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Original Research Article

Role of height of an individual and low lying pubic tubercle as risk factors of inguinal hernia: case controlled study

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ABSTRACT

Background: Hernia is defined as abnormal protrusion of whole or a part of a viscus through the wall that contains it. Among all external abdominal hernias, inguinal hernia is one most typically encountered. Many factors are responsible for the formation of hernia. We intended to study the risk of inguinal hernia in low lying pubic tubercle.
Methods: The study was conducted on patients in AJIMS, India. It is a case-control study with 80 cases and 80 control meeting inclusion criteria, in all patients, following parameters SS line, ST line, height, weight was recorded and evaluated.
Results: The average SS value for case which was much above the average in control.ST value was higher case group than control group, and $p<0.0001$ which was significant. when it comes to the mean of (SS/ST ratio)/height was higher in the case group than control group. Results developed show majority of the subjects with a low-lying pubic tubercle were inguinal hernia patients.
Conclusions: Based on my study, interspinal distance (SS line) and pubo-spinal distance (ST line) are more in cases compared to control. Configuration of bony pelvis seems to be a major contributing factor in determining the risk of development of inguinal hernia as evidenced by the variations in ST length. This low-lying pubic tubercle is very important before selecting the patient for any surgical correction. So, the proper demonstration of anatomy of inguinal region is very important before selecting the surgical technique.

Keywords: Inguinal hernia, Low lying pubic tubercle, Pubic tubercle, Anterior superior iliac spine, Interspinal distance

INTRODUCTION

Hernia is defined as abnormal protrusion of whole or a part of a viscus through the wall that contains it, or within the cavity in which that viscus is typically located.[1] Among abdominal hernias, inguinal hernia is the most commonly encountered type. Indirect hernia is the commonest of all forms of the hernia, affecting the males seven times over the females.

The inguinal hernia based on anatomical characteristic divided into two types. The most common type is indirect inguinal hernia, in which hernia sac emerge side to inferior epigastric artery.[2] It occur due to the persistence of process vaginalis. Direct inguinal hernia occur medial to the inferior epigastric vessels when abdominal contents protrudes along a weak spot in the fascia transversalis which forms the posterior wall of the inguinal canal.

Inguinal canal is 3.75 cm in length extends from deep to superficial inguinal ring.[3] There are various defensive mechanisms of the inguinal canal to prevent the formation of hernia which are based on anatomical factors. Anatomic variations of various structures facilitating herniation are assessed. The origin of the

internal oblique muscle from the inguinal ligament distant from the pubic tubercle and its lower fibers not covering the internal ring has been implicated in the indirect inguinal hernia.[4] The various degree of incompleteness of the interior oblique muscle in the inguinal region affect in the essential predisposition to direct hernia. Other factors are an increase in the size of Hessert's triangle.[5] One important factor that determines the probability of an individual to suffer from a hernia is that the location of the pubic tubercle.[6] Among all spontaneous external abdominal hernias, inguinal hernia is the most commonly encountered type. Age old descriptions have been made of inguinal hernia. The causation of hernia is multifactorial with evolutionary, congenital, environmental, inheritable factors and also the overall state of health all contributing to its development.

Anatomic variations of various structures facilitate herniation and have been assessed by clinicians. The course of a hernia going to irreducibility, obstruction or strangulation, makes it a life- threatening emergency sometimes. The Africans compared to the Europeans are more susceptible to develop hernia thanks to the more oblique pelvis of them and this is often due to the low pubic tubercle of the bony pelvis.[7] Thus a study on this will help to throw light on the etiopathogenesis of hernia, life style modification and an appropriate treatment when needed.

METHODS

The study was conducted on the patients in the department of general surgery in A. J. institute of medical sciences and research centre, Mangalore during the period of September 2019 to March 2021. Institutional ethical committee clearance obtained and study was initiated.

Inclusion criteria

Any case of uncomplicated inguinal hernia irrespective of sex and occupation were included.

