



A prospective cross-sectional study comparing surgical and conservative management in acute scrotum.

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Abstract

Background:

Acute scrotum is a common urological emergency presenting with the sudden onset of pain and swelling. Its causes range from benign inflammatory conditions to testicular torsion, a time-sensitive surgical emergency. Accurate differentiation between surgical and conservative cases is crucial for preserving testicular function. This study aimed to compare the outcomes of surgical and conservative management of acute scrotum in a tertiary care setting.

Methods:

This prospective cross-sectional observational study was conducted at Acharya Vinobha Bhave Rural Hospital, Sawangi (Meghe), Wardha, from August 2016 to October 2018. A total of 100 male patients presenting with acute scrotal pain and swelling were evaluated clinically and with Colour Doppler Ultrasonography. Patients were managed surgically (n = 58) or conservatively (n = 42) based on diagnosis, and outcomes were assessed at 14 days and 1 month.

Results:

The mean age was 41.56 ± 15.81 years (range 12–74). Testicular torsion accounted for 44 surgical cases, with an 81.8% salvage rate when treated within 6 hours, but 18.2% required orchidectomy after delayed presentation. Epididymo-orchitis was the predominant conservative diagnosis (85.7%), all resolving with medical therapy. Minor wound infection occurred in 3.4% of surgical cases; no recurrences or long-term complications were observed.

Conclusion:

Surgical exploration is vital for torsion and complicated scrotal pathology, while conservative therapy is effective for infective and inflammatory conditions. Timely presentation and Colour Doppler Ultrasonography are key to optimal outcomes.

Recommendation:

Early surgical exploration should be undertaken in suspected torsion, ideally within six hours, and Colour Doppler Ultrasonography should be routinely used to enhance diagnostic accuracy.

Keywords: Acute scrotum, Testicular torsion, Epididymo-orchitis, Surgical management, Conservative management.

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Introduction

Acute scrotum is a common but potentially serious urological emergency characterized by the abrupt onset of pain, swelling, and tenderness in one or both hemiscrotums [1]. The underlying causes encompass a wide range of conditions, including testicular torsion, torsion of testicular or epididymal appendages, epididymo-orchitis, trauma,

pyocele, and less common systemic or referred conditions such as Henoch–Schönlein purpura or haemoperitoneum [2,3]. Among these, testicular torsion is the most critical, as testicular viability diminishes drastically beyond 6–8 hours of vascular compromise, and delays in surgical intervention may result in irreversible ischemic injury, atrophy, or even orchidectomy [4].



Accurate differentiation between torsion and non-torsion causes remains a significant clinical challenge. Overlapping presentations—such as hemiscrotal pain, erythema, fever, nausea, and vomiting—may obscure the diagnosis [5]. While thorough history-taking and physical examination provide essential clues, adjunctive imaging has become central to evaluation. Colour Doppler ultrasonography offers high sensitivity and specificity by assessing testicular perfusion, enabling the clinician to reduce the incidence of negative explorations [6,7]. Nevertheless, in equivocal cases or in settings where advanced imaging is limited, prompt surgical exploration continues to be advocated to avoid the catastrophic sequelae of missed torsion [8].

Management strategies for acute scrotum are broadly categorized into surgical and conservative approaches. Surgical exploration with orchidopexy or orchidectomy remains the cornerstone in cases of confirmed or highly suspected torsion [9]. Conversely, conservative management—including bed rest, scrotal elevation, antibiotics, and anti-inflammatory therapy—is often sufficient for infective and inflammatory conditions such as epididymo-orchitis [10]. The decision-making process, however, is complicated by the need to balance the urgency of surgery for torsion with the risks of unnecessary operative intervention in benign conditions.

Despite advances in diagnostic modalities, the relative outcomes of surgical versus conservative treatment remain under-reported, particularly in rural and resource-limited settings where access to immediate imaging and specialist care may be constrained. Establishing an evidence-based protocol tailored to such contexts can significantly improve patient outcomes.

