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Original article

Validity of Selective Management in Trans pelvic Gunshot Wounds

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Abstract
The purpose of this study was to assess the validity of selective management in patients presenting with penetrating transpelvic gunshot wounds. In hemodynamically stable individuals who do not exhibit significant clinical warning signs, non-operative management may be a safe and viable approach. This method, known as selective management, emphasizes the identification of patients who do not necessitate immediate surgical intervention following such trauma. A retrospective analytical study was carried out at the Department of General Surgery, Misurata Teaching Hospital, over two years from February 17, 2011, to February 16, 2013. All patients admitted with transpelvic gunshot injuries were treated according to a predefined management protocol. Surgical exploration via laparotomy was reserved for cases showing clear clinical indicators, such as peritoneal signs, hemodynamic instability, gross hematuria, or rectal bleeding. Patients who did not exhibit these signs were managed conservatively and kept under close observation. The diagnostic accuracy of this selective approach was evaluated by calculating sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and overall accuracy. A total of 37 patients were included in the study and categorized into two groups. The first group consisted of 16 patients (43.2%) who underwent immediate laparotomy based on initial clinical assessment. In 15 of these cases, the procedure was deemed therapeutic. The clinical examination in this group demonstrated a sensitivity of 68.2%, a specificity of 92.3%, a PPV of 93.8%, and an NPV of 63.2%. The second group comprised 21 patients (56.8%) who were managed conservatively under the selective non-operative protocol. Among these, nine patients (24.3%) eventually required delayed surgery due to emerging clinical symptoms, although two of these laparotomies were non-therapeutic. The remaining twelve patients (32.4%) were successfully treated without surgery. For this group, the selective protocol achieved a sensitivity of 100%, specificity of 85.7%, PPV of 77.8%, and NPV of 100%. In conclusion, selective management appears to be a safe and effective strategy for reducing the incidence of unnecessary laparotomies in cases of transpelvic gunshot wounds. The cornerstone of this approach remains careful clinical examination, supplemented by appropriate diagnostic tools. As the adoption of selective non-operative protocols becomes more widespread, the rate of non-therapeutic surgical interventions continues to decline. Nevertheless, the success of this strategy depends heavily on accurate patient selection and strict adherence to the established management criteria.
Keywords. *Gunshot Wounds, Selective Management, Non-Operative Management.*

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Introduction

Pelvic gunshot wounds (PGSWs) represent some of the most complex and demanding injuries faced in trauma surgery. Their management requires rapid decision-making, strategic planning, and frequently, the involvement of a multidisciplinary team due to the potential for damage to multiple vital organ systems. These injuries often affect the gastrointestinal tract, vascular structures, and genitourinary system, all of which are situated within the confined and anatomically intricate pelvic region. The high-energy nature of ballistic trauma further complicates these scenarios, often necessitating immediate and coordinated surgical intervention to control hemorrhage, manage contamination, and repair structural injuries [1].

From the perspective of general surgery, several priorities must be addressed when managing PGSWs. Chief among these is hemorrhage control, as bleeding is the leading cause of early mortality in such cases. Prompt and decisive interventions, such as pelvic packing, vessel ligation, or angioembolization, are often necessary to stabilize the patient. Vascular injuries are reported in approximately 25% of PGSW cases and require swift recognition and management to prevent fatal outcomes from exsanguination [2].

Another major concern involves injuries to hollow visceral organs, particularly the rectum and bladder, which are commonly involved due to their anatomical proximity. These injuries demand meticulous surgical repair to minimize contamination and reduce the risk of infection. In cases of rectal injury, diversion via colostomy is often performed to

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prevent pelvic sepsis. Additionally, injuries may extend to adjacent structures such as the small intestine or sigmoid colon, necessitating careful intraoperative assessment and management [3].

In hemodynamically unstable patients, the principle of damage control surgery (DCS) plays a central role. DCS prioritizes rapid control of hemorrhage and contamination, followed by physiological stabilization, deferring definitive repair to a later stage. This strategy often includes the use of temporary abdominal closure to allow for resuscitation and subsequent reoperation under more favorable conditions [4].

