



CODEN [USA]: IAJPBB

ISSN: 2349-7750

**INDO AMERICAN JOURNAL OF
PHARMACEUTICAL SCIENCES**

<http://doi.org/10.5281/zenodo.3904300>

Available online at: <http://www.iajps.com>

Research Article

DOPPLER ULTRASONOGRAPHY FOR TESTICULAR TORSION

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Article Received: April 2020

Accepted: May 2020

Published: June 2020

Abstract:

Objective: Objective of this study was to find out the diagnostic accuracy Doppler ultrasound in diagnosis of testicular torsion in patients presenting with scrotal pain taking surgical findings as Gold Standard.

Study Design: Cross-sectional study

Place and Duration of Study: Department of Radiology, Allied Hospital, Faisalabad from October 2017 to March 2018.

Material and methods; we took 111 male patients of 15-45 years of age with acute scrotal pain (12-48 hours) and with clinical suspicion of testicular torsion. Data was collected using non-probability - purposive sampling from department of Radiology, Allied Hospital, Faisalabad in 6 months. Doppler ultrasonography was carried out in all the patients by a single radiologist under supervision of my supervisor by using TOSHIBA Just Vision USG machine equipped with curvilinear probe and Doppler USG facilities and the findings was recorded. Then patients were sent for surgery and intraoperative findings were noted. All surgeries were done by a single surgical team.

Results: In this study the mean age of patients was 29 ± 6.52 years. The mean duration of scrotal pain 18.12 ± 5.03 and average scrotal pain was 7.17 ± 1.50 . Forty-three (38.7%) patients had moderate pain and 68 (61.3%) presented with severe pain. On Doppler ultra-sonography testicular swelling was seen in 106(95.5%) patients, decreased Echogenicity was not found in any patient while decreased blooded follow was observed in 100 (90.1%) of the patients. The sensitivity and specificity of Doppler ultrasonography was 98.06% and 87.5% respectively taking surgical findings as gold standard. Positive and negative predictive value of Doppler Ultrasonography were 99.02% and 77.78% respectively while overall diagnostic accuracy of Doppler ultrasonography was 97.3% taking surgical findings as gold standard

Conclusion: According to this study, Doppler ultrasonography can be used to detect testicular torsion in patients presenting with acute scrotal pain with reliable sensitivity (98.06%), specificity (87.5%) and good diagnostic accuracy (97.3%).

Keywords: Scrotal pain, Echogenicity, Testicular swelling, Doppler ultra-Sonography

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Please cite this article in press Misbah Shakoor et al., *Doppler Ultrasonography For Testicular Torsion, Indo Am. J. P. Sci.*, 2020; 07(06).

INTRODUCTION:

Acute scrotal pain is most commonly caused by testicular torsion, torsion of the appendix testis, epididymitis and/or orchitis. Of these, only testicular torsion is an absolute surgical emergency as testicular salvage is inversely related to the duration of ischaemia.(1) Testicular torsion is a true urologic emergency and must be differentiated from other complaints of testicular pain because a delay in diagnosis and management can lead to loss of the testicle.(2)

All prepubertal and young adult males with acute scrotal pain should be considered to have testicular torsion until proven otherwise.(3) About 20% of boys presenting with an acute scrotum actually have Testicular Torsion.(4) The most common signs and symptoms include red, swollen scrotum and acutely painful testicle, often in the absence of trauma. Nausea and vomiting are common. (5)

It is difficult, however, to differentiate testicular torsion from torsion of the appendix testis and epididymitis/orchitis based on historical features alone. The boys with testicular torsion did, however, seek medical attention earlier.(6) More recently, Doppler ultrasonography (DUS) has become an imaging modality for the examination of the acute scrotum with the purpose of detecting ischaemia, thus reducing the need for explorative surgery. (7)

US findings include an enlarged heterogeneous testis, ipsilateral hydrocele, skin thickening, and no color Doppler flow signal in the testis or spermatic cord.(8) Doppler ultrasonography for the diagnosis of testicular torsion has 94% sensitivity, 96% specificity.(9)

However, on review of literature it becomes evident that there are shortcomings in considering Doppler as Gold Standard, and stating that testicular torsion is a clinical diagnosis requiring consideration of many variables, not only color Doppler. (10)

