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Original Article

Surgery Section

Diagnostic Utility of the Absent Cremasteric Reflex and Prehn's Sign in Testicular Torsion: A Multicentre Retrospective Observational Study Comparing Clinical Examination with USG and Colour Doppler Imaging

G RAGHAVENDRA PRASAD[1], ABDULLAH UMAYR KHAN[2]

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ABSTRACT

Introduction: Testicular torsion is a urological emergency requiring timely diagnosis and surgical intervention to prevent ischaemia and testicular loss. Clinical signs such as the absent cremasteric reflex and Prehn's sign are traditionally used, but their accuracy compared to Ultrasonography (USG) and colour doppler imaging needs validation.

Aim: To validate the diagnostic utility of the absent cremasteric reflex and Prehn's sign in identifying testicular torsion and compare them with USG and colour doppler imaging.

Materials and Methods: The present multicentre retrospective observational study was conducted at Princess Esra Hospital and Deccan College of Medical Sciences, Hyderabad, India. The study reviewed records of 332 male patients presenting with acute scrotum over a five-year period (January 2015 to December 2019). The study was planned, executed, and data analysed between January 2020 and March 2021. Patients were divided into pre USG era (n=229) and USG era (n=103) based on the availability of imaging at the time of presentation. However, only 93 cases with complete clinical and imaging documentation met the inclusion criteria and were used for detailed statistical analysis. Clinical signs (absent cremasteric reflex and Prehn's sign) and imaging findings (USG and colour doppler) were compared against surgical exploration outcomes. Diagnostic performance was evaluated using sensitivity, specificity, Positive Predictive Value (PPV), Negative Predictive Value (NPV), and accuracy. Statistical comparison between clinical signs and imaging modalities was performed using the McNemar test with significance set at $p<0.05$.

Results: The absent cremasteric reflex showed sensitivity of 82.43% and accuracy of 74.19%, comparable to USG and colour Doppler, which demonstrated sensitivity of 81.08% and accuracy of 81.72%, as confirmed by the study results. Prehn's sign had lower reliability, with sensitivity of 63.51% and accuracy of 59.14%, consistent with the original data.

Conclusion: The absent cremasteric reflex is a reliable clinical sign for diagnosing testicular torsion, with sensitivity comparable to USG and Doppler. Prehn's sign is less reliable. In ambiguous cases, immediate surgical exploration remains crucial.

Keywords: Adolescents, Diagnosis, Emergencies, Male, Orchiectomy, Pain, Ultrasonography

INTRODUCTION

Testicular torsion is a time-sensitive surgical emergency, primarily affecting males aged 1-25 years, with an incidence ranging from 1.4 to 4.5 cases per 100,000 individuals annually, depending on geographic and demographic factors [1-4]. The classic clinical presentation includes sudden onset of severe unilateral scrotal pain, often accompanied by nausea, vomiting, and a characteristic horizontal lie of the affected testis [5]. Prompt and accurate diagnosis is essential, as delays in intervention particularly those exceeding six hours can drastically reduce testicular viability and compromise future fertility [6-8].

In resource-limited or emergency settings where imaging may not be immediately available, clinical examination remains the cornerstone of early triage. Historically, physical signs such as the cremasteric reflex-elicited by stroking the inner thigh to provoke ipsilateral testicular retraction and Prehn's sign-assessed by lifting the affected testis to evaluate pain relief-have been relied upon to differentiate torsion from epididymo-orchitis and other causes of acute scrotum. While these signs are simple, non-invasive, and immediately available at the bedside, their diagnostic accuracy has been questioned with the advent of imaging modalities such as USG and colour doppler, which offer high sensitivity and specificity for assessing testicular perfusion [9-11].

However, doppler USG is highly operator-dependent, and its availability may be limited during off-hours, in rural settings, or in paediatric emergencies. Studies have shown that false-negative Doppler results may occur in early or partial torsion, potentially leading to misdiagnosis and testicular loss if surgical exploration is delayed [12-14]. Furthermore, over-reliance on imaging may delay definitive surgical management, particularly in borderline cases where time is critical. In contrast, clinical signs, though often underemphasised, provide immediate cues that can influence surgical decision-making.

