Journal of Research in
Orthopedic Science

May 2025. Volume 12. Number 2

Case Report

Atypical Terrible Triad Injuries of the Elbow Associated With Triceps Tendon Avulsion: A Case Series

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Citation Nakhaei Amroodi M, Bahaeddini M, Khajeh Alizadeh Attarr M, Hashemipour B, Mahdavifar M, Tabrizian P. Atypical Terrible Triad Injuries of the Elbow Associated With Triceps Tendon Avulsion: A Case Series. Journal of Research in Orthopedic Science. 2025; 12(2):103-106. http://dx.doi.org/10.32598/JROSJ.12.2.2736.1

http://dx.doi.org/10.32598/JROSJ.12.2.2736.1

Article info:
Received: 15 Jan 2025
Revised: 23 Feb 2025
Accepted: 21 Mar 2025
Available Online: 01 May 2025

Keywords:
Terrible triad, Elbow fracture, Triceps tendon avulsion, Elbow instability

ABSTRACT

Background: The terrible triad of the elbow classically consists of elbow dislocation, radial head fracture, and coronoid fracture, frequently accompanied by ligamentous injury leading to instability. However, atypical patterns have been increasingly reported, including associated injuries beyond the classical definition.

Case Presentation: We report a case series of four patients presenting with an atypical terrible triad injury of the elbow associated with triceps tendon avulsion. All patients sustained elbow fracture–dislocations following trauma, predominantly due to falling down or car accidents. Surgical management included open reduction and internal fixation (ORIF) with selective repair of osseous and capsuloligamentous structures. All patients achieved elbow stability following surgical intervention. Pain scores, assessed using the visual analog scale (VAS), improved postoperatively, and no cases of recurrent instability were observed during follow-up.

Conclusion: Atypical terrible triad injuries involving triceps tendon avulsion represent a rare but clinically significant variant of elbow fracture–dislocation. Early recognition and comprehensive surgical management are essential to restore elbow stability and function.

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Introduction

The terrible triad injury of the elbow was first introduced by Hotchkiss in 1966 and is defined by the presence of elbow dislocation or subluxation accompanied by fractures of the coronoid process and the radial head [1]. Notably, rupture of the triceps tendon is not considered part of the classical description of this injury pattern [2]. Terrible triad injuries are associated with a wide spectrum of complications, including nerve damage, wound-healing problems, heterotopic ossification, joint stiffness, nonunion, malunion, infection, and persistent instability [3, 4]. Given the highly congruent nature of the elbow joint, even minimal residual incongruity can adversely affect joint function and lead to unfavorable clinical outcomes [5].

With advances in surgical techniques and an improved understanding of elbow biomechanics, functional outcomes have significantly improved; nevertheless, deviations from the classic definition of the terrible triad are being increasingly reported in the literature [6, 7].

The purpose of this case series was to describe four patients with atypical terrible triad injuries of the elbow associated with triceps tendon avulsion and to highlight diagnostic considerations and surgical management strategies.

Case Presentation

This case series includes four patients diagnosed with atypical terrible triad injuries of the elbow. Demographic data, mechanism of injury, associated lesions, surgical treatment, and clinical parameters are summarized in Table 1.

All patients presented with acute elbow trauma accompanied by fracture–dislocation. Radiographic evaluation confirmed radial head involvement in all cases, along with elbow dislocation and associated triceps tendon avulsion. The mechanism of injury was falling down in three patients and car accident in one patient. One patient had a medical history of hypertension.

Surgical treatment consisted of open reduction and internal fixation (ORIF) tailored to fracture configuration, including management of the lateral collateral ligament and anterior capsule when indicated. Postoperative protocols emphasized early controlled mobilization to prevent stiffness while maintaining joint stability.

Discussion

Accurate preoperative diagnosis of triceps tendon rupture in the setting of terrible triad elbow injuries remains challenging. Due to pain, swelling, and gross instability, reliable clinical assessment of elbow extension strength is often not feasible in the acute phase. Consequently, diagnosis frequently depends on radiologic findings rather than physical examination.

One important radiographic indicator of triceps avulsion is the so-called “flake sign,” which appears as a small avulsed bony fragment from the olecranon, representing the insertion site of the triceps tendon [6]. Recognition of this subtle finding is critical, as failure to identify triceps involvement may lead to underestimation of elbow instability. However, it should be noted that triceps ruptures do not always demonstrate a visible flake sign on standard radiographs [3-5].

