



Is the John Thomas Sign a Finding Indicating the Direction of a Pelvis Fracture?

John Thomas İşareti Pelvis Kırığının Yönünü Gösteren Bir Bulgu mudur?

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ABSTRACT

Introduction: The John Thomas (JT) sign is defined as the penis showing the direction of the fracture in hip or pelvic fractures in male patients. The sensitivity and specificity values of the John Thomas sign vary widely in studies.

Materials and Methods: Male patients over the age of 18 who applied to the Emergency Department of the Faculty of Medicine of Kafkas University between 01.01.2015 and 14.10.2020 due to trauma and who had pelvic tomography were included in the study. The study included 118 male patients who had fractures in the pelvis, proximal femur, and femoral shaft as a result of tomography and 73 male individuals who applied for trauma and had pelvic tomography but did not have any abdominal, pelvis, or lower extremity injuries. The penis angle was recorded as the intersection angle of the vertical line drawn from the symphysis pubis and the line drawn from the midline of the penis corpus cavernosum to the tip of the penis. The study did not include individuals with pelvic asymmetry and those with previous pelvic surgery.

Results: The mean age of the patient group was 45.2±6.4 years, and the mean age of the control group was 44.9±5.9 years. There was no statistically significant difference between the mean ages of the groups ($p=0.557$). While 52 (83.9%) of 62 patients with fractures on the left side of the pelvis had positive JT sign, 37 (66.1%) of 56 patients with right-side fractures had positive JT sign. There was a moderate correlation between fracture and penile direction in the patient group ($p=0.0001$, $\rho=0.509$).

Conclusion: As a result of our study, it was determined that the John Thomas sign alone is not sufficient to detect pelvic fractures, but it can help to diagnose patients with pelvic trauma and suspected fractures.

Keywords: John Thomas sign; Throckmorton sign; pelvic fractures; Solooki sign
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ÖZET

Giriş: John Thomas (JT) bulgusu erkek hastalarda, kalça ya da pelvis kırıklarında penisin kırığın yönünü göstermesi olarak tanımlanır. Yapılan araştırmalarda John Thomas bulgusunun sensitivite ve spesifite değerleri geniş aralıkta değişmektedir.

Materyal Metod: Kafkas Üniversitesi Tıp Fakültesi Acil Servisine 01.01.2015–14.10.2020 tarihleri arasında travma sebebiyle başvurmuş ve pelvis tomografisi çekilmiş 18 yaş üzeri erkek hastalar çalışmaya dâhil edildi. Çalışmaya çekilen tomografi sonucunda pelvis kemiklerinde, femur proksimalinde ve femur shaftında fraktür saptanmış olan 118 erkek hasta ile travma sebebiyle başvurup pelvis tomografisi çekilmiş, herhangi batin, pelvis veya alt ekstremitte yaralanması saptanmamış 73 erkek birey dâhil edildi. Penis açısı symphysis pubisten çizilen dikey hat ile penis corpus cavernosum orta hattından penis ucuna çizilen çizginin kesişim açısı olarak kaydedildi. Pelvik asimetrisi mevcut olan bireyler ve önceden pelvis cerrahisi geçirmiş olan bireyler çalışmaya dâhil edilmedi.

Bulgular: Hasta grubun yaş ortalaması 45,2±6,4 yıl, kontrol grubunun yaş ortalaması ise 44,9±5,9 olarak saptandı. Grupların yaş ortalamaları arasında istatistiksel olarak anlamlı farklılık saptanmadı ($p=0,557$). Pelvisin sol tarafında fraktür saptanan 62 hastanın 52 (%83,9)'sinde JT bulgusu pozitifken, sağ tarafında fraktürü olan 56 hastanın 37'sinde (%66,1) JT bulgusu pozitif olarak saptandı. Hasta grubunda fraktür yönü ve penis yönü arasında orta derecede korelasyon saptandı ($p=0,0001$, $\rho=0,509$).

Sonuç: Çalışmamız sonucunda John Thomas bulgusunun pelvis fraktürleri tek başına tespit etmede yeterli olmadığı fakat pelvis travması olan ve fraktürden şüphelenilen hastalarda tanı koymada yardımcı olabileceği saptanmıştır.

Anahtar kelimeler: John Thomas işareti; Throckmorton işareti; pelvis kırıklar; Solooki işareti

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Introduction

The pelvis is an important junctional region of the body that connects vascular and neuronal structures, especially the gastrointestinal and gastro-urinary systems^{1,2}. Studies show that although pelvic fractures constitute 1–3% of all fractures, the incidence of pelvic fractures may increase up to 20% in patients with multiple traumas due to their connection with many systems. Despite current medical approaches, pelvic fractures are a significant cause of mortality and morbidity^{3,4}. Every year, approximately one-third of the population aged 65 and over falls, and this rate rises to 50% over the age of 80⁵. Hip fracture is suspected in 75000 patients every year in the United Kingdom, and the annual cost of these patients is estimated to be approximately 2 billion pounds⁶.