Rationale of the study is to evaluate the diagnostic accuracy of Doppler USG as the noninvasive technique to detect testicular torsion and avoid undue surgical exploration. DUS is cost & time effective and non-invasive technique. If DUS will yield high diagnostic accuracy for testicular torsion, then in future we will use DUS as primary diagnostic tool to screen patients with scrotal pain. It will help to excessive surgeries and reduce burden of surgeons and hospital

MATERIALS AND METHODS:

This Cross-sectional study performed in Department of Radiology, Allied Hospital, Faisalabad. After taking permission from ethical committee of hospital, 111 male patients fulfill

selection criteria were enrolled in the study from emergency department of NHM. Written informed consent was taken from each patient was taken. Demographic profile (name, age, address) will also obtained from each patient. Doppler ultrasonography was carried out in all the patients by a single radiologist under supervision of my supervisor by using TOSHIBA Just Vision USG machine equipped with curvilinear probe and Doppler USG facilities and the findings was recorded. Then patients were sent for surgery and intraoperative findings were noted. All surgeries were done by a single surgical team. All this information was recorded on proforma (attached). Statistical analysis was performed by entering all the data in SPSS version 18. The qualitative data like Doppler USG findings, severity of pain (mild, moderate, severe) for testicular torsion was presented as frequency distribution. Quantitative data in the study like age was presented as means and standard deviations. 2x2 table was generated to calculate sensitivity, specificity, positive predictive values, negative predictive values and diagnostic of CDUS taking surgery as a gold standard. Effect modifiers like age and duration of pain was controlled by stratifications. Chi-Square test was applied to see significance of these effect modifiers, at p-value ≤ 0.05 .

RESULTS:

In this study the mean age of patients was 29 ± 6.52 years with minimum and maximum ages 15 and 45 years (age range = 30 years) respectively. **Table-1** There were 56 (50.45%) patients who were 15-29 years of age and 55(49.5%) were 30-45 years of age. The mean duration of scrotal pain was 18.12 ± 5.03 hours with minimum and maximum duration of pain 12 – 24 hours. There were 61 (54.95%) patients who presented with 12-17 hours of their pain and rest of 50 (45.05%) presented with 18-24 hours. According to visual analog scale (VAS) scrotal pain was also measured, the average scrotal pain was 7.17 ± 1.50 . The minimum and maximum scrotal pain was 5 and 10 on VAS respectively. Forty-three (38.7%) patients had moderate pain and 68 (61.3%) presented with severe pain. On Doppler ultra-Sonography testicular swelling was seen in 106(95.5%) patients, decreased Echogenicity was not found in any patient while decreased blooded flow was observed in 100 (90.1%) of the patients. Testicular torsion was found positive in 102 (91.9%) patients on Doppler ultrasonography. **Table-2** Testicular torsion was found positive in 103 (92.8%) patients on their surgical findings. **Table-3** Moreover there were 101 (91%) patients who were diagnosed positive on both Doppler ultrasonography and on surgical findings, 1(0.9%) patient was diagnosed positive on Doppler ultrasonography but was negative on surgical findings, 2(1.8%) patients were diagnosed positive on

surgical findings and were negative on Doppler ultra sonography. Lastly there were 9(6.3%) cases that were diagnosed negative on both Doppler ultra sonography and surgical findings. The sensitivity and specificity of Doppler ultrasonography was 98.06% and 87.5% respectively taking surgical findings as gold standard. Positive and negative predictive value of Doppler Ultrasonography were 99.02% and 77.78% respectively while overall

diagnostic accuracy of Doppler ultrasonography was 97.3% taking surgical findings as gold standard. **Table- 4** We stratified our data over age groups (15-29 and 30-45) and duration of pain (12-17 hours and 18-24 hours). Applying chi-square we found significant association between diagnosis of Testicular torsion on surgical and Doppler ultra sonography with respect to age groups and duration of pain (p-value < 0.05).