General surgeons play a pivotal role in the early management of PGSWs. As first responders, they are tasked with the initial assessment, triage, and life-saving interventions that are critical for patient survival. Their role continues throughout the care continuum, from emergency procedures to long-term follow-up. While optimal outcomes often depend on a team-based approach involving multiple specialties, the leadership and expertise of general surgeons are indispensable in addressing the acute challenges posed by these complex injuries [5].

Methods

Study design and setting

This was a retrospective cross-sectional study that encompassed all patients admitted to the Department of General Surgery at Misurata Teaching Hospital with transpelvic gunshot wounds over 24 months.

Eligibility criteria

The criteria for selecting non-operative management included hemodynamic stability, the presence of stable pelvic fractures, absence of significant hollow organ injury, no clinical signs of infection or sepsis, and intact neurovascular function. These patients were carefully monitored for any change in condition that might necessitate surgical intervention.

Data collection

During this time, a standardized management protocol was implemented to guide clinical decisions and ensure consistency in treatment. Surgical intervention in the form of exploratory laparotomy was reserved for patients presenting with specific clinical indicators suggestive of significant intra-abdominal injury. These indicators included signs of peritoneal irritation, hemodynamic instability, gross hematuria, or rectal bleeding. In contrast, patients who did not exhibit any of these critical signs were managed conservatively under close clinical observation.

Additional diagnostic tools were utilized selectively based on the clinical judgment of the attending surgeon. These included computed tomography (CT) scans, contrast enemas, flexible sigmoidoscopies, and cystograms. None of these investigations were employed as part of a routine protocol, but rather tailored to the specific presentation and evolving clinical scenario of each case.

Each patient was assessed comprehensively, and management decisions were personalized to reflect both the nature of the injury and the overall clinical condition. This individualized approach aimed to optimize outcomes by balancing the risks of unnecessary surgical intervention against the dangers of missed injuries.

Ethical approval

This study was conducted following approval from the Ethics Committee of Misurata Teaching Hospital, and all patient data were handled with strict confidentiality to ensure privacy and compliance with ethical standards.

Statistical Analysis

Data were entered into Microsoft Excel, and the categorical variables were reported as frequencies and percentages, while continuous variables (e.g., age, length of hospital stay) were summarized using means and ranges. These measures were derived by comparing the initial clinical management decisions (operative vs. conservative) with the outcomes (therapeutic vs. non-therapeutic laparotomy or successful conservative management).

Results

This study included a total of thirty-seven patients who sustained transpelvic gunshot wounds and were managed according to a standardized clinical protocol. Patients were stratified into two groups based on their initial clinical presentation and management strategy. Group 1 consisted of sixteen patients (43.2%) who underwent immediate

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surgical intervention due to clear clinical indications, while Group 2 included twenty-one patients (56.8%) who were managed conservatively with close clinical observation.

Table 1. Distribution of injured abdominal and vascular structures among patients with transpelvic gunshot wounds.

Abdominal organ	Number of Patients
Left colon	13
Small bowel	10
Right colon	6
Urinary bladder	2
Femoral artery	1
Iliac vessels	1
Sacrum fracture	1