Early treatment of hip fractures reduces hospital stays and helps with pain control. However, it is accepted that 2–10% of fractures may not be visible on initial radiographs, and further imaging is required to make a definitive diagnosis. These fractures are called occult hip fractures⁷. This situation has led clinicians to seek additional signs for suspicious cases.

The John Thomas (JT) sign is defined as the penis showing the direction of the fracture in hip or pelvic fractures in male patients. Few studies have determined its diagnostic value objectively⁸.

This finding is named after Thomas “Tom” Bentley Throckmorton, a neurologist and Iowa president of the American Medical Association⁸. This is called the “Solooki Sign” in Iran⁹ and the “Oram Sign” in Scandinavia¹⁰.

The sensitivity and specificity values of the John Thomas sign vary widely in studies. Additional studies on this sign are needed, as some suggest an ‘over chance’ relationship between the JT sign and unilateral hip fracture⁸.

The definitive diagnosis of suspected hip fractures can be made more easily in centers with computerized tomography (CT) or magnetic resonance imaging (MRI). However, physicians have to decide only with physical examination and radiography in centers where these imaging facilities are unavailable or cannot be performed due to the patient (such as implants). In our study, we investigated whether the John Thomas sign is an additional finding to facilitate the diagnosis of hip fractures.

Material and Method

Male patients over the age of 18 who applied to the Emergency Department of the Faculty of Medicine of Kafkas University between 01.01.2015 and 14.10.2020 due to trauma and who had a pelvic tomography were included in the study. One hundred eighteen male patients with fractures in the pelvic bones, proximal femur, and femoral shaft as a result of tomography and 73 male individuals who applied for trauma and had a pelvic tomography without any abdominal, pelvic, or lower extremity injuries were included. The age, gender, location of the pelvic fracture, penile direction, and penile shaft angle of the patient group were recorded in the data set. In the control group, age, gender data, penile direction, and penile shaft angle were recorded in the data set. The study did not include individuals with pelvic asymmetry and those with previous pelvic surgery (46 patients).

Penile Direction and Penile Angle Measurement

While determining penile direction and angle, a vertical line (line a) was drawn down from the symphysis pubis level in the scenogram imaging of pelvis CT. The area was divided into two areas, right and left. The half area where the glans penis stood was recorded in the data set (Fig. 1, line a).

Another line (line b) was drawn from the glans penis to the dorsum penis. The angle α , where the line between the glans penis and the dorsum penis intersects the vertical line from the symphysis pubis, was determined as the penile angle (Fig. 1).

Statistical Analysis

The power analysis we performed before the study determined that 110 people (at least 55 for each group) were needed, assuming that the estimated effect size would be medium-high ($f=0.65$) to 95% power at the 95% confidence interval. The IBM Statistical Package for Social Sciences (SPSS) package program was used to analyze the dataset obtained from the study.

Mean \pm standard deviation or median (IQR) gave continuous variables. Sample size frequencies were used to provide categorical variables. The normality of the parameters’ distribution was analyzed using the Kolmogorov-Smirnov test.

Relations between the categorical variables were analyzed by using the chi-square test. Independent

nonparametric group comparisons were analyzed by using the Mann-Whitney U test. Spearman's correlation test was used to investigate correlations between the fracture side and penile angle. Binary logistic regression analysis was used to analyze the factors that affect JT sign positivity. The significance level for all analyses was determined as $p < 0.05$.



Figure 1. Scenogram of pelvic CT image. Line a is a vertical line drawn down from the symphysis pubis level, and line b is an oblique line drawn from the glans penis to the dorsum penis. The angle α , where the line between the glans penis and the dorsum penis intersects the vertical line from the symphysis pubis, was determined as the penile angle.

Results

The mean age of the patient group was 45.2 ± 6.4 years, and the mean age of the control group was 44.9 ± 5.9 years. There was no statistically significant difference between the mean ages of the groups ($p=0.557$). In the patient group, 68 (57.6%) patients had femoral neck-trochanter region fractures, 26 (22%) patients had femoral shaft fractures, and 24 (20.3%) patients had fractures of other pelvic bones (Table 1).

Eighty-nine (75.42%) patients had positive JT signs, and 29 (24.58%) patients had negative JT signs. There was no statistically significant difference in penile direction distribution in patients with and without JT sign and the control group ($p=0.17$) (Table 1).

Considering the penile shaft angles, it was 42.2 (12.9–56.85) degrees in the control group and 37.5 (16.22–91.52) in the patient group. There was no statistically significant difference between the groups regarding penile shaft angles ($p=0.646$) (Table 1).

Considering the penile direction, 71 (60.2%) patients had the penis in the left direction; 47 (39.1%) people had the right direction in the patient group. In the control group, 53 (72.6%) people had the left direction, and 20 (27.4%) had the right direction. There was no statistically significant difference between the patient and control groups in terms of penile direction ($p=0.088$) (Table 1).