Exclusion criteria

Patients with obvious risk factors like obstructive uropathy, chronic cough etc. Patient below the age of 16 year, as exact position of pubic tubercle cannot be forecasted due to the growth of skeletal system. Patient with congenital and acquired pelvic anomalies were excluded.

Sample size

Sample size was calculated for case control study based on the previous study of Thomas et al using the formula openepi.com in epi info 20.1. Using the formula-

$n=(p0q0 + p1q1)\ z1\text{-}\alpha/2 + z1\text{-}\beta)^2 / (p1\text{-}p0)^2$ where,

p0= proportion of controls p1- proportion of cases

α-Level of significance 1-β- power of test

Z1-α/2 - Z value Corresponding level of significance Z1-β - Z value corresponding level of power

n= Sample size for each group.

A cut off value of 7.75 cm was established for ST, and it was found that among the 140 candidates with an ST length of more than 7.75 cm, 94.3% had an indirect inguinal hernia. 68 out of 70 of the controls had ST length of less than 7.75 cm. This shows that majority of the sample size in their study with low lying tubercle, which is 33 out of 35 of the total sample size had an indirect inguinal hernia.80 each of cases and control. Thus, we consider total of 160 patients.

Analysis

The data was analysed using Graph Pad Prism version 9.2. An attempt was made to find any relationship between ST Line and SS Line measurement and SS/ST ratio, height, weight, built, and age with side of hernia of the patient. The ST and SS Line measurements of the case were compared with those of controls to find out whether there is tendency of having low lying pubic tubercle in case of inguinal hernia. An attempt was also made to observe any correlation between ST segment and height, weight of the patients. The quantitative variables were summarized as mean and standard deviation while qualitative variables as percentage and proportion. The hemodynamic data and demographic data were tested for its distribution through normality tests using Shapiro-wilk test. To the statistical significance between the two independent two groups student t test while in more than two groups ANOVA (one way) was applied and the difference was considered significant when p value was less than 0.05. And to show correlation Pearson ‘s correlation was applied.

The study subjects were asked to lie in supine relaxed position on a hard bed. Keeping both their lower limbs straight, so that both the anterior superior iliac spine were at the same level. A line was drawn on the anterior abdominal wall. Connecting both anterior superior iliac spine which was given the name SS Line and the length of SS Line was noted; next the pubic tubercle on the side of hernia was marked by the palpation. Then vertical distance between this point and the SS Line was measured in cm. This line was designated as ST line. The midpoint between the anterior superior iliac spine and the pubic symphysis was marked as the mid inguinal point and the distance from it to the centre of the superficial inguinal ring was measured, the inguinal ligament length was measured as well.

RESULTS

The patient with age more than 16 years are chosen. The lowest age was 21 years and highest age was 76 years.

Distribution of cases is shown below, highest incidence was noted in 50-60 age group with 69%. The lowest incidence 20-30 age group with 6% and 70-80 years 1%.

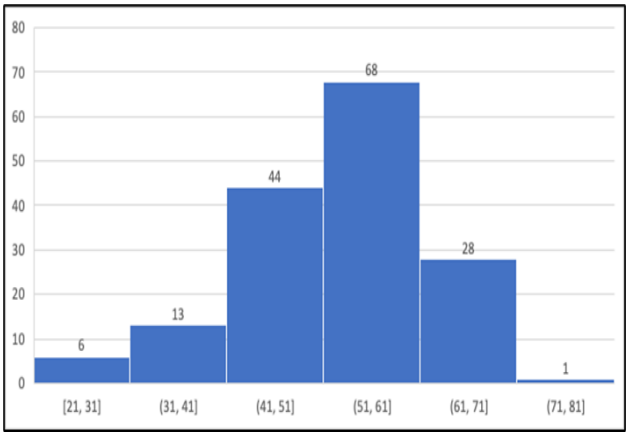

Figure 1: Age wise distribution of case.

