Research Article

Clinical Evaluation Of Causes Of Scrotal Pain And Its Ultrasonographic Correlation

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A B S T R A C T

Background: Scrotal pain is a common urological emergency with causes ranging from benign inflammatory conditions to surgical emergencies like testicular torsion. Accurate diagnosis is essential to guide timely management and prevent complications.

Objectives: To evaluate the clinical causes of scrotal pain and correlate them with ultrasonographic findings for accurate diagnosis and management.

Materials and Methods: This prospective observational study was conducted on patients presenting with scrotal pain at a tertiary care hospital. Detailed clinical evaluation was performed, followed by ultrasonography with color Doppler. Findings were correlated to determine diagnostic accuracy and outcomes.

Results: Epididymo-orchitis was the most common cause of scrotal pain, followed by hydrocele and testicular torsion. Ultrasonography with color Doppler showed high sensitivity and specificity in differentiating torsion from inflammatory conditions. Clinical diagnosis alone was less reliable, but when combined with ultrasonography, diagnostic accuracy significantly improved.

Conclusion: Clinical evaluation supplemented with ultrasonography is the most effective approach for assessing scrotal pain. This combined strategy enhances diagnostic precision, reduces unnecessary surgical exploration, and ensures timely intervention, thereby improving patient outcomes.

Keywords: Scrotal pain, Ultrasonography, Color Doppler, Epididymo-orchitis, Testicular torsion.

INTRODUCTION

Scrotal pain is a common urological emergency and a significant cause of morbidity in males of all age groups. It can present as acute or chronic and is associated with a wide range of etiologies ranging from benign and self-limiting conditions to life-threatening surgical emergencies such as testicular torsion [1]. Accurate and timely diagnosis is essential because the clinical presentation of different conditions often overlaps, and delays in treatment, especially in cases like torsion, can result in testicular loss and infertility [2].

The causes of scrotal pain are diverse and include testicular torsion, epididymo-orchitis, hydrocele, pyocele, hematocele, varicocele, inguinoscrotal hernia, trauma, tumors, and scrotal cellulitis [3]. Differentiating among these conditions on clinical grounds alone may be challenging due to nonspecific findings, particularly in pediatric and adolescent age groups where history-taking can be limited [4].

Ultrasonography (USG) with color Doppler has emerged as the imaging modality of choice for evaluating scrotal pathology. It is non-invasive, widely available, cost-effective, and provides real-time assessment of scrotal contents. Doppler sonography, in particular, is invaluable in distinguishing vascular from non-vascular causes of scrotal pain and in differentiating torsion from inflammatory conditions [5,6]. Studies have shown that scrotal USG has a sensitivity and specificity exceeding 90% in diagnosing testicular torsion and epididymo-orchitis [7].

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Clinical evaluation remains the cornerstone of diagnosis, but when combined with ultrasonography, it enhances diagnostic accuracy, reduces unnecessary surgical explorations, and guides appropriate management [8]. Moreover, structured outcome measures such as the Karnofsky Performance Status Scale (KPSS) can be employed to assess the functional impact of scrotal diseases and monitor recovery following treatment [9].

In India, where scrotal pain is a frequent presenting complaint in surgical and emergency departments, there is limited published literature on the clinical spectrum and ultrasonographic correlation of this condition. Hence, this study was undertaken to evaluate the clinical profile of scrotal pain, correlate it with ultrasonographic findings, and assess treatment outcomes among patients presenting to a tertiary care hospital.

MATERIALS AND METHODS
Study Design and Setting
This was an **observational, prospective study** conducted in the Department of Surgery, Santosh Medical College & Hospital, Ghaziabad, Uttar Pradesh. The study was carried out among male patients presenting with scrotal pain referred for ultrasonographic evaluation.

Study Area and Duration
The study was conducted in **District Ghaziabad (Uttar Pradesh), India,** over a period of **18 months (November 2018 to April 2020).**

Study Population and Sample Size
A total of **100 male patients** of all age groups presenting with acute or chronic scrotal pain were enrolled. Sample size was calculated using **OpenEpi v3.0** based on findings of Rottenstreich M. et al. (2017), which reported that 6.2% of patients required surgical management for scrotal pain among 382,036 medical records. With a **95% confidence interval (CI)** and **design effect = 1**, the minimum sample size was estimated to be 90. To compensate for potential non-responders and loss to follow-up, an additional 10% was added, rounding the final sample to **100 patients.** Patients were selected using a **convenience sampling method** (i.e., first-come, first-served basis).