While 52 (83.9%) of 62 patients with fractures on the left side of the pelvis had positive JT sign, 37 (66.1%) of 56 patients with right-sided fractures had

Table 1. Clinical data of the groups

	Patient group (n=118)	Control group (n=73)	p-value
Age, median \pm sd	45.2 \pm 6.4	44.9 \pm 5.9	
Fracture area			
Femoral neck-trochanter, N (%)	68 (57.6%)		
Femoral shaft, N (%)	26 (22%)		
Other, N (%)	24 (20.3%)		
JT sign			
Positive	89 (75.42%)		
Negative	29 (24.58%)		
Penis shaft angle median (IQR)	37.5 (16.22–91.52)	42.2 (30.35–56.85)	0.646
Penile direction, N (%)			
Left	71 (60.2%)	53 (72.6%)	0.088
Right	47 (39.1%)	20 (27.4%)	

Table 2. Clinical data of the subgroups

	JT (+) Subgroup (n=62)	JT (-) Subgroup (n=56)	p-value	Correlation coefficients
Fracture area				*p=0.0001 *rho=0.509
<i>Femoral neck-trochanter, N (%)</i>	53 (77.9%)	15 (22.1%)	0.247	
<i>Femoral shaft, N (%)</i>	21 (80.8%)	5 (19.2%)		
<i>Other, N (%)</i>	15 (62.5%)	9 (37.5%)		
Penis shaft angel median (IQR)	31 (15.05–89.6)	53 (34.25–93)	0.082	
Penile direction, N (%)				
<i>Left</i>	52 (58.42%)	19 (65.51%)	0.272	
<i>Right</i>	37 (41.58%)	10 (34.49%)		
Fracture sides		*		
<i>Left</i>	52 (83.9%)	10 (16.1%)	0.032	
<i>Right</i>	37 (66.1%)	19 (33.9%)		

*p-value and rho value are derived from the Spearman correlation test.
p values are derived from the chi-square test.

Table 3. Logistic regression about factors which are related to John Thomas sign positivity

	B	S. E.	Wald	p-value	OR (95%CI for OR)
Age	-0.002	0.015	0.018	0.892	0.998 (0.968–1.028)
Fracture area	-0.630	0.550	1.314	0.252	0.532 (0.181–1.564)
Fracture_side	-1.420	0.541	6.888	0.009	0.242 (0.084–0.698)
Penil direction	1.089	0.548	3.947	0.047	0.336 (0.115–0.985)
Penil shaft angle	0.004	0.005	0.542	0.462	1.004 (0.994–1.014)

negative JT sign. The JT sign positive subgroup includes patients with left side fracture more than the JT sign negative subgroup ($p=0.032$). Also, there was a moderate correlation between the fracture side and penile direction in the patient group ($p=0.0001$ and $\rho=0.509$) (Table 2).

While the JT sign was positive in 53 (77.9%) of 68 patients with femoral head, neck-trochanter region fractures, the JT sign was found in 21 (80.8%) of 26 patients with femoral shaft fractures and 15 (62.5%) of 24 patients with fractures in other pelvic bones (Table 2).

When the factors affecting the JT sign positivity in the patient group were examined, it was determined that the fracture direction and penile direction had an effect on the JT sign positivity in the patient group ($p=0.009$, OR=0.242 and $p=0.047$, OR=0.336 respectively) (Table 3).

Discussion

At the end of our study, we found the JT sign to be positive in the range of 66–83.9% in hip fracture cases. In the literature, there are different values regarding the positivity of the JT finding in studies on this subject. In the study of Murphy et al.⁸, the JT sign was positive, with a rate of 46%.

Gerber et al.¹¹, on the other hand, stated that although they found 75.7% sensitivity in determining the side of a fracture when a fracture is present in their meta-analysis compiled from 9 articles published on the JT finding, the results of the meta-analysis could not determine the laterality of the fracture with any degree of certainty.

Although the JT sign is positive in the range of 66–83.9% in the patient group, the lack of penile direction difference between the general population and the patient group suggests that the JT finding may be due to a unilateral point of view.

Although radiography is the first-choice imaging method in the emergency department, it can miss 4–14% of fractures in the emergency room population. This rate is higher in the elderly population (39–44)¹². As a result of our study, the JT sign in pelvis fractures was found to be positive in the range of 66–83.9%, depending on the location of the fracture. According to these results, JT findings should also be considered for diagnosis in elderly patients with suspected pelvic fractures, especially in emergency services where there is no imaging other than radiography.

In the study of Gill et al.⁷ on using MRI and CT in occult hip fractures, 1353 patients were examined. Advanced imaging studies were performed in 92 of

the patients with the suspicion of occult hip fracture. Occult hip fractures were found in 34 of these patients. Occult hip fracture was detected in 2.5% of the patients included in the study. When the results of our research are evaluated together with the data in the literature, even if the JT finding is weak, it may be suggestive in detecting the location of occult fractures.

Skura et al.¹³ investigated the ability of JT findings to predict orthopedic pathologies in orthopedic trauma patients. The mean patient age of the study, which included 360 male patients, was 42, close to our study (range 18–91 years). As a result of the study, although the relative risk ratio of the JT finding was found to be 4.24, similar to our study, it was determined that the JT sign could not be used alone as a diagnostic tool but could be used as an additional diagnostic tool.

Conclusion

As a result of our study, it was determined that the John Thomas sign alone is not sufficient to detect pelvic fractures but may help in the diagnosis of patients with pelvic trauma and suspected fractures.

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