Hernia type

Based on the anatomy which was confirmed intraoperatively the hernia is divided into indirect, direct and pantaloon type with both components. Of this 80 hernia, 22 patients have direct hernia and 55 have indirect hernia.3 patients had pantaloon type.

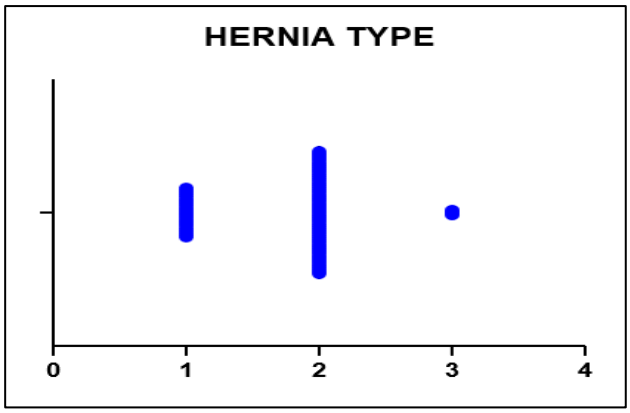

Figure 2: Hernia type.

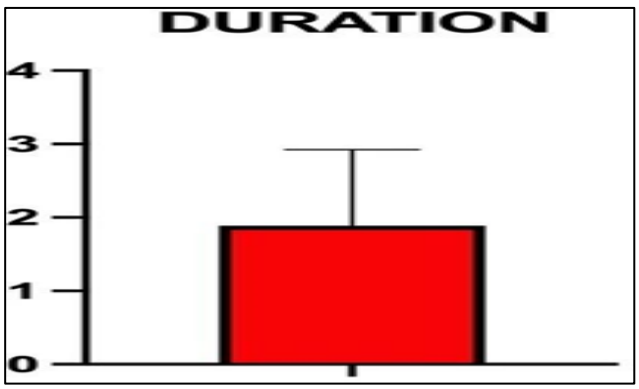

Figure 3: Based on duration of disease.

From the 80 patient's, 39 patients presented within one year 18 patients between one- and two-year, 15 patients between 2nd and 3rd year. In rest the symptoms are present for more than 3 years.

In my study there was 80 cases and 80 controls. Among them the average SS value for case was 24.48 which was much above the average in control group which was 22.89. The t= 9.786, and p<0.0001 which is significant.

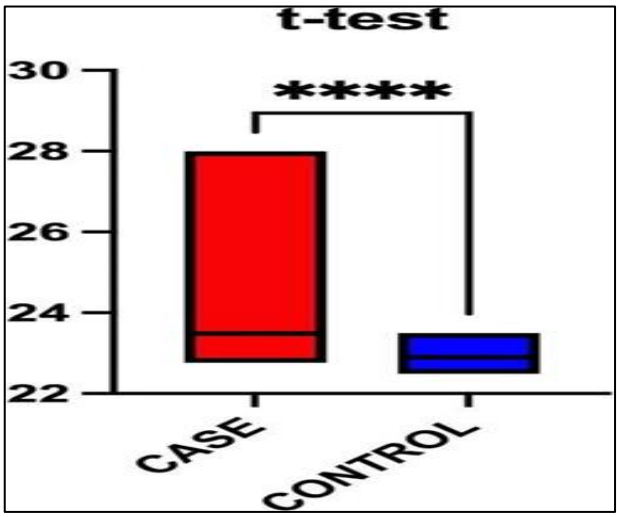

Figure 4: Cases and control by ss values.