Inclusion Criteria
1. Male patients of all age groups reporting with acute or chronic scrotal pain.
2. Patients willing to participate in the study.
3. Patients consenting to undergo ultrasonography of the scrotum.

Exclusion Criteria
1. Patients with open wounds in the scrotum.
2. Patients with bleeding disorders.
3. Patients absconding before complete clinical evaluation and treatment.
4. Patients not willing to provide informed consent.

Ethical Considerations
Approval was obtained from the **Institutional Ethical Committee** prior to commencement of the study. Written **informed consent** was taken from all participants after explaining the aim, objectives, and procedures of the study. Participation was voluntary, and confidentiality of patient data was ensured.

Method of Data Collection
Each participant underwent detailed **history-taking** and **clinical examination.** Data regarding demographic profile, occupation, socio-economic status, presenting complaints, duration and onset of pain, side of involvement, associated symptoms, and past medical history were recorded in a **pre-designed case history proforma.**

Functional impairment was assessed using the **Karnofsky Performance Status Scale (KPSS).** Clinical findings were further correlated with **ultrasonography (USG) of the scrotum** with Doppler studies where required.

Clinical and Diagnostic Evaluation
1. **Initial Evaluation** – All patients underwent general physical, systemic, and local examination.
2. **Basic Investigations** – Complete blood count (CBC), bleeding time (BT), clotting time (CT), renal function tests (RFTs), and viral markers were performed. ECG, echocardiography, and chest X-ray were done if clinically indicated.
3. **Radiological Assessment** – Ultrasonography of the scrotum and abdomen was performed for all patients. Doppler studies were conducted as needed.
4. **Treatment** – Based on clinical diagnosis and USG findings, patients were managed accordingly. Cases of acute epididymo-orchitis were treated conservatively, while surgical intervention was performed in indicated cases.

5. **Postoperative Monitoring** – Patients undergoing surgery were observed in the postoperative period for complications.
6. **Follow-up** – Patients were followed up clinically at three intervals: **7 days, 15 days, and 30 days** after the first visit. KPSS was reassessed at each follow-up to evaluate functional improvement.

Statistical Analysis

Data were entered in Microsoft Excel and analyzed using **SPSS version 24.0 (IBM Corp., Chicago, IL, USA).** Continuous variables were expressed as **mean ± standard deviation (SD)** and categorical variables as **frequency and percentage.** Comparisons between groups were made using the **Student's t-test** for continuous variables and the **Chi-square test** for categorical variables. For non-parametric data, results were presented as **median (minimum–maximum)**, and statistical significance was tested using appropriate non-parametric tests. A **p-value <0.05** was considered statistically significant.

RESULTS AND OBSERVATIONS

The study was carried out among 100 patients of scrotal pain of any age group who voluntarily consented to be a part of the study. In this study, clinical profiling of various causes of scrotal pain was clinically and ultrasonologically evaluated. The present study was a Randomized, Prospective study conducted in Santosh Medical College & Hospital, Ghaziabad (Uttar Pradesh).

Table 1: Demographic and Clinical Profile of Study Participants (N = 100)

Variable	Category	Frequency (n)	Percentage (%)
Age Group (years)	01–20	25	25.0
	21–40	63	63.0
	41–60	11	11.0
	61–80	1	1.0
	Mean ± SD	**27.0 ± 11.9**	–
Residence	Urban	33	33.0
	Rural	67	67.0
Socio-economic Status	Upper	4	4.0
	Upper Middle	17	17.0
	Lower Middle	29	29.0
	Upper Lower	31	31.0
	Lower	19	19.0
Onset of Pain	Gradual	91	91.0
	Sudden	9	9.0

Table 2: Clinical Profile of Scrotal Pain among Study Participants (N = 100)

Variable	Category	Frequency (n)	Percentage (%)
History of Scrotal Swelling	Yes	72	72.0
	No	18	18.0
Duration of Pain (days)	Mean ± SD (Range)	**9.23 ± 5.65 (2–27)**	–
Location of Pain	Right side	37	37.0
	Left side	38	38.0
	Bilateral	25	25.0
Radiation of Pain	Localized (No radiation)	96	96.0
	Yes (to abdomen)	4	4.0