This prospective study aims to analyze the clinical presentation, diagnostic modalities, and outcomes of various causes of acute scrotum and to compare the effectiveness of surgical and conservative management in a tertiary care hospital.

Materials and Methods

Study Design

This was a prospective cross-sectional observational study conducted at Acharya Vinobha Bhawe Rural Hospital, Sawangi (Meghe), Wardha, India. The study was carried out over two years, from August 2016 to October 2018.

Setting

The research was conducted in the Department of General Surgery at a tertiary care teaching hospital serving both urban and rural populations. All male patients presenting

with acute scrotal pain and/or swelling to the emergency department or outpatient clinic were evaluated. The period of recruitment extended from August 2016 to October 2018, and patients were followed up for 14 days and one month after initial management, either through in-person visits or telephonic assessment. Data collection and exposure assessment were performed prospectively during the hospital stay and follow-up visits.

Ethical Consideration

The study was approved by the Institutional Ethics Committee of Acharya Vinobha Bhawe Rural Hospital, Sawangi (Meghe), Wardha (Ethical Clearance No: AVBRH/IEC/2016/102, dated August 5, 2016). Written informed consent was obtained from all participants before inclusion in the study. All procedures were conducted in accordance with the Declaration of Helsinki (2013 revision).

Participants

A total of 100 male patients presenting with acute scrotal pain and/or swelling were included. Patients with painless swellings, isolated scrotal wall pathology, or acute inguinoscrotal hernias were excluded.

Bias

To minimize selection bias, all consecutive patients meeting the inclusion criteria during the study period were enrolled. Diagnostic and treatment decisions were guided by standardized clinical protocols and Colour Doppler ultrasonography to reduce diagnostic bias. Observer bias was minimized by involving two independent surgeons in the assessment and decision-making process.

Statistical analysis

Data were recorded prospectively and analyzed using SPSS version 22.0 (IBM Corp., Armonk, NY, USA), applying descriptive statistics to evaluate demographics, management approach, and treatment outcomes.

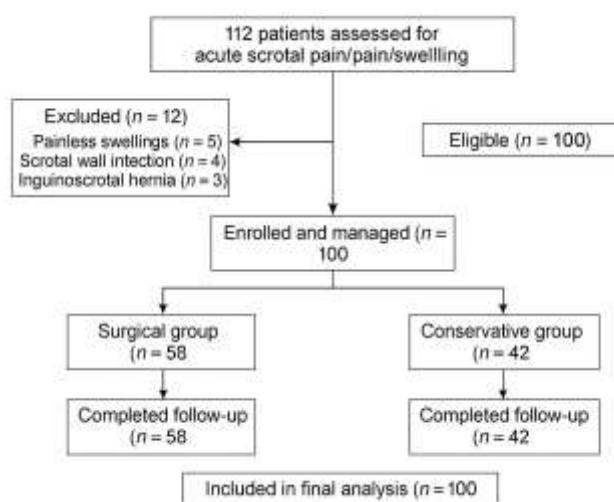
Result

Participant Flow

A total of 112 patients presented to the Department of General Surgery with acute scrotal pain and/or swelling during the study period (August 2016 to October 2018).

- 12 patients were excluded based on exclusion criteria — 5 had painless scrotal swellings, 4 had isolated scrotal wall infections, and 3 presented with acute inguinoscrotal hernia.

- 100 patients met the eligibility criteria and were enrolled in the study.
 - All 100 patients completed initial evaluation and management and were included in the final analysis.
 - 58 patients underwent surgical management, while
 - 42 patients were managed conservatively.
- During follow-up, 94 patients (94%) were reviewed in person at 14 days and 1 month, while 6 patients (6%) were followed up via telephone consultation due to travel constraints.
- No patients were lost to follow-up or withdrew consent, and therefore all 100 patients were included in the final analysis.