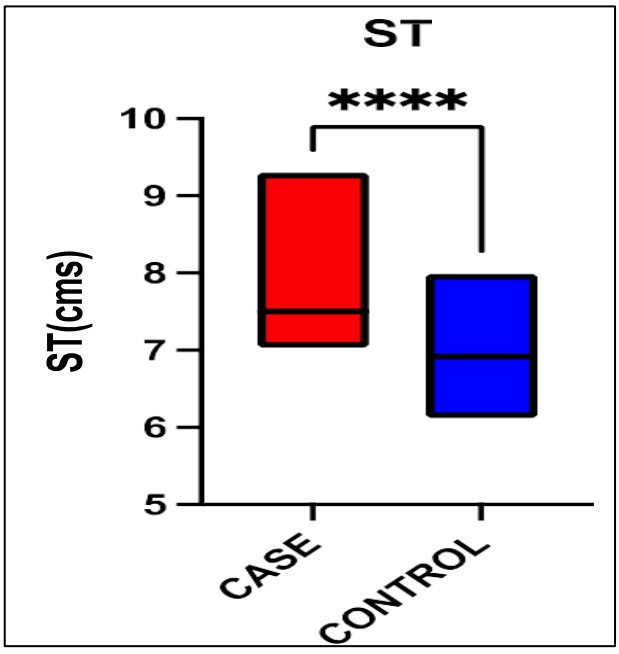

Figure 5: Cases and control by ST values.

In my study, ST value of mean was 7.705 in the case group and mean was only 6.975 in the control group. The statistical significance was proved with t=10.45 and p<0.0001.

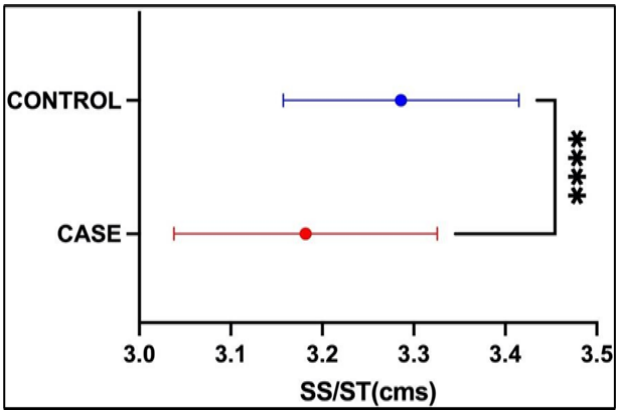

Figure 6: Cases and control by SS/ST values.

In my study When it comes to SS/ST ratio the mean was 3.182 in the case group and mean was 3.286 in the control group. The statistical significance was proved with p<0.0001 and t=4.830.

Figure 7: Cases and control by height.

In my study, the mean height was 162.4 in the case group and mean was 164.0 in the control group. The statistical significance was proved with t=2.645 and p=0.0090.

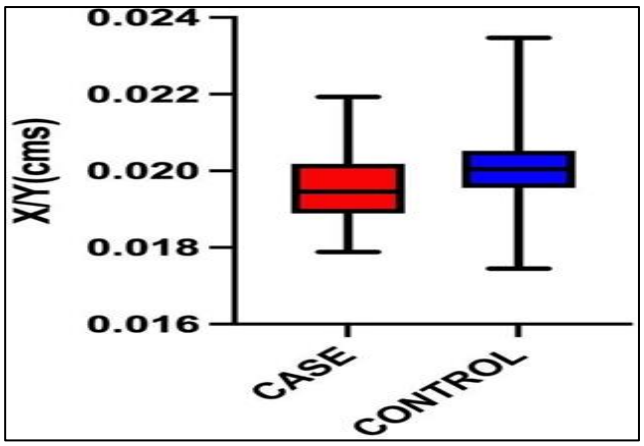

Figure 8: Cases and control by (SS/ST ratio)/height.

In my study, when it comes to the mean of (SS/ST ratio)/height was 0.01961 in the case group and mean was 0.02005 in the control group. The statistical significance was proved with t=2.953 and p=0.0036.