Table 3: Clinical Symptoms among Study Participants (N = 100)

Variable	Category	Frequency (n)	Percentage (%)
Fever	Yes	33	33.0
	No	67	67.0
Burning Micturition	Yes	31	31.0
	No	69	69.0
Active Sexual History	Yes	41	41.0

Variable	Category	Frequency (n)	Percentage (%)
	No	59	59.0

Table; 4 Clinical, Laboratory, and Imaging Findings among Study Participants (N=100)

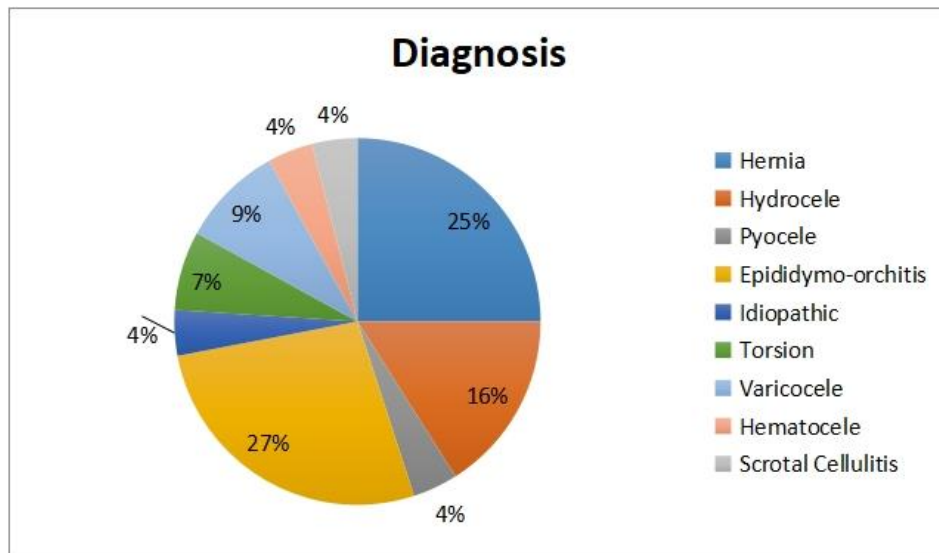| Parameter	Category	Frequency (n)	Percent (%)
Co-morbid Condition	None	88	88.0
	Diabetic	12	12.0
General Physical Examination	None	81	81.0
	Tachycardia	17	17.0
	Pallor	2	2.0
	Hypertension	7	7.0
Local Examination (Scrotum)	Swelling – Yes	82	82.0
	Swelling – No	18	18.0
	Redness – Yes	37	37.0
	Redness – No	63	63.0
	Raised Temperature – Yes	35	35.0
	Raised Temperature – No	65	65.0
Urine Routine Examination	Pus cells (0–4/HPF)	70	70.0
	Pus cells (>5/HPF)	30	30.0
	Sugar – Present	8	8.0
	Sugar – Absent	92	92.0
Other Laboratory Parameters	TLC (Mean ± SD)	9492 ± 5243	Range: 2900–36500
	Random Blood Glucose (mg/dl)	117.3 ± 47.5	Range: 35–289
	Blood Urea (mg/dl)	37.0 ± 6.7	Range: 9–48
	Serum Creatinine (mg/dl)	0.69 ± 0.55	Range: 0.2–2.3
Viral Markers	Present (HbsAg)	2	2.0
	Absent	98	98.0
Ultrasonography (Scrotum)	No abnormality	4	4.0
	Enlarged epididymis with increased vascularity	27	27.0
	Hydrocele with homogenous fluid	16	16.0
	Torsion with reduced/no vascularity	7	7.0
	Varicocele	9	9.0
	Scrotal wall thickening	4	4.0
	Heterogeneous contours	25	25.0
	Fluid collection (pyocele/hematocele)	8	8.0

Figure 1: Final diagnosis of acute scrotal pain among study participants

Table; 5 Treatment Modalities and Outcomes among Study Participants (N=100)

