of the pubic tubercle cannot be forecasted due to the growth of the skeletal system).<sup>8</sup>

Patients with a history of pelvic fracture and pelvic bone anomalies, other abdominal surgeries, deformity of the spine or lower limb and pregnant patients were excluded. Non-probability sampling was used. Ethical committee approval was obtained from the institutional review committee. A detailed history was taken using pre-formed proforma. Pre-operatively, the patient was made to lie supine in a relaxed position on a flat, hard bed, keeping both lower limbs straight so that both the anterior superior iliac spines (ASIS) were at the same level. Bilateral ASIS and pubic tubercle (on the side of the hernia) were marked by palpation (In the obese pubic tubercle is obscured by the pubic fat; it can, however, be detected by following up the tendon of origin of adductor longus). Interspinous distance (SS Line) and spino-tubercular distance (ST-line) were recorded using standardized measuring tape. The patient was categorized for statistical analysis as.

**OBSERVATIONS AND RESULTS**

**Age Distribution of the Study Population**

The mean age of the study population was 51.83 years ± 18.92 (Mean ± SD). The minimum age was 17 years and the maximum age was 95 years. The highest incidence age group was 40-80 years (25.35%) (Figure 3 and Table 1).

**Sex Distribution Among The Study Population**

Of the total study population 71, 68 (95.77 %) were male and remaining 3, (4.23 %) were female.

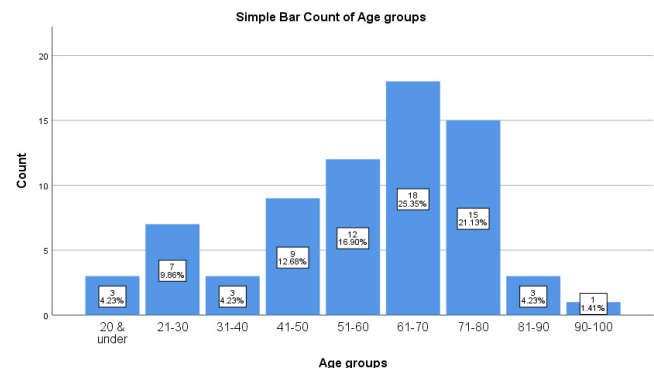


Figure 3: Distribution of age in the study population

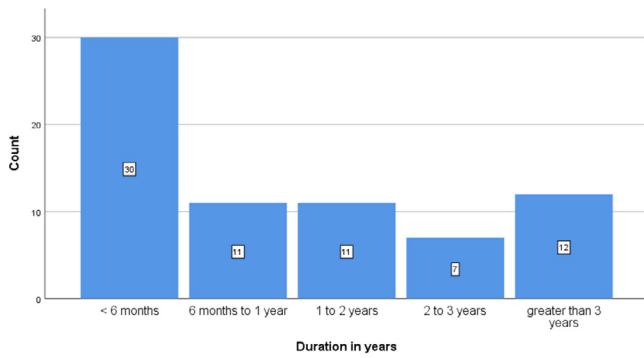


Figure 4: Duration of symptoms at the time of presentation

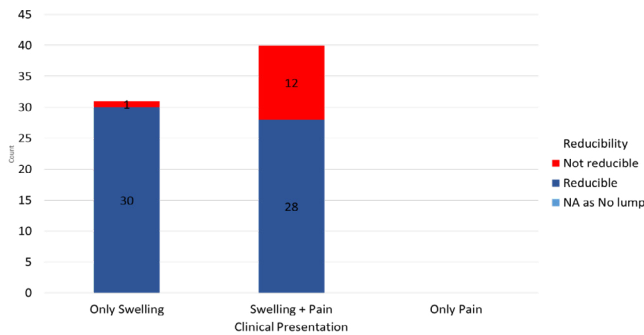


Figure 5: Clinical presentation of patients

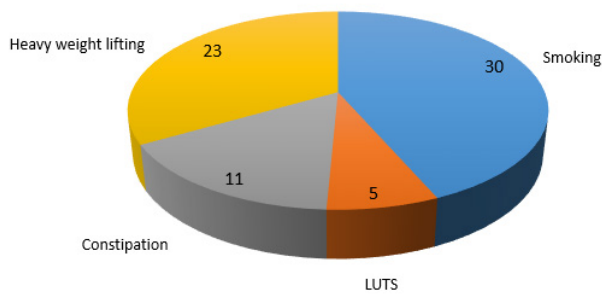


Figure 6: Predisposing factors

**Duration of Disease and Associated Symptoms**

Of all the patients, 30 (42.25%) patients presented within 6 months of the onset of symptoms (Figure 4). The most common presenting symptom was swelling associated with pain in 40 (56.34%) patients (Figure 5). Irreducibility among patients presenting with a painful swelling was 30% (12 out of 40 patients) and in patients presenting with only swelling was 3.3 % (1 out of 30 patients)