Recent systematic reviews and meta-analyses have evaluated the performance of various clinical and imaging findings in testicular torsion. For example, Boettcher M et al., and Srinivasan A et al., demonstrated that the absence of the cremasteric reflex was one of the most reliable indicators of torsion, with sensitivity approaching 99% in some paediatric cohorts [6,7]. Nonetheless, such findings are inconsistently applied in practice, and few comparative studies systematically evaluate the real-world performance of these signs versus imaging in a modern clinical setting. This reflects a knowledge gap in understanding whether traditional clinical indicators still hold diagnostic value when weighed against advanced imaging.

A unique aspect of the present study is its design, which considers two clearly defined time periods: the pre USG era, when diagnosis

relied exclusively on clinical findings, and the USG era, when imaging became more accessible. While this temporal segmentation strengthens the comparative aspect, it also presents potential limitations-such as variability in record quality, evolving clinical protocols, and differing surgeon thresholds for exploration across time-which must be acknowledged when interpreting the findings.

Despite advances in imaging, no additional biochemical or radiological investigations were performed in this study beyond clinical evaluation and USG/doppler imaging. Hence, this analysis focuses strictly on comparing bedside clinical assessment with imaging in patients undergoing surgical exploration. The aim of the present study was to evaluate the diagnostic utility of the absent cremasteric reflex and Prehn's sign in identifying testicular torsion and to compare their diagnostic performance with ultrasonography and colour doppler imaging.

MATERIALS AND METHODS

The present multicentre retrospective observational cohort study conducted at two tertiary care institutions: Princess Esra Hospital and Deccan College of Medical Sciences both located in Hyderabad, Telangana, India. The study was designed to evaluate the diagnostic accuracy of clinical signs and imaging in testicular torsion across two distinct diagnostic periods. Clinical data were retrieved for a total duration spanning from January 2015 to December 2019, while data analysis and interpretation were carried out between January 2020 and March 2021. The study protocol adhered to the ethical standards outlined in the Declaration of Helsinki. Due to its retrospective design, formal informed consent was not required. Patient confidentiality was maintained throughout the study.

The study population was divided into two defined timeframes to reflect the diagnostic approach adopted during each period. The pre USG era included cases evaluated and explored based primarily on clinical findings, owing to limited availability of imaging. The USG era represented the phase where ultrasonography and colour doppler imaging were routinely available and integrated into diagnostic workflows. This division facilitated a temporal comparison of clinical and imaging-based diagnostic methods.

Sample size selection: Out of 332 patients who presented with acute scrotum during the study period, only 93 cases had complete records documenting both clinical signs (cremasteric reflex and Prehn's sign) and USG/Doppler imaging findings. These 93 cases were included for final analysis to ensure uniformity in data comparison and methodological integrity. Emphasis on this subset was necessary to minimise analytical bias and to enable direct comparison of clinical and imaging modalities against the gold standard-surgical exploration. Cases with incomplete data were excluded from analysis to preserve the validity of the statistical evaluation.

Inclusion criteria: The study included male patients who presented with acute scrotal pain and subsequently underwent scrotal exploration. Only those cases were included in the final analysis where complete documentation of clinical evaluation was available, including findings related to the cremasteric reflex, Prehn's sign, and, where applicable, imaging results from USG and colour doppler studies.

Exclusion criteria: Patients were excluded from the study if their medical records lacked complete documentation of clinical examination findings, such as the cremasteric reflex or Prehn's sign, or if imaging results (USG and colour doppler) were missing. Additionally, cases that were managed conservatively without undergoing surgical exploration were excluded, as surgical confirmation was considered the definitive diagnostic standard for inclusion in this analysis.

Study Procedure

Patient data were retrieved from archived surgical registers and electronic medical records. Although a total of 332 cases of acute scrotum were initially reviewed from institutional records- 229 from the pre USG era and 103 from the USG era-only 93 cases had complete documentation of clinical evaluation and USG/Doppler findings. These 93 cases were included in the final analysis to ensure consistency and reliability in diagnostic comparison against surgical outcomes. During the "pre USG era" period, the diagnosis of testicular torsion was based primarily on clinical signs, such as the absence of the cremasteric reflex and testicular lie, as immediate surgical intervention was prioritised to maximise the chances of testicular salvage. The prevailing clinical approach adhered to the longstanding surgical principle: "When in doubt, explore."

The "USG era", represents the more recent period when ultrasonography with colour doppler became routinely used in evaluating acute scrotum cases. It is important to note that while the core diagnostic criteria for testicular torsion remained unchanged, the availability of imaging has significantly enhanced the precision and confidence of diagnosis by complementing clinical judgment.