Table -1: Descriptive Statistics of Age (years)

	Age (years)
Mean	29.00
Std. Deviation	6.52
Range	30.00
Minimum	15.00
Maximum	45.00

Table -2: Findings of testicular torsion on Doppler ultrasound

	Frequency	Percent	Cumulative Percent
Positive	102	91.9	91.9
Negative	9	8.1	100
Total	111	100.0	

Table -3: Surgical Findings of testicular torsion

	Frequency	Percent	Cumulative Percent
Positive	103	92.8	92.8
Negative	8	7.2	100
Total	111	100.0	

Table -4

Sensitivity	98.06%
Specificity	87.5%
Positive Predictive Value	99.02%
Negative Predictive Value	77.78%
Diagnostic Accuracy	97.3%

DISCUSSION:

The acute scrotum remains to be most challenging diagnostic confusion for radiologists due to absence of any single or combined examination, or test that could provide definitive results with 100% accuracy. Because of this surgical exploration is considered the only better option. (13) This need further necessitates due to lack of latest and accurate diagnostic materials and therapies. However sometimes surgical exploration may not be required and results in delay or misleading diagnosis issues. (14) The implications of a missed diagnosis have emphasized the need for a non-invasive test for confirming testicular ischaemia which has long been highlighted for facing

difficulties in establishing the diagnosis clinically. (15)

Most urologists would immediately suggest that if the clinical history and examination are highly suspicious for torsion, immediate surgical exploration is indicated, without radiologic evaluation. However, up to 70% of cases with an acute scrotum have pathology that does not require surgery. (16) For that reason, there exists a great need for rapid, accurate, noninvasive, widely available radiologic test for testicular torsion that could provide faster and accurate utility for this purpose. One such modality which meets many of these criteria is color Doppler ultrasound (US). Understandably, the advent of colour Doppler

ultrasound (CDUS) (and subsequently 'power' Doppler and microbubble ultrasound contrast), has been greeted with enthusiasm. However, as in other fields of medicine, a policy placing sole reliance on a single technique is likely to be flawed. (12, 15)

A number of studies have established through their researches that High-frequency real-time sonography has enhanced accuracy in the diagnosis of scrotal abnormalities. (17) One study stated that color Doppler imaging (CDI) has become the study of choice in evaluation of the scrotum due to technological advances resulting in superior resolution and sensitive Doppler systems. CDI has become particularly helpful in evaluating the scrotum in the setting of acute disorders, such as torsion of the spermatic cord, epididymal and testicular inflammation, and scrotal trauma (18) and should conveniently be opted for such investigations. (19) Most reports concerning color Doppler US in the acute scrotum incorporated patients whose history, physical examination, and laboratory evaluation warranted direct surgical exploration for torsion without radiologic investigation. However, the urologic literature has multiple isolated case reports demonstrating instances of missed testicular torsion by color Doppler US imaging (US) raising justified concerns over its use. Despite these isolated cases, color Doppler US is commonly used during the evaluation of the acute scrotum and is considered a safe and preferable approach. (20)

The greater support of data to prove high sensitivity, specificity, and accuracy of Ultrasonography is important to limit the patient population with equivocal or low probability for testicular torsion. (21)

Therefore, the aim of our investigation was to find out the diagnostic accuracy Doppler ultrasound in diagnosis of testicular torsion in patients presenting with scrotal pain taking surgical findings as Gold Standard.

Testicular torsion has a bimodal distribution, with extragenitally torsion affecting neonates in the perinatal period, and intravaginal torsion affecting males of any age but most commonly adolescent boys. (2) In males <25 years of age, the annual incidence of torsion in the US is 1 in 4000. (22) Torsion can be seen at any age but it is not generally a disease affecting the elderly. (23)

In our study the mean age of patients was 29 ± 6.52 years with minimum and maximum ages 15 and 45 years (age range = 30 years) respectively. One study included 670 patients with torsion of the spermatic cord presenting in Bristol between 1960 and 1984 to see the incidence and other factors of testicular torsion over the period of 25 years. They concluded that the annual incidence of torsion had

increased fourfold from 11.2 cases between 1960 and 1964 to 42.8 cases between 1980 and 1984. Throughout this period > 90 per cent of patients were managed by general surgeons. Patients aged between 12-18 years comprised 62 per cent but 20 per cent were 21 years or older. The age ranges of our study resemble this review to great extent. (24)