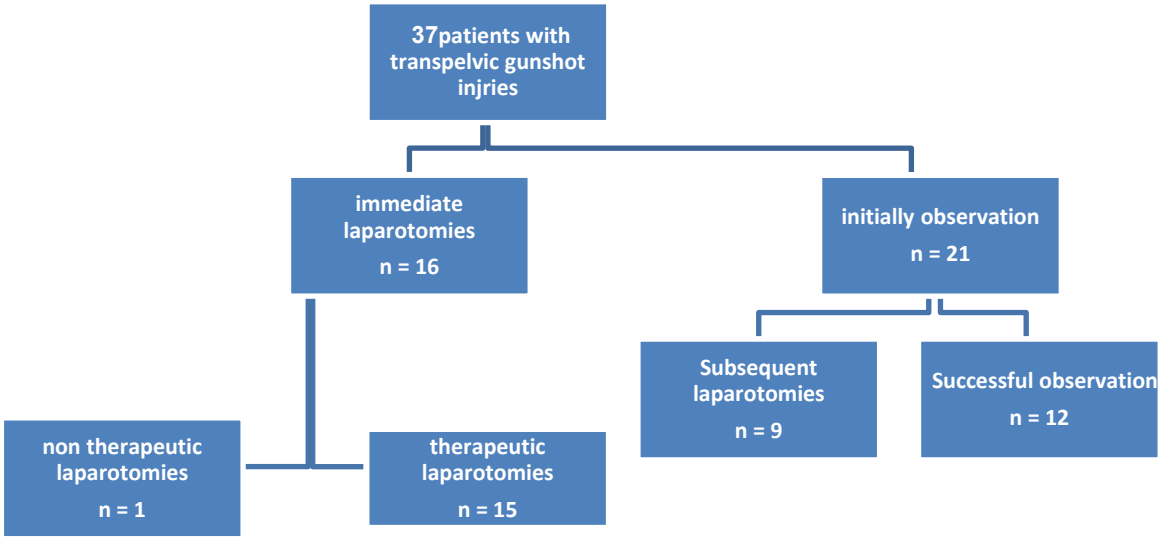

Figure 1. Summary of overall outcomes among patients with transpelvic gunshot wounds.

The mean age of the cohort was twenty-nine years, with a range spanning from eighteen to sixty-seven years. Twenty-eight patients sustained gunshot injuries localized to the anterior pelvic region, and nine patients had injuries affecting the buttock area. In Group 1, the predominant clinical presentation was signs of peritonitis, observed in fourteen patients (87.5%). Other indications for immediate surgery included rectal bleeding in two patients (12.5%), hemodynamic instability with absent pulses in the lower extremity in two patients (12.5%), gross hematuria in one patient (6.25%), and neurological deficit in one patient (6.25%). Surgical intervention, consisting primarily of exploratory laparotomy, was highly effective, with therapeutic procedures performed in fifteen of the sixteen patients (93.75%), confirming the presence of injuries requiring surgical repair. Patients in Group 2 were initially managed non-operatively due to the absence of critical clinical signs. However, during the observation period, nine patients (24.3%) developed abdominal tenderness necessitating delayed exploratory laparotomy. Among these, two laparotomies were non-therapeutic. The remaining twelve patients (32.4%) were successfully managed without operative intervention.

Diagnostic imaging modalities, including computed tomography and ultrasound, were utilized selectively at the discretion of the attending physician rather than routinely. Importantly, imaging results did not influence the initial decision for surgery in Group 1, which was based primarily on clinical examination. The average length of hospital stay was 4.5 days for patients undergoing surgery and 2.7 days for those managed conservatively, resulting in an overall mean hospital stay of 3.9 days. There were no recorded mortalities, and complications were limited to three patients (8.1%).

Clinical examination demonstrated robust diagnostic performance, with a sensitivity of 68.2%, specificity of 92.3%, positive predictive value of 93.8%, and negative predictive value of 63.2% in determining the need for immediate

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surgical intervention. The selective conservative management protocol exhibited even higher performance, with sensitivity and negative predictive value of 100%, specificity of 85.7%, and positive predictive value of 77.8%.

Table 2. Diagnostic performance metrics of clinical exam vs. conservative protocol.

Metric	Clinical Exam	Conservative Protocol
Sensitivity	68.2%	100%
Specificity	93.3%	87.5%
Positive Predictive Value	93.8%	77.8%
Negative Predictive Value	66.7%	100%

Discussion

Transpelvic gunshot wounds (TPGSWs) present a formidable challenge to trauma surgeons due to the complex anatomy of the pelvis, which houses multiple vital organ systems within a relatively small and rigid anatomical space. The pelvis contains major vascular structures such as the iliac vessels, components of the gastrointestinal tract, including the rectum and sigmoid colon, and elements of the genitourinary system, such as the bladder and urethra. Injuries in this region, therefore, carry a high risk of life-threatening hemorrhage, visceral contamination, and subsequent sepsis [1, 2]. Historically, the management of TPGSWs mandated routine exploratory laparotomy for all patients, aiming to prevent missed injuries and their complications. However, such a strategy often led to a substantial proportion of nontherapeutic laparotomies, exposing patients to unnecessary operative risks, prolonged recovery times, and increased healthcare costs [3, 4].