Only cases from the USG era with comprehensive clinical and imaging documentation were included. Out of these, 93 cases met the criteria for inclusion and were used for detailed analysis, as they had complete records of clinical examination findings and corresponding USG and colour doppler reports confirmed by surgical exploration.

Clinical assessments: Data on clinical assessments were retrospectively extracted from detailed patient records documented at the time of initial evaluation. These assessments included the cremasteric reflex, Prehn's sign, and testicular lie.

The cremasteric reflex was assessed by gently stroking the medial aspect of the thigh and observing whether the ipsilateral testicle retracted upwards. An absent response was documented as a potential clinical indicator of testicular torsion. This reflex is considered a sensitive bedside sign and has been shown in previous studies to be absent in the majority of torsion cases, particularly in paediatric populations [1,2].

The Prehn's sign was evaluated by elevating the affected hemiscrotum to assess for pain relief. A positive Prehn's sign (pain relief) was typically interpreted as suggestive of epididymitis, while a negative result (no relief) was more consistent with torsion. However, its diagnostic reliability has been questioned in literature due to variable sensitivity and specificity [3].

The testicular lie was documented based on physical examination findings noted in clinical records. A horizontal or abnormal orientation of the testicle was considered suspicious for torsion and was frequently noted in confirmed cases [4].

Imaging modalities: In cases belonging to the USG era, colour doppler USG findings were retrospectively reviewed based on the imaging reports documented in the medical records. These reports, prepared by radiologists with expertise in emergency imaging, were used to assess testicular blood flow. The doppler findings were categorised as either "absent", which was interpreted as being consistent with testicular torsion, or "present", which suggested an alternative diagnosis such as epididymo-orchitis. No new imaging investigations were performed as part of this study; only the existing imaging documentation from patient records was analysed.

The patients were grouped into two groups according to the final diagnosis as follows:

- **Torsion Group (A):** Patients diagnosed with testicular torsion confirmed during surgical exploration (n=74).
- **Negative Exploration Group (B):** Patients who underwent surgical exploration but were found to have a condition other than torsion (n=19).

Parameters assessed: The following diagnostic parameters were evaluated in comparison to surgical exploration, which served as the definitive standard.

- Sensitivity, specificity, and accuracy of the cremasteric reflex and Prehn's sign.
- Sensitivity, specificity, and accuracy of USG and colour Doppler imaging.
- Comparison of diagnostic performance between clinical tests and imaging modalities.

STATISTICAL ANALYSIS

The data were analysed using MedCalc© statistical software version 19.2.6. Diagnostic performance was expressed in terms of sensitivity, specificity, PPV, NPV, and overall accuracy. The McNemar test was used to compare the statistical significance of diagnostic modalities. A p-value of <0.05 was considered statistically significant.

RESULTS

Demographic findings and patient information: A total of 93 male patients with acute scrotum who met the inclusion criteria were included in the final analysis. The age of the patients ranged from 4 to 25 years, with a mean age of 14.8±5.3 years. The majority of patients (65.6%) were in the 10-20-year age group, reflecting the typical demographic affected by testicular torsion. Among these 93 patients, 74 (79.6%) were diagnosed with testicular torsion during surgical exploration and were classified under the Torsion Group (Group-A), while the remaining 19 (20.4%) patients had negative exploration findings and were included in the negative exploration group (Group-B). All patients presented with acute onset unilateral scrotal pain, with associated symptoms such as nausea and vomiting noted in approximately 52% of cases.

Clinical evaluation and imaging data were collected retrospectively from patient records and analysed to assess the diagnostic accuracy of the cremasteric reflex, Prehn's sign, and ultrasonography with colour doppler, using surgical findings as the definitive standard.

Cremasteric reflex: The cremasteric reflex was absent in 61 out of 74 patients (82.43%) in the Torsion Group (A) and in 11 out of 19 patients (57.89%) in the Negative Exploration Group (B). [Table/Fig-1] sensitivity for detecting torsion based on the absence of the reflex was calculated as 82.43%, highlighting its value as a reliable clinical indicator in acute settings. However, specificity was lower at 42.11%, reflecting a moderate proportion of false positives. The overall diagnostic accuracy of the absent cremasteric reflex was found to be 74.19%, suggesting that while it remains a useful bedside tool, it should ideally be supported by adjunct diagnostic methods such as imaging to improve clinical decision-making [Table/Fig-2].

Group	Absent	Present
Torsion Group (A)	61	13
Negative exploration (B)	11	8

[Table/Fig-1]: Showing absent and present cremasteric reflex in both groups (n=93).