Parameter	Category	Frequency (n)	Percent (%) / Mean ± SD (Range)
Treatment Given	Conservative	38	38.0
	Surgical	62	62.0
Surgical Treatment Pattern	Hernioplasty	23	37.0
	Herniorrhaphy	2	3.0
	Eversion of Sac	16	26.0
	Incision & Drainage (I&D)	7	11.0
	Orchidectomy	2	3.0
	Orchidopexy	6	10.0
	Varicocelectomy	6	10.0
Karnofsky Performance Status Scale (KPSS)	On Admission	–	**61.5 ± 14.2** (Range: 40–80)
	After Treatment	–	**64.9 ± 10.0** (Range: 50–80)
	At 7-Day Follow-up	–	**71.5 ± 8.8** (Range: 60–90)
	At 15-Day Follow-up	–	**80.3 ± 7.8** (Range: 70–100)
	At 30-Day Follow-up	–	**90.3 ± 7.8** (Range: 80–110)

Table 6: Comparison of clinical diagnosis with onset of pain:

Diagnosis	Gradual		Sudden		Total
	N	%	N	%	
Hernia	23	23.0	2	2.0	25
Hydrocele	16	16.0	0	0.0	16
Pyocele	4	4.0	0	0.0	4
Epididymo-orchitis	27	27.0	0	0.0	27
Idiopathic	4	4.0	0	0.0	4
Torsion	0	0.0	7	7.0	7
Varicocele	9	9.0	0	0.0	9
Hematocele	4	4.0	0	0.0	4
Scrotal Cellulitis	4	S4.0	0	0.0	4
Total	91	91.0	9	9.0	100
Chi-square = 4.391; p-value = 0.004*					

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Table 7: Comparison of clinical diagnosis with presence of fever:

Diagnosis	Fever		No fever		Total
	N	%	N	%	
Hernia	1	1.0	24	24.0	25
Hydrocele	0	0.0	16	16.0	16
Pyocele	2	2.0	2	2.0	4
Epididymo-orchitis	25	25.0	2	2.0	27
Idiopathic	1	1.0	3	3.0	4
Torsion	0	0.0	7	7.0	7
Varicocele	0	0.0	9	9.0	9
Hematocele	0	0.0	4	4.0	4
Scrotal Cellulitis	4	4.0	0	0.0	4
Total	33	33.0	67	67.0	100
Chi-square = 7.222; p-value = 0.021*					

Table 8: Comparison of clinical diagnosis with clinical condition:

Diagnosis	None		Tachycardia		Pallor		Total
	N	%	N	%	N	%	
Hernia	23	23.0	1	1.0	1	0.0	25
Hydrocele	16	16.0	0	0.0	0	0.0	16
Pyocele	4	4.0	0	0.0	0	0.0	4
Epididymo-orchitis	19	19.0	7	7.0	1	1.0	27
Idiopathic	4	4.0	0	0.0	0	0.0	4
Torsion	0	0.0	7	7.0	0	0.0	7
Varicocele	9	9.0	0	0.0	0	0.0	9
Hematocele	4	4.0	0	0.0	0	0.0	4
Scrotal Cellulitis	2	2.0	2	2.0	0	0.0	4
Total	81	81.0	17	17.0	2	2.0	100
Chi-square = 5.519; p-value = 0.001*							

Table: 9 Comparison of KPSS Score with Demographic Variables

KPSS Score	Age Group (Years)	N	Mean ± SD	SE	F / t-statistic	p-value	Residence	N	Mean ± SD	SE	F / t-statistic	p-value
On Admission	01–20	25	59.60 ± 15.13	3.03	F = 0.481	0.696	Urban	33	61.82 ± 14.46	2.52	t = 0.157	0.876
	21–40	63	62.54 ± 13.91	1.75			Rural	67	61.34 ± 14.13	1.73		
	41–60	11	59.09 ± 14.46	4.36								
	61–80	1	70.00	–								
After Treatment	01–20	25	63.60 ± 9.95	1.99	F = 0.278	0.841	Urban	33	64.85 ± 10.04	1.75	t = 0.036	0.871
	21–40	63	65.40 ± 10.29	1.30			Rural	67	64.93 ± 10.06	1.23		
	41–60	11	64.55 ± 9.34	2.82								
	61–80	1	70.00	–								
7-day Follow-up	01–20	25	70.00 ± 8.17	1.63	F = 0.402	0.752	Urban	33	70.61 ± 8.64	1.50	t = 0.711	0.479
	21–40	63	72.22 ± 8.70	1.10			Rural	67	71.94 ± 8.92	1.09		
	41–60	11	70.91 ± 11.36	3.43								
	61–80	1	70.00	–								
15-day Follow-up	01–20	25	78.80 ± 6.66	1.33	F = 0.891	0.449	Urban	33	79.70 ± 7.70	1.34	t = 0.538	0.592

