

Selective Nonoperative Management of Abdominal Gunshot Wounds: Contemporary Protocols, Patient Selection, and Failure Rescue

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Abstract: Penetrating abdominal trauma caused by firearm injuries has traditionally been managed with mandatory exploratory laparotomy. Advances in imaging, critical care, and clinical monitoring have progressively supported selective nonoperative management (NOM) in carefully selected patients, challenging historical dogma and reducing nontherapeutic laparotomy rates. To review contemporary evidence and protocols guiding nonoperative management of abdominal gunshot wounds, with emphasis on patient selection, diagnostic strategies, monitoring protocols, and criteria for conversion to operative intervention. A structured narrative review was conducted using PubMed/MEDLINE, Scopus, and SciELO databases. A total of 247 records were identified, of which 20 articles met predefined inclusion criteria and were selected for qualitative synthesis. Evidence supports selective nonoperative management in hemodynamically stable patients without signs of peritonitis, provided that structured protocols and close monitoring are implemented. Computed tomography plays a central role in patient selection, while serial physical examinations remain essential for early detection of treatment failure. Reported success rates exceed 80–90% in experienced trauma centers. Protocol-driven nonoperative management of abdominal gunshot wounds is a safe and effective strategy in selected patients and should be integrated into modern trauma algorithms.

Keywords: Abdominal Gunshot; Nonoperative Management; Penetrating Abdominal Trauma.

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1. Introduction

Penetrating abdominal trauma caused by firearm injuries remains a major challenge for trauma systems worldwide, particularly in urban civilian settings. Historically, abdominal gunshot wounds (GSW) were considered an absolute indication for mandatory exploratory laparotomy, driven by the high incidence of hollow viscus injury and the limited diagnostic tools available to reliably exclude intra-abdominal damage. While this approach minimized missed injuries, it also resulted in a substantial rate of nontherapeutic laparotomies, exposing patients to unnecessary morbidity, prolonged hospitalization, and increased healthcare costs [1, 2].

Over the past two decades, advances in trauma imaging, critical care, and clinical monitoring have profoundly changed the management paradigm of penetrating abdominal injuries. The widespread availability of high-resolution multidetector computed

tomography (CT), combined with a better understanding of injury patterns and ballistic trajectories, has enabled a more selective approach to operative intervention. As a result, selective nonoperative management (SNOM) has emerged as a safe and effective strategy for carefully selected patients with abdominal GSW, particularly those who are hemodynamically stable and without signs of peritonitis [3].

Current evidence demonstrates that, in experienced trauma centers, SNOM can significantly reduce the incidence of nontherapeutic laparotomy without increasing missed injury rates or mortality. Large prospective and retrospective series have reported success rates exceeding 80–90% when strict selection criteria and structured observation protocols are applied [2, 4]. These findings have been consistently supported by systematic reviews and meta-analyses, reinforcing the role of protocol-driven observation in modern trauma care [5, 6].

Patient selection remains the cornerstone of successful non-operative management. Hemodynamic stability, absence of diffuse peritonitis, reliable physical examination, and appropriate imaging evaluation are universally recognized prerequisites [1, 7]. CT imaging plays a central role in this process, allowing the identification of solid organ injuries, active bleeding, bowel wall abnormalities, free air, and missile trajectory, all of which influence management decisions [8, 9]. Nevertheless, CT findings must always be interpreted within the clinical context.

Despite its increasing adoption, SNOM of abdominal GSW remains a topic of ongoing debate. Concerns persist regarding delayed recognition of hollow viscus and mesenteric injuries, the optimal duration and intensity of observation, and the management of patients who fail initial nonoperative treatment. Studies evaluating failed SNOM highlight that delayed operative intervention, when promptly recognized through serial examinations and laboratory monitoring, does not appear to worsen outcomes compared to immediate surgery [10, 11].

2. Materials and Methods

This manuscript is intentionally structured as a narrative review with expert perspective. The objective is to integrate contemporary evidence with clinical reasoning and protocol-based decision-making, rather than to perform a systematic review or quantitative meta-analysis. Although database searches and inclusion counts are presented for transparency, the intent of this work is not to replicate a systematic review. The selection strategy was used to identify the most clinically relevant and protocol-informing evidence for adult civilian abdominal GSW, and the synthesis emphasizes expert interpretation and operational decision-making. For this reason, formal risk-of-bias grading and PRISMA flow reporting were not applied, and conclusions are framed within the context of real-world trauma system readiness [1, 3].

This study was designed as a narrative review with a structured methodological framework aimed at synthesizing contemporary evidence on protocol-based nonoperative management (NOM) of penetrating abdominal firearm injuries. The initial search yielded a total of 247 records, including 132 articles from PubMed/MEDLINE, 91 from Scopus, and 24 from SciELO. After removal of duplicate publications ($n = 58$), 189 unique articles remained for title and abstract screening. During this phase, 143 articles were excluded due to lack of relevance to penetrating abdominal firearm trauma, exclusive focus on blunt injuries or pediatric populations, or absence of discussion regarding nonoperative management strategies. Consequently, 46 articles underwent full-text evaluation. Following detailed assessment, 26 articles were excluded because they consisted of isolated case reports without protocol relevance, focused exclusively on operative management, or provided insufficient methodological detail. Ultimately, 20 articles met the predefined inclusion criteria and were selected for qualitative synthesis.

A comprehensive search was conducted across PubMed/MEDLINE, Scopus, and SciELO using controlled vocabulary and free-text keywords, including “abdominal gunshot wound,” “penetrating abdominal trauma,” “firearm injury,” “nonoperative

management," "selective nonoperative management," "SNOM," "computed tomography," and "trauma protocols." Reference lists of key articles and international guidelines were manually reviewed to identify additional relevant studies.