Our study reinforces the contemporary trend towards selective management protocols guided predominantly by clinical assessment. Among the 37 patients studied, those who underwent immediate laparotomy due to clinical signs (such as peritonitis, gross hematuria, rectal bleeding, and hemodynamic instability) had a high rate of therapeutic laparotomies (93.75%). This strongly supports the use of specific clinical criteria as reliable predictors for operative intervention. These results are consistent with the seminal work by Velmahos et al. [5], who demonstrated that the presence of peritoneal signs and hemodynamic instability are robust indications for surgery in TPGSW patients, thereby minimizing the rate of negative laparotomies. Conversely, patients who were initially managed conservatively under a selective protocol showed favorable outcomes, with 57.1% successfully avoiding surgery. Among this group, only 24.3% subsequently developed clinical signs warranting delayed laparotomy, with two nontherapeutic procedures reported. Notably, there were no mortalities, and the complication rate was low (8.1%). These findings corroborate earlier studies such as those by Munera et al. [6], which reported that selective nonoperative management (SNOM) can safely reduce unnecessary laparotomies without increasing missed injuries or adverse outcomes. Moreover, the high sensitivity (100%) and negative predictive value (100%) of the selective management protocol in our cohort emphasize its safety and efficacy when combined with vigilant clinical surveillance.

Diagnostic imaging, particularly computed tomography (CT), played an adjunctive but important role. While CT was not routinely decisive in surgical decision-making in our cohort, it facilitated detailed assessment of bullet trajectories, identification of potential organ injury, and exclusion of occult complications. This selective use of imaging aligns with current trauma management paradigms that advocate for CT scans as complementary tools rather than substitutes for thorough clinical evaluation [7, 8]. Recent literature, including the studies by Demetriades et al. [9] and Smith et al. [10], underscores the utility of CT in refining patient stratification and optimizing management pathways, particularly in stable patients where clinical signs may be subtle.

Implementing selective nonoperative management is not without challenges. Distracting injuries, such as concomitant pelvic fractures or extremity trauma, may impair accurate abdominal examination. In our cohort, no significant delays or missed injuries were observed related to such distractions, likely due to rigorous serial clinical evaluations. Patients with altered sensorium, whether due to intoxication or traumatic brain injury, were excluded from conservative management, consistent with established guidelines, given the unreliability of physical examination in these cases [11]. Furthermore, bullet trajectories suspicious for intra-abdominal penetration warrant a lower threshold for exploration, even in the absence of overt clinical signs, to mitigate the risk of missed hollow viscus injuries [12].

Comparing our results with existing literature, the low rate of nontherapeutic laparotomies (2.7%) contrasts favorably with older studies reporting rates as high as 30–40% when mandatory laparotomy was performed [3, 4]. The selective management protocol's specificity (85.7%) and positive predictive value (77.8%) reflect an acceptable trade-off, wherein a small proportion of initially non-operated patients require delayed intervention. This is an expected and manageable

aspect of conservative strategies, provided there is access to timely reassessment and intervention [6, 13]. The clinical examination's sensitivity (68.2%) and negative predictive value (63.2%) in immediate surgical candidates highlight that while clinical assessment is robust, it is not infallible, underscoring the need for adjunct imaging and close follow-up.

Conclusion

Selective management of transpelvic gunshot wounds represents a safe, effective, and evidence-based approach that significantly reduces the incidence of unnecessary surgical interventions. Careful and repeated clinical examination remains the fundamental element guiding decision-making, supported by targeted diagnostic investigations when clinically indicated. The growing adoption of Selective Nonoperative Management reflects an important paradigm shift in trauma care, particularly for hemodynamically stable patients without clear signs of peritoneal violation. This strategy substantially lowers the rate of nontherapeutic laparotomies and their associated morbidity, while preserving excellent patient outcomes. Successful implementation of this approach requires meticulous patient selection, strict adherence to standardized management protocols, and continuous clinical monitoring to promptly identify those requiring delayed surgical intervention. When appropriately applied, selective management offers a reliable and resource-conscious alternative to routine exploratory laparotomy in penetrating pelvic trauma, improving patient safety and optimizing healthcare delivery.

Authors' Contributions

Esam Alsaghair: Study design, data collection, and surgical management; **Taher Alkesa:** Data analysis, manuscript drafting; **Wesam Elsaghayer:** Literature review, manuscript revision, and final approval.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this study

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