**Common Predisposing Factors**

Known predisposing factors<sup>14</sup> that were studied are a history of smoking, occupation requiring heavy weightlifting, Constipation, and Lower Urinary Tract Symptoms (LUTS). The total frequency of the above factors is depicted in the pie chart. (More than one predisposing factor were also present in few patients) (Figure 6).

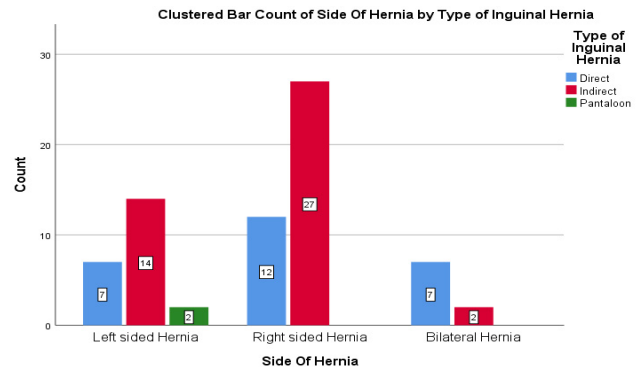


Figure 7: Site of inguinal hernia with the prevalent type

Table 1: Mean, median, mode, and SD of SS and ST distance

	Inter-spinous distance (SS)	Inter-tubercular distance (ST)
Mean	25.68	7.558
Median	26	7.500
Mode	26	8
Standard deviation (SD)	1.538	0.555

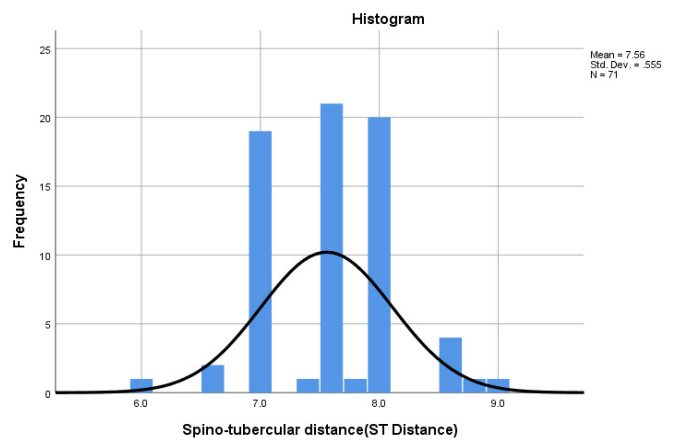


Figure 8: Distribution curve for ST distance

Table 2: Frequency table for ST distance

St value	Frequency	Percentage
6.0	1	1.4
6.5	2	2.8
7.0	19	26.8
7.4	1	1.4
7.5	19	26.8
7.6	2	2.8
7.8	1	1.4
8.0	20	28.2
8.5	4	5.6
8.7	1	1.4
9.0	1	1.4

**Table 3:** Percentage prevalence of low-lying pubic tubercle

Type of pubic tubercle	Frequency	Percentage
Low-lying pubic tubercle (ST $\geq$ 7.5)	48	67.6
High-lying pubic tubercle (ST<7.5)	23	32.4

### Family History

Of all the 71 patients, 10 (14%) patients had a family history of first-degree relatives having inguinal hernia.

### Incidence of Recurrence

The overall incidence of recurrence was 9.8% (7 out of 71 patients). Recurrence was more common in patients with direct inguinal hernia (4 out of 22 patients). Previous inguinal hernioplasty was done outside in all the patients.

### Site of Inguinal Hernia

Of the 71 patients, In 39 patients, the hernia was on the right side and in 23 patients, the hernia was on the left side. In the rest of the 9 patients, the lesion was bilateral. Out of 71 patients, 43 had indirect hernia, 26 had direct hernia and 2 had Pantaloon hernia (Figure 7).