Although magnetic resonance imaging (MRI) can provide detailed evaluation of soft tissue injuries, its routine use in all patients with terrible triad injuries may not be cost-effective or practical, particularly in the acute trauma setting [3-5]. Similar diagnostic difficulties have been described in other complex joint injuries, such as rotator cuff tears associated with shoulder fracture–dis-

Table 1. Clinical characteristics of patients with atypical terrible triad injury

Case	Age (y)	Sex	Dominant Arm	Associated Injury	Mechanism	ORIF Procedure	PMH	VAS Score	Height (cm)	Weight (kg)	BMI (kg/m²)
1	37	M	R	Triceps avulsion	CA*	LCL + anterior capsule	–	2	175	85	27.8
2	64	F	R	Triceps avulsion	FD 8	LCL*	HTN	4	155	72	29.9
3	28	M	R	Triceps avulsion	FD	LCL	–	0	187	102	29.2
4	11	F	R	Triceps avulsion	FD	MCL*	–	3	156	61	25.1

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Abbreviations: PMH: Past medical history; VAS: Visual analog scale; FD: falling down; CA: Car accident; LCL: Lateral collateral ligament; MCL: Medial collateral ligament; M: Male; F: Female; R: Right.

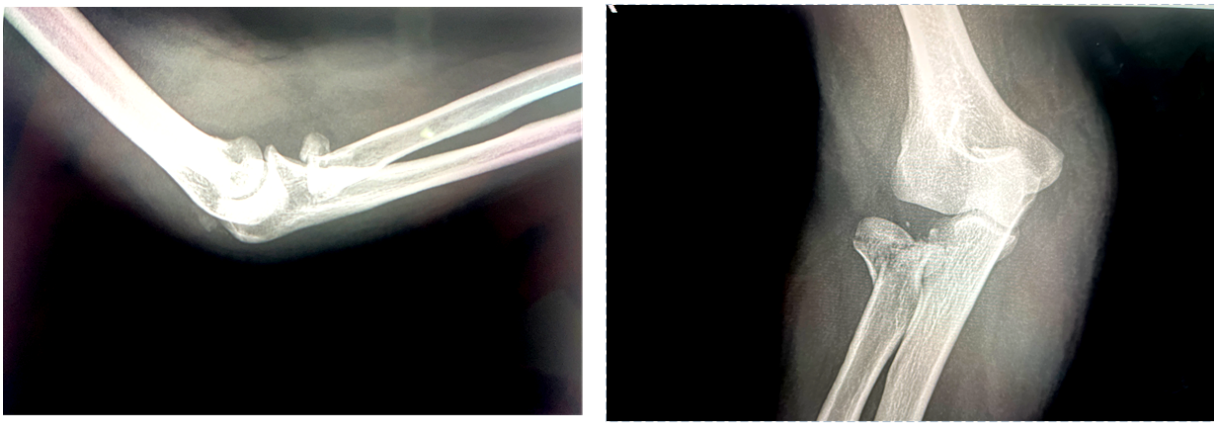

Figure 1. Radiographic evidence of triceps tendon avulsion associated with an atypical terrible triad injury of the elbow

locations or patellar tendon ruptures occurring with knee dislocations [8].

These complex injury patterns require a comprehensive diagnostic approach that integrates clinical suspicion with careful interpretation of imaging studies [9-11]. When a triceps tendon avulsion is suspected or confirmed, early and appropriate surgical intervention is essential to prevent long-term complications, such as persistent instability, weakness in elbow extension, and poor functional outcomes [4, 5, 11, 12].

Surgical repair of the triceps tendon is crucial to restoring posterior stability of the elbow and maintaining functional joint mechanics. In cases of atypical terrible triad injuries, instability is often more severe than that observed in classical terrible triad patterns, emphasizing the need for meticulous surgical planning and complete soft-tissue reconstruction [12].

Additionally, previous studies have shown that radial head resection may yield acceptable outcomes in selected terrible triad cases, provided that the interosseous membrane remains intact and an adequate range of motion is preserved postoperatively [13]. This highlights the importance of individualized treatment strategies based on the overall stability of the elbow rather than adherence to a single fixed surgical algorithm.

Conclusion

Atypical terrible triad injuries of the elbow associated with triceps tendon avulsion represent a rare and complex injury pattern. Awareness of this variant, careful imaging assessment, and individualized surgical management are essential to achieve satisfactory clinical outcomes.

Ethical Considerations

Compliance with ethical guidelines

Informed consent was obtained from the patients for the publication of this case report.

Funding

This research did not receive any grant from funding agencies in the public, commercial, or non-profit sectors.

Authors' contributions

All authors contributed equally to the conception and design of the study, data collection and analysis, interception of the results and drafting of the manuscript. Each author approved the final version of the manuscript for submission.

Conflict of interest

The authors declared no conflict of interest.

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