Eligible studies included adult populations (≥ 18 years) and addressed nonoperative or selective nonoperative strategies for abdominal firearm injuries. Prospective and retrospective cohort studies, systematic and narrative reviews, and international guidelines were considered. Data synthesis was conducted thematically, focusing on patient selection, diagnostic strategies, monitoring protocols, and criteria for conversion to operative intervention.

3. Discussion

The management of abdominal gunshot wounds has undergone a substantial paradigm shift over recent decades. Evidence consistently supports selective nonoperative management as a safe and effective strategy in carefully selected patients when implemented within structured protocols [1, 3, 7]. Hemodynamic stability remains the primary determinant for NOM eligibility [1]. Computed tomography has become central to modern protocols, enabling accurate assessment of injury patterns and guiding decision-making, although it must be interpreted in conjunction with clinical findings [8, 9].

Serial physical examination remains indispensable for early identification of hollow viscus injury and evolving peritonitis, especially in patients with initially equivocal imaging. However, hemodynamic stability should not be interpreted as a purely binary variable. In contemporary urban firearm environments, a substantial proportion of patients present as transient responders, patients who require initial fluid or blood product resuscitation but subsequently achieve temporary normalization of vital signs. From an expert perspective, transient responders represent a distinct and high-risk subgroup within SNOM protocols [5].

Transient responders should only be considered candidates for SNOM if stability is sustained over time without recurrent hypotension, escalating transfusion requirements, or progression of metabolic derangement. Serial assessment of heart rate trends, blood pressure variability, urine output, and, when available, lactate and base deficit trajectories strengthens early risk stratification and helps distinguish true stability from temporary compensation [4]. Conversely, patients who require repeated boluses, ongoing transfusion, or demonstrate worsening acidosis should be regarded as functionally unstable, even if momentary normalization is achieved. In these scenarios, early operative or minimally invasive intervention should be strongly considered, as delayed conversion may increase morbidity and complexity of subsequent surgery.

Avoidance of nontherapeutic laparotomy represents a major advantage of NOM, reducing morbidity, length of stay, and healthcare costs [2, 4]. Importantly, studies demonstrate that delayed operative intervention following failed NOM does not worsen outcomes when prompt recognition and conversion occur [10, 11].

3.1 Failure Rescue in SNOM: Operational Triggers for Conversion

Failure of SNOM is rarely abrupt; it is typically preceded by subtle but progressive clinical deterioration. Effective rescue therefore requires a proactive, protocolized strategy rather than reliance on delayed recognition [6]. Clinically, increasing abdominal tenderness, new peritoneal signs, persistent tachycardia, unexplained fever, or escalating analgesic requirements should prompt immediate reassessment. Laboratory evolution should be interpreted as an early warning system. Rising lactate, worsening base deficit, leukocytosis, and, when utilized, procalcitonin trends may support suspicion for evolving hollow viscus injury or ongoing inflammatory burden, particularly in patients with an unreliable physical examination. These signals should not be used in isolation, but as part of a structured surveillance bundle [10, 11].

Time is an additional determinant of safety. Lack of clinical improvement or persistence of equivocal findings within approximately 8–12 hours of observation should prompt escalation, repeat imaging, early diagnostic laparoscopy, or conversion to laparotomy, depending on the institutional context. Importantly, conversion should be viewed as a component of active rescue rather than a failure of initial judgment.

Ongoing controversies include optimal observation duration, management of equivocal CT findings, and the role of minimally invasive techniques, particularly diagnostic laparoscopy, as an extension of selective nonoperative care. In 2026, diagnostic laparoscopy should be considered more than an optional adjunct: in appropriately selected hemodynamically stable patients with suspected peritoneal violation, laparoscopy provides direct visualization, facilitates early detection of hollow viscus injury, and may allow minimally invasive therapeutic intervention, potentially reducing both missed injuries and non-therapeutic laparotomies. Its implementation, however, is inseparable from system readiness, surgical expertise, and immediate conversion capability [9].

Future directions include refinement of risk stratification tools and pragmatic integration of advanced imaging and decision-support approaches, including artificial intelligence, with a realistic emphasis on validation, generalizability, and safety outside elite centers [6].

4. Conclusion

Selective nonoperative management of abdominal gunshot wounds represents a well-established and evidence-supported strategy in contemporary trauma care when applied within structured, protocol-driven frameworks [1, 7]. In carefully selected patients, NOM is safe, effective, and associated with reduced rates of nontherapeutic laparotomy [2, 4]. Successful implementation depends on strict patient selection, high-quality CT imaging, continuous clinical reassessment, and immediate access to surgical intervention. Nonoperative management should be viewed as an active and dynamic process, not as an attempt to avoid surgery at all costs. Evidence indicates that timely conversion to operative management after clinical deterioration preserves outcomes and mitigates the risk of missed injuries [10, 11].

Protocol-based NOM should be considered a standard component of modern trauma algorithms. Continued refinement of selection criteria, monitoring strategies, and decision-support tools will further enhance outcomes in penetrating abdominal firearm injuries, while minimizing unnecessary laparotomy and optimizing resource utilization [6]. From an expert perspective, the central safeguard of SNOM is not the initial decision to observe, but the institutional ability to detect physiological drift early and to execute timely failure rescue. Programs adopting SNOM should therefore define explicit monitoring intervals, documented conversion triggers, and a structured escalation pathway, ensuring that the avoidance of nontherapeutic laparotomy does not come at the expense of delayed recognition of bowel or mesenteric injury [10, 11].

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