Parameters	Value (%)	95% CI
Sensitivity	82.43%	71.83% to 90.30%
Specificity	42.11%	20.25% to 66.50%
Positive likelihood ratio	1.42	0.96 to 2.12
Negative likelihood ratio	0.42	0.20 to 0.86
Disease prevalence (*)	79.57%	69.95% to 87.23%
Positive Predictive Value (PPV) (*)	84.72%	78.84% to 89.19%
Negative Predictive Value (NPV) (*)	38.10%	23.01% to 55.89%
Accuracy (*)	74.19%	64.08% to 82.71%

[Table/Fig-2]: Showing sensitivity and specificity of cremasteric reflex.

Prehn's sign: Prehn's sign was positive in 47 out of 74 patients (63.51%) in the Torsion Group (A) and in 11 out of 19 patients (57.89%) in the Negative Exploration Group (B) [Table/Fig-3]. The sensitivity of this test for detecting torsion was 63.51%, which is notably lower than that of the cremasteric reflex. The sensitivity of this test for detecting torsion was 63.51%, which is notably lower than that of the cremasteric reflex. Specificity was also 42.11%, similar to the cremasteric reflex. The accuracy of Prehn's sign was calculated at 59.14%, underscoring its limited reliability as a standalone diagnostic test [Table/Fig-4].

Group	Positive	Negative
Torsion group (A)	47	27
Negative exploration (B)	11	8
Classification	**Value**	**Explanation**
True Positive (TP)	47	Torsion confirmed+Prehn's positive
False Negative (FN)	27	Torsion confirmed+Prehn's negative
False Positive (FP)	11	No torsion+Prehn's positive
True Negative (TN)	8	No torsion+Prehn's negative

[Table/Fig-3]: Showing positive and negative Prehn's sign in both groups.

Parameters	Value (%)	95% CI
Sensitivity	63.51%	51.51% to 74.40%
Specificity	42.11%	20.25% to 66.50%
Positive likelihood ratio	1.10	0.72 to 1.67
Negative likelihood ratio	0.87	0.47 to 1.59
Disease prevalence (*)	79.57%	69.95% to 87.23%
Positive Predictive Value (PPV) (*)	81.03%	73.72% to 86.68%
Negative Predictive Value (NPV) (*)	22.86%	13.90% to 35.22%
Accuracy (*)	59.14%	48.46% to 69.23%

[Table/Fig-4]: Showing sensitivity and specificity of Prehn's sign.

Testicular lie: An abnormal or horizontal testicular lie was recorded in 51 out of 74 patients (68.92%) in the Torsion Group (A). In the negative exploration Group (B), an abnormal lie was noted in only three out of 19 cases (15.79%), while 16 cases exhibited a normal lie [Table/Fig-5].

Group	Abnormal lie (Present)	Normal lie (Absent)	Total
Torsion Group (A)	51	23	74
Negative exploration (B)	3	16	19

[Table/Fig-5]: Shows the presence of abnormal and normal testicular lie.

USG and Colour Doppler

Absent blood flow on USG and coour doppler was observed in 60 out of 74 patients (81.08%) in the Torsion Group (A), indicating its high sensitivity. In the negative exploration Group (B), absent blood flow was noted in 13 out of 19 patients (68.42%) [Table/Fig-6]. Sensitivity for diagnosing torsion via USG and colour doppler was 81.08%, and specificity was higher at 84.01%. The accuracy of USG and colour doppler was calculated at 81.72%, demonstrating its superiority to clinical tests but also revealing a margin for error [Table/Fig-7].

Group	Absent blood flow	Present blood flow
Torsion Group (A)	60	14
Negative exploration (B)	13	6

[Table/Fig-6]: Showing USG and Colour Doppler data in both groups.

Parameters	Value (%)	95% CI
Sensitivity	81.08%	70.30% to 89.25%
Specificity	84.21%	60.42% to 96.62%
Positive likelihood ratio	5.14	1.81 to 14.59
Negative likelihood ratio	0.22	0.13 to 0.37
Disease prevalence (*)	79.57%	69.95% to 87.23%
Positive Predictive Value (PPV) (*)	95.24%	87.56% to 98.27%

Negative Predictive Value (NPV) (*)	53.33%	40.69% to 65.56%
Accuracy (*)	81.72%	72.35% to 88.98%

[Table/Fig-7]: Showing sensitivity and specificity of USG and colour doppler in our study.