Management Distribution

Of the 58 surgically managed patients, the leading cause was testicular torsion (44 cases, 75.9%), with 36 (62.1%) undergoing successful detorsion and orchidopexy, and 8 (13.8%) requiring orchidectomy due to a non-viable testis at exploration. Additionally, 14 patients (24.1%) underwent scrotal exploration with drainage for pyocele or abscess. The 42 patients in the conservative group were predominantly diagnosed with epididymo-orchitis (36 cases, 85.7%), followed by mild pyocele or inflammatory swellings (6 cases, 14.3%), which responded favorably to conservative measures including broad-spectrum antibiotics, analgesics, scrotal elevation, and bed rest.

Outcomes

Testicular salvage rates were closely linked to the timing of surgical intervention. Among patients with testicular torsion,

81.8% achieved successful salvage when intervention was performed within six hours of symptom onset, whereas delayed presentation (>12 hours) resulted in an orchidectomy rate of 18.2% due to irreversible testicular necrosis.

Patients managed conservatively showed complete resolution of symptoms within two weeks, with no need for subsequent surgical intervention. Follow-up at one month revealed no recurrence of acute symptoms in either group, and no long-term complications were observed. Minor postoperative wound infections occurred in two patients (3.4% of the surgical group) and resolved with local care and antibiotics (Figure 1). There were no reports of chronic pain, scrotal deformity, or atrophy in the early postoperative period.

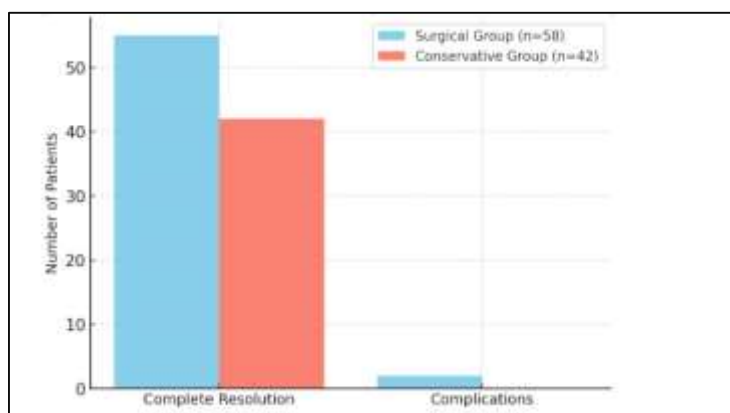


Figure 1. Comparative outcomes of surgical and conservative management of acute scrotum.

Statistical Overview

Surgical interventions constituted 58% of all cases, while conservative management accounted for 42% (Table 1). The

overall testicular salvage rate in torsion cases was 81.8%, demonstrating the critical importance of early intervention. No mortality or major systemic complications were reported during the study period.

Table 1: Distribution of Patients According to Management and Diagnosis

Group	Diagnosis/Procedure	Number of Patients (%)
Surgical (n=58)	Detorsion with orchidopexy	36 (62.1%)
	Orchidectomy	8 (13.8%)
	Pyocele/abscess drainage	14 (24.1%)
Conservative (n=42)	Epididymo-orchitis	36 (85.7%)
	Mild pyocele/inflammatory swelling	6 (14.3%)

Discussion

The present study compared surgical and conservative management of acute scrotum, emphasizing diagnostic accuracy, treatment outcomes, and timing of intervention. The findings highlight that timely diagnosis and appropriate management are essential to minimize morbidity and preserve testicular function. Testicular torsion emerged as the most frequent cause requiring surgical intervention, whereas infective and inflammatory conditions such as epididymo-orchitis were effectively managed conservatively. These results reaffirm the need for rapid differentiation between torsion and infection to guide appropriate treatment pathways.

The testicular salvage rate of 81.8% among patients operated within six hours of symptom onset underscores the critical importance of early surgical intervention. Delay beyond twelve hours was associated with a higher orchidectomy rate (18.2%) due to irreversible ischemic necrosis. These results are consistent with previous studies by Çayan et al. [13] and Kapoor [4], which demonstrated

that the likelihood of testicular salvage declines sharply after six to eight hours of torsion. Anderson and Williamson [9] similarly emphasized that surgical exploration should be immediate in suspected torsion to avoid testicular loss. This highlights the need for public awareness and efficient referral systems to ensure timely presentation and intervention.