### Spino-Tubercular Distance (ST)

The distribution of spino-tubercular distance is as described in the diagram (Table 2 and Figure 8)

### Prevalence of low-lying pubic tubercle

Low-lying pubic tubercle was defined as ST distance greater or equal to 7.5 cm. Out of 71 patients, 48 (i.e., 67.6 %) patients had a Low-lying pubic tubercle. (Table 3)

### Height of Pubic Tubercle and the Type of Inguinal Hernia

Out of 48 patients with a low-lying pubic tubercle, 26 (54%) had an indirect inguinal hernia.

### Height of Pubic Tubercle and the Side of Hernia

Of the 48 patients with low-lying pubic tubercle, 26 (54%) patients had a right-sided Inguinal Hernia, and of the 23 patients with high-lying pubic tubercle, 13 (56.5%) had a right-sided inguinal hernia. Hence, no major difference in the presentation regarding the height of the pubic tubercle was noted.

## DISCUSSION

'Has the gradual development of human bipedalism during evolution predisposed them to inguinal hernia development?' This idea has been tested multiple times by researchers in various forms.

The incidence of emergency admissions in groin hernias is as high as 10%.<sup>10</sup> Finding a predisposing factor even in asymptomatic patients can alert the physician for early, elective and/or bilateral treatment, preventing patients from directly presenting with complications.

Most of the studies, as shown in Table 4, have defined the low-lying pubic tubercle as a Spino-tubercular (ST) distance of more than or equal to 7.5 cm. Taking this as an arbitrary reference value, 71 patients were subjected to the measurement of ST distance, among which 48 (67.6%) patients were found to have a low-lying pubic tubercle.

On further comparison between the two groups, there were similar hernia-related characteristics like the side of hernia, the type of hernia, and the association of pain on presentation.

Another important part of this study was the establishment of the clinical profile of the patients presenting with inguinal hernia. The highest incidence age group was 40 to 80 years (25.35%), with male sex predominant. This is in coherence with other studies that have shown a higher prevalence of Inguinal hernia after the age of 45 years, like Saldahna *et al.* (47.05)<sup>6</sup> and Stewart *et al.*<sup>17</sup> This can be explained by the fact that most patients choose surgery later when the condition interferes with their profession or daily activities.

An abdominal lump was the most common complaint. Pain/discomfort was present in 66% (40) patients, which is likely the reason for the earlier presentation. The literature also states that about 2/3<sup>rd</sup> of patients with inguinal hernia present with a swelling that is associated with pain.<sup>18</sup> Irreducibility was found in 30% (12) of the patients presenting with a swelling associated with pain and in 3.3% (1) patients presenting with only swelling. This is likely due to the formation of adhesions around the sac, with the sac impinging on the contents during vigorous physical activity. Hernia was common on the Right side in 54.9% (39) and was more often Indirect in 60.6% (43),

**Table 4:** Comparison of various studies

Study	Year	Journal	ST criteria	Prevalence of low-lying pubic tubercle (%)	Mean ST distance
Sehgal <i>et al.</i> <sup>6</sup>	2000 (India)	Indian J Surg	$\geq$ 7.5	73.6	8.25
Lopez <i>et al.</i> <sup>5</sup>	2005 (Spain)	Hernia	$\geq$ 7.5	69.7	8.17
Farhan <i>et al.</i> <sup>7</sup>	2011 (Iraq)	Iraqi Journal	$\geq$ 7.5	74	7.81
Agarwal <i>et al.</i> <sup>8</sup>	2014 (India)	Journal of Evolution of Medical and Dental Sciences	$\geq$ 7.5	82.22	9.06
Saldahana <i>et al.</i> <sup>9</sup>	2018 (India)	Imaging and Radiation Research	$\geq$ 7.5	76	-
Thomas <i>et al.</i> <sup>15</sup>	2018 (India)	International Surgery Journal	$\geq$ 7.75	47.1 (94.3%: Indirect Hernia)	7.6

while bilateral hernia was seen in 12.7% (9), of which the majority (7) were Direct. These results reaffirm the known facts of Right-sided and indirect types being the most common type of inguinal Hernia and Direct hernia being the prevalent type in patients with bilateral hernia. The right-sided hernia is more common due to a slower descent of the testis on the right side and, hence, a delayed obliteration of processus vaginalis in males.

## CONCLUSION

Inguinal hernia is common amongst the young and the older male population. A low-lying pubic tubercle was found in a majority of patients with inguinal hernia. This study did not find a clear link between low-lying pubic tubercles and the development of inguinal hernias.

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