KPSS Score	Age Group (Years)	N	Mean ± SD	SE	F / t-statistic	p-value	Residence	N	Mean ± SD	SE	F / t-statistic	p-value
	21–40	63	81.27 ± 8.13	1.02			Rural	67	80.60 ± 7.96	0.97		
	41–60	11	78.18 ± 8.74	2.64								
	61–80	1	80.00	–								
30-day Follow-up	01–20	25	88.80 ± 6.66	1.33	F = 0.912	0.491	Urban	33	89.70 ± 7.70	1.34	t = 0.544	0.512
	21–40	63	91.27 ± 8.13	1.02			Rural	67	90.60 ± 7.96	0.97		
	41–60	11	88.18 ± 8.74	2.64								
	61–80	1	90.00	–								

DISCUSSION

The present prospective study evaluated 100 patients presenting with scrotal pain and correlated clinical findings with ultrasonographic results. The majority of patients (63%) belonged to the 21–40 years age group, with a mean age of 27 years, indicating that scrotal disorders are more common among young and sexually active males. This is in agreement with previous studies by Srinivasan et al. [1] and Lewis et al. [2], who reported a peak incidence in adolescents and young adults.

In our study, gradual onset of pain (91%) was more common than sudden onset (9%). Testicular torsion was significantly associated with sudden onset pain (p=0.004), consistent with the findings of Kapoor [3] and Barada et al. [4], who emphasized that sudden severe pain is a diagnostic hallmark of torsion and necessitates immediate surgical exploration to prevent testicular loss.

Epididymo-orchitis (27%) was the most frequent diagnosis, followed by inguinoscrotal hernia (25%) and hydrocele (16%). Epididymo-orchitis was significantly associated with fever and urinary symptoms (p=0.021), supporting an infective etiology, as also highlighted by Street and Wilson [5]. Hydrocele and hernia were largely associated with chronic, painless or mildly painful swelling, in agreement with Dogra et al. [6].

Ultrasonography with Doppler was pivotal in differentiating between torsion, infection, and other scrotal pathologies. In our study, 27 patients had enlarged epididymis with increased vascularity (suggestive of epididymo-orchitis), 7 had absent/reduced vascularity (torsion), 16 had hydrocele, and 9 had varicocele. These findings are in line with Kalfa et al. [7] and Munden et al. [8], who reported that Doppler ultrasonography has high sensitivity and specificity (>90%) in distinguishing torsion from inflammatory causes of scrotal pain.

Management in our study revealed that 62% required surgical intervention, while 38% were treated conservatively. The most common surgeries were hernia repair (37%) and hydrocele surgery (26%), whereas torsion cases required orchidopexy or orchidectomy depending on viability. Similar surgical predominance was reported by Anderson and Giacomantonio [9], who highlighted the importance of timely surgery in torsion and complicated scrotal conditions.

Functional outcome, measured using the Karnofsky Performance Status Scale (KPSS), showed significant improvement from admission (61.5 ± 14.2) to 30-day follow-up (90.3 ± 7.8). This underscores the positive impact of appropriate diagnosis and timely intervention on patient recovery and quality of life. Although limited literature exists on KPSS application in scrotal pathology, its utility in quantifying surgical outcomes has been validated in other clinical contexts [10].

Overall, our study reinforces the complementary roles of **clinical examination** and **ultrasonography**. Clinical features such as onset of pain, fever, and urinary symptoms provide diagnostic clues, while ultrasonography confirms the diagnosis and guides treatment. Early recognition of surgical emergencies like torsion is crucial, as delays can result in irreversible testicular damage and infertility [11].

CONCLUSION

Scrotal pain has varied etiologies, with clinical overlap making diagnosis difficult. Ultrasonography with color Doppler, when combined with clinical evaluation, provides high diagnostic accuracy, minimizes unnecessary surgical interventions, and ensures timely management. This integrated approach should be the standard for evaluating scrotal pain to improve outcomes and preserve testicular function.

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