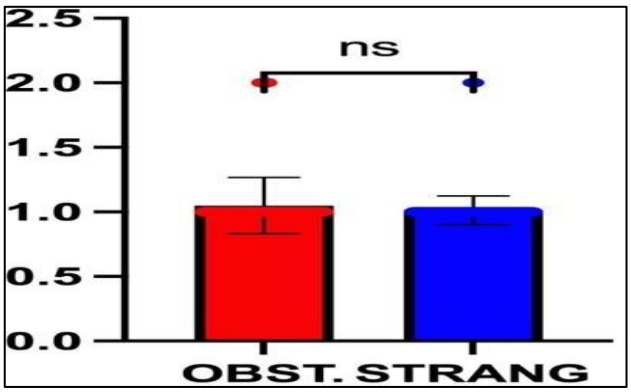

Figure 9: Based on obstruction and strangulation complication.

Complications which I came across in my studies were symptoms of obstruction and strangulation. Obstruction was present in 4 patients, patient's had features of obstruction like vomiting, constipation and abdominal distention. The features of strangulation present in 1 patient with severe pain, tenderness and redness in the skin over inguinal region.

DISCUSSION

The causation of inguinal hernia is varied with evolutionary, congenital, environmental, genetic factors, job and also the general state of health all contributing to its development. The low lying pubic tubercle predisposes to the development of inguinal hernia.[8] Africans have a higher incidence of inguinal hernia as compared to Europeans since the Africans has comparatively more oblique pelvis (low lying pubic tubercle) than the Europeans.[9] Sehgal et al 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.[9] They found out 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. 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 hernia.[11]

In the present study 74% of cases belonged to the group II whereas 91.5% of controls belonged to group I. The mean value of ST line in our study group is 7.705 which is significantly greater (p=0.001) than the controls the mean value being 6.975. Lopez-Cano et al have mentioned that the low pubic arch group showed a significantly longer inguinal ligament and a higher angle made by the superior border of the supra-inguinal space

and inguinal ligament at its medial insertion.[12] The lower the pubic tubercles anatomically located, the more often morphological variation are found in the external oblique, internal oblique, transversus, cremasteric muscles and the fascia transversalis.[13] Similar finding was observed by and Novarro et al that European subjects having inguinal hernia have much low lying public tubercle as compared to the controls not having inguinal hernia.[14,15] Feasibility of correlation between the measurements of ST line with weight and height was found out by calculating the values of correlation coefficients. A positive correlation was found between weight and ST line (r=0.0975) while (r=0.0384) between height and ST line. Similar finding has been revealed by a case control study by Ledinsky et al, Ajmani et al and others.

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. The unusual origin and insertion of internal oblique and transverses abdominis muscle, results in an ineffective shutter mechanism of the inguinal canal.

This low lying pubic tubercle is very important before selecting the patient for any surgical correction. Its believe that higher the distance between the inguinal ligament and musculoaponeurotic arch the classical inguinal hernia will not be feasible such patient should be chosen for hernioplasty. So, the proper demonstration of anatomy of inguinal region is very important before selecting the surgical technique. Pelvimetry is a simple, and non-invasive method that could help in identification of the risk factors as well as adequately plan pre operatively the kind of hernia repair to be undertaken for individual patients.

CONCLUSION

Based on present study following conclusions can be drawn. Inguinal hernia was more common in 50-60 age group. The males are commonly affected than females. The right-side inguinal hernia is predominant over left side. The indirect type predominates over direct type The most common complication seen is irreducibility. The most common systemic disease associated is hypertension. The most of my patient had BMI 18.5-24.99. The most common clinical presentation was swelling. Most patients present within 1 year of disease onset. SS line, ST line was higher in cases. SS/ST ratio were higher in cases. (SS/ST)/height ratio were higher in cases. Configuration of bony pelvis seems to be a major contributing factor in determining the risk of development of inguinal hernia as evidenced by the variations in ST length. Other parameters such as SS/ST and (SS/ST)/height also showed statistically significant variations. Early identification of said risk factors in early adulthood could help in the prevention of hernia. Pelvimetry with radiograph correlation is a simple, and non-invasive method that could help in identification of the risk factors as well as adequately plan pre operatively the kind of hernia repair to be undertaken for individual patients.

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Ethical approval: The study was approved by the Institutional Ethics Committee AJ institution of medical sciences and research centre (AJEC/REV/194/2019)

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