According to visual analog scale (VAS) scrotal pain was also measured, the average scrotal pain was 7.17 ± 1.50 . The minimum and maximum scrotal pain was 5 and 10 on VAS respectively. Forty-three (38.7%) patients had moderate pain and 68 (61.3%) presented with severe pain. Scrotal pain is the first indication for possibility of testicular torsion. One 2-year retrospective review of 238 cases of acute scrotal pain showed that the incidences of testicular torsion, torsion of a testicular appendage, and epididymitis were 16%, 46%, and 35%, respectively. They concluded that the testicular disease was dependent on duration from onset of pain till surgical exploration. (11) Hence role of pain and its intensity cannot be overlooked at all.

In our study, on Doppler ultra-sonography testicular swelling was seen in 106(95.5%) patients, decreased Echogenicity was not found in any patient while decreased blood flow was observed in 100 (90.1%) of the patients. Testicular torsion was found positive in 102 (91.9%) patients on Doppler ultrasonography. Testicular torsion was found positive in 103 (92.8%) patients on their surgical findings.

Moreover, there were 101 (91%) patients who were diagnosed positive on both Doppler ultrasonography and on surgical findings, 1(0.9%) patient was diagnosed positive on Doppler ultrasonography but was negative on surgical findings, 2(1.8%) patients were diagnosed positive on surgical findings and were negative on Doppler ultra-sonography. Lastly there were 9(6.3%) cases that were diagnosed negative on both Doppler ultra-sonography and surgical findings. The sensitivity and specificity of Doppler ultrasonography was 98.06% and 87.5% respectively taking surgical findings as gold standard. Positive and negative predictive value of Doppler Ultrasonography were 99.02% and 77.78% respectively while overall diagnostic accuracy of Doppler ultrasonography was 97.3% taking surgical findings as gold standard.

Another study compared the clinical accuracy of ultrasound with that of surgical exploration. There results showed that in 3 patients, intermittent testicular torsion was diagnosed and in 17 patients, emergent exploration was performed for US diagnosis of testicular torsion. Twenty-five patients (22.7%) were subsequently lost to follow-up.

Follow-up of 85 patients with US negative for torsion (mean length of follow-up = 466.9 days) revealed no testicular atrophy in 83. Two patients underwent delayed orchiectomy/contralateral orchiopexy for missed testicular torsion. Consequently, in their study color Doppler US for the equivocal acute scrotum yielded a 1% false-positive rate, sensitivity of 88.9%, and specificity of 98.8%. (25)

Another study compared the diagnostic accuracy of Color Doppler Sonography (CDS) and Ultrasound with surgical exploration. They found that out of 150 patients to be examined Standard US was pathological in 95 patients (63.3%); CDS was pathologic in 70 patients and in 42 of them suggested a testicular torsion. In the pre-operative assessment of scrotal trauma, the Ultrasound showed a sensitivity and specificity of 100% and 90%, respectively and the sensitivity and specificity of physical exam and CDS were 100% versus 95.7% and 86.5% versus 85.3%, respectively. They concluded that color Doppler analysis did not supply with additional elements compared to ultrasound for planning a surgical exploration. (26) Moreover US findings include an enlarged heterogeneous testis, ipsilateral hydrocele, skin thickening, and no color Doppler flow signal in the testis or spermatic cord.(8) Doppler ultrasonography for the diagnosis of testicular torsion has 94% sensitivity, 96% specificity.(9)

All the above cited studies are compatible with our results and support that inclusion of Doppler ultrasound should be appreciated for its advantages like speed, accuracy, non-invasive nature and safety. Further studies are recommended to explore all diagnostic options in depth and generate evidence for usage of ultrasound for possibility of testicular torsions after acute scrotal pain.

CONCLUSION:

According to this study, Doppler ultrasonography can be used to detect testicular torsion in patients presenting with acute scrotal pain with reliable sensitivity (98.06%), specificity (87.5%) and good diagnostic accuracy (97.3%). DUS is cost & time effective and non-invasive technique so in future we can use DUS as primary diagnostic tool to screen patients with scrotal pain that will help to get rid of excessive surgeries and reduce burden of surgeons and hospital.

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