Conversely, the conservative group, which primarily consisted of cases of epididymo-orchitis and mild pyocele, showed complete recovery with antibiotic and supportive therapy. These findings are in agreement with those reported by Madaan et al. [12] and Visser and Heyns [18], who observed cure rates exceeding 90% with conservative management. This confirms that when guided by clinical and ultrasonographic evaluation, non-surgical treatment can yield excellent outcomes and prevent unnecessary surgical exploration. The differentiation of infective from ischemic pathology, therefore, remains a cornerstone in managing acute scrotal pain.



Colour Doppler ultrasonography was instrumental in improving diagnostic precision. It provided a reliable assessment of testicular perfusion and effectively distinguished torsion from inflammatory causes. Previous authors such as Kalfa et al. [14] and Sidhu [6] have reported high sensitivity and specificity of Doppler imaging for acute scrotum. Our findings support these observations, although occasional false negatives may occur, particularly in early or partial torsion. As suggested by Mellick [11], when imaging findings are equivocal but clinical suspicion remains high, surgical exploration should not be delayed. This underscores that imaging should complement, not replace, clinical judgment.

The bimodal age distribution observed in our cohort—with torsion predominating in adolescents and epididymo-orchitis in middle-aged adults—correlates well with previous epidemiological data. Srinivasan et al. [3] and Mitemeyer et al. [17] have described similar patterns, attributing the first peak to anatomical predisposition in younger males and the second to urinary tract infections and comorbidities in adults. Such age-based trends assist clinicians in refining diagnostic suspicion and tailoring management strategies. Moreover, the low complication rate in our study (3.4% minor wound infection) parallels the findings of Jefferson et al. [19], who also reported minimal postoperative morbidity when evidence-based management protocols were followed.

The findings of this study are generalizable to tertiary and rural hospital settings where patients often present late or lack immediate access to specialist urological care. The inclusion of a broad age range (12–74 years) and use of standardized diagnostic and treatment protocols enhances the external validity of the results. However, extrapolation to urban or resource-rich settings should be done cautiously, as patient demographics, presentation timing, and healthcare accessibility may differ. Although measures such as consecutive sampling and standardized assessment were adopted to reduce bias, the study's single-center design and relatively small sample size limit its generalizability to larger populations.

In conclusion, the management of acute scrotum demands timely differentiation between surgical and conservative cases. Early surgical exploration in suspected torsion significantly improves testicular salvage, while conservative therapy remains highly effective for infective and inflammatory conditions. Colour Doppler ultrasonography should be used routinely to aid diagnosis, but clinical suspicion must remain paramount. Future multicenter prospective studies with larger sample sizes, longer follow-up periods, and regional representation are recommended to

validate these findings and further develop evidence-based guidelines for managing acute scrotum in both urban and rural healthcare contexts.

Conclusion

The management of an acute scrotum requires a careful balance between urgent surgical intervention and conservative therapy. Study demonstrates that early surgical exploration is critical in cases of testicular torsion and complicated scrotal infections, with high salvage rates when performed within six hours of symptom onset. Conversely, conservative treatment is highly effective for infective and inflammatory conditions such as epididymo-orchitis and mild pyocele, with complete symptom resolution and no recurrence. The findings emphasize that accurate and timely differentiation, supported by Colour Doppler ultrasonography, is essential to guide management and optimize outcomes.

Recommendation:

Early surgical exploration should be undertaken in suspected torsion, ideally within six hours, and Colour Doppler Ultrasonography should be routinely used to enhance diagnostic accuracy.

Abbreviation Full Form

AVBRH Acharya Vinobha Bhawe Rural Hospital
CDUS Colour Doppler Ultrasonography
SPSS Statistical Package for the Social Sciences
SD Standard Deviation
IEC Institutional Ethics Committee

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Data Availability

The data supporting the findings of this study are available from the corresponding author upon reasonable request.



Conflict of Interest

The authors declare that there is no conflict of interest regarding the publication of this study.

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