Sensitivity, specificity, accuracy, PPV, and NPV were calculated using surgical exploration as the reference standard.

McNemar's test was applied to compare clinical modalities against USG and against each other. *S* indicates statistically significant difference ($p<0.05$); *NS* indicates no statistically significant difference ($p\geq0.05$).

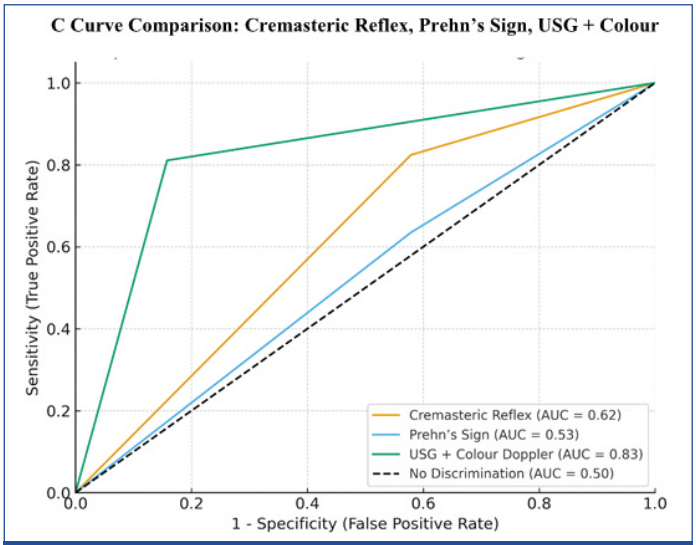
Comparison of cremasteric reflex to USG revealed a p-value of 0.108, which was not statistically significant, suggesting comparable diagnostic sensitivity. Comparison of Prehn's Sign to USG yielded a significant p-value of 0.0003, reflecting the inferior diagnostic reliability of Prehn's sign. Comparison of cremasteric reflex to Prehn's Sign also showed a significant p-value of 0.0002, underscoring the superior diagnostic performance of the cremasteric reflex over Prehn's sign [Table/Fig-8].

Diagnostic modality	Sensitivity (%)	Specificity (%)	Accuracy (%)	Positive predictive value (%)	Negative predictive value (%)	p-value vs USG (MeNemar test)	p-value vs Prehn's (Meemar test)
Cremasteric reflex	82.43	42.11	74.19	84.72	38.1	0.108 (NS)	0.0002 (S)
Prehn's sign	63.51	42.11	59.14	81.03	22.86	0.0003 (S)	-
USG and color doppler	81.08	68.42	78.49	95.24	53.33	-	-

[Table/Fig-8]: Descriptive and inferential statistics comparing the diagnostic performance of the cremasteric reflex, Prehn's sign, and ultrasonography with colour Doppler in identifying testicular torsion.

Comparative diagnostic accuracy: To evaluate and compare the diagnostic performance of clinical signs and imaging, Receiver Operating Characteristic (ROC) curves were plotted for the absent cremasteric reflex, Prehn's sign, and USG with colour Doppler. As shown in [Table/Fig-9], the Area Under the Curve (AUC) was highest for USG and colour doppler, indicating superior diagnostic accuracy compared to both clinical signs. The cremasteric reflex showed better diagnostic performance than Prehn's sign, consistent with the findings of sensitivity, specificity, and accuracy in earlier sections.

[Table/Fig-9] ROC curves comparing the diagnostic performance of clinical signs (absent cremasteric reflex and Prehn's sign) and imaging (USG with colour Doppler) in detecting testicular torsion. Imaging modality refers specifically to grayscale ultrasonography combined with colour doppler flow assessment. AUC: Area Under the Curve.



[Table/Fig-9]: Receiver Operating Characteristic (ROC) curves comparing the diagnostic performance of clinical signs (absent cremasteric reflex and Prehn's sign) and imaging (USG with colour Doppler) in detecting testicular torsion. The Area Under the Curve (AUC) is highest for USG with colour Doppler (AUC=0.86), followed by the cremasteric reflex (AUC=0.70) and Prehn's sign (AUC=0.58), indicating that USG is the most accurate diagnostic tool.
AUC: Area under the curve; USG: Ultrasonography

These results underscore the diagnostic reliability of the absent cremasteric reflex, particularly in settings where imaging modalities may not be available. USG and colour Doppler remain the most accurate tools but require operator expertise and availability, making the cremasteric reflex a critical clinical adjunct.

DISCUSSION

This study reinforces the clinical utility of the absent cremasteric reflex as a diagnostic marker for testicular torsion, particularly in acute care and resource-limited settings. The study findings showed a sensitivity of 82.43% for this sign, aligning well with previous and recent studies that emphasise its importance in early triage. For instance, a 2020 systematic review by Sheth KR et al., noted that the absence of the cremasteric reflex remains one of the most consistent physical exam findings in testicular torsion, particularly among adolescents and children presenting within six hours of symptom onset [15].

However, the specificity in the present study was comparatively low at 42.11%, suggesting a moderate false-positive rate. This reduced specificity may be multifactorial. It could reflect variations in examiner expertise, subjectivity in interpretation, and age-related physiological differences-as the reflex tends to be less brisk or even absent in prepubertal boys, potentially reducing its reliability in younger age groups [16,17]. Additionally, the presence of pain or muscle fatigue at the time of examination might blunt the reflex response, leading to misclassification.

Prehn's sign, with a sensitivity of 63.51%, showed limited utility in distinguishing torsion from other causes of acute scrotum. This finding supports earlier critiques of the sign's clinical reliability. A 2023 systematic review by Choudhury P et al., [16] highlighted the poor interobserver reproducibility of Prehn's sign, further questioning its standalone diagnostic value in emergency practice.

USG and colour Doppler imaging demonstrated higher diagnostic performance, with sensitivity and specificity both exceeding 80% in the study cohort. While these modalities are now standard in many institutions, their operator dependency and potential limitations in detecting early or partial torsion are well documented. A large multicentre retrospective study by Pinar U et al., [18] showed that colour Doppler, while accurate, had a false-negative rate of 11% in early torsion cases, emphasising the need for clinical correlation even when imaging appears normal [18].

Importantly, the study findings reiterate that immediate surgical exploration remains the gold standard, especially when clinical suspicion is high. Delayed intervention particularly beyond six hours has been consistently associated with decreased salvage rates and increased orchiectomy risk, as shown in multiple contemporary reviews [19,20]. Therefore, integrating clinical signs like the cremasteric reflex with imaging findings into a diagnostic algorithm ensures a more balanced approach- one that can expedite decision-making while reducing unnecessary explorations.

In summary, the present study validates the role of bedside clinical signs, particularly the absent cremasteric reflex, in identifying testicular torsion. Although limited by specificity, its consistent presence across diverse settings underlines its value when imaging

is delayed or inconclusive. As supported by both historical evidence and recent data, a combined approach using clinical judgment and imaging ensures timely, effective care. The dictum "when in doubt, explore" continues to hold true and must be respected in ambiguous or high-risk presentations.

Limitation(s)

This study has several limitations that warrant consideration. First, the retrospective design inherently restricts control over data quality, with possible inconsistencies in clinical documentation across time and between observers. Although the analysis included only those 93 patients with complete clinical and imaging records, the exclusion of a significant portion of the initial cohort (332 cases) due to incomplete data may have introduced selection bias. Second, the study was conducted at two centers within a single geographic region, potentially limiting the generalisability of the findings to broader populations or different healthcare settings. Third, the accuracy of clinical signs such as the cremasteric reflex and Prehn's sign is highly dependent on examiner skill and consistency, which could not be standardised or verified retrospectively. Additionally, the time interval between symptom onset, clinical evaluation, and imaging was not uniformly documented, which may influence the diagnostic accuracy of all modalities studied. Lastly, no additional imaging techniques or biochemical markers were evaluated, which could have provided a more comprehensive diagnostic comparison.

CONCLUSION(S)

Absent cremasteric reflex is a reliable clinical sign, comparable to USG and colour doppler in sensitivity and superior to Prehn's sign. In resource-limited or emergency settings, clinical examination should guide immediate exploration when imaging is unavailable or inconclusive. Combining clinical findings with imaging enhances diagnostic accuracy, minimising unnecessary interventions. "When in doubt, explore" remains the cornerstone of acute scrotum management.

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PARTICULARS OF CONTRIBUTORS:
1. Professor, Department of Surgery, Princess Esra Hospital, Deccan College of Medical Sciences, Hyderabad, Former Telangana, India.
2. Junior Resident, Department of Surgery, Princess Esra Hospital, Deccan College of Medical Sciences, Hyderabad, Former Telangana, India.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:
G Raghavendra Prasad
Professor, Department of Surgery, Princess Esra Hospital, Deccan College of Medical Sciences, Hyderabad, Telangana, India.
E-mail: grprasad22@gmail.com

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