Article

Impact of a Responsibility System Management Model on Deep Vein Thrombosis and Functional Recovery Following Internal Fixation for Pelvic Fractures

Ann. Ital. Chir., 2025 96, 11: 1479–1486
https://doi.org/10.62713/aic.4364

Meilan Ding[1], Li Huang[1]

[1]Department of Trauma Emergency Center, Ganzhou People's Hospital, 341000 Ganzhou, Jiangxi, China

AIM: This study evaluates the impact of a responsibility system management model in patients undergoing internal fixation for pelvic fractures, by examining the incidence of deep vein thrombosis (DVT) and postoperative pelvic functional recovery.

METHODS: This retrospective observational study included 145 patients who underwent internal fixation for pelvic fractures at Ganzhou People's Hospital between January 2022 and October 2024. Based on the nursing model, patients were categorized into a responsibility care group (n = 70), which received responsibility system management nursing care and a conventional care group (n = 75), which was managed through conventional postoperative care. The incidence of postoperative lower extremity DVT was compared between the two groups. Furthermore, pelvic function was assessed using the Majeed Pelvic Score and pain levels were evaluated using the Visual Analogue Scale (VAS). Additional parameters assessed were postoperative recovery, compliance with mechanical prophylaxis, and nursing satisfaction.

RESULTS: The responsibility system management care group demonstrated a significantly lower incidence of postoperative lower extremity DVT compared to the conventional care group ($p < 0.05$). Furthermore, the responsibility care group had significantly higher postoperative Majeed functional scores, lower VAS pain scores ($p < 0.05$), better overall recovery, longer duration of mechanical prophylaxis use, and higher nursing satisfaction ($p < 0.05$).

CONCLUSIONS: The responsibility system management nursing model was significantly associated with a lower risk of early DVT and better short-term pelvic functional recovery during hospitalization. This model represents a promising postoperative management strategy; however, its long-term efficacy and generalizability require further validation through multicenter prospective studies with extended follow-up.

Keywords: pelvic fractures; deep vein thrombosis; functional recovery

Introduction

Pelvic fractures are usually caused by high-energy trauma, accounting for approximately 3% of all fractures; unstable pelvic fractures are particularly severe and complex, frequently associated with multiple injuries, and are characterized by high mortality and disability rates [1–4]. Internal fixation is crucial to restore pelvic ring stability; however, the two major challenges that postoperative management faces are deep vein thrombosis (DVT) and limited functional recovery [5–7].

DVT is a common complication following pelvic surgery. Thrombosis risk is significantly elevated by vascular endothelial injury from the trauma, venous stasis linked to pain and immobility, and a hypercoagulable state [8]. Without effective prophylaxis, the incidence of DVT can exceed 60% in pelvic fracture patients [9,10]. Subsequent pulmonary embolism (PE) is life-threatening. Although pharmacological and mechanical management approaches are widely adopted, their effectiveness depends heavily on adherence and proper implementation, which are often suboptimal in routine clinical practice [11,12].

Functional recovery after pelvic fracture surgery is typically a lengthy and complex process. Outcomes depend not only on the quality of fracture reduction but also on effective analgesia and the timely initiation of adequate rehabilitation exercises [13]. To enhance nursing care and improve outcomes, the responsibility system management nursing model has been introduced, which focuses on providing nurses with greater autonomy and responsibility [14]. Emerging evidence suggests that responsibility system management models can facilitate recovery and enhance patient satisfaction [15,16].

This model aims to address the limitations of traditional rehabilitation nursing by providing a more targeted, comprehensive, and patient-centered care. However, standardized accountability management protocols are yet to be established, and implementing such models remains challenging. Therefore, to assess its impact, our department established a nursing team operating under a responsibility-system man-

Submitted: 23 September 2025 Revised: 27 October 2025 Accepted: 31 October 2025 Published: 10 November 2025

Correspondence to: Li Huang, Department of Trauma Emergency Center, Ganzhou People's Hospital, 341000 Ganzhou, Jiangxi, China (e-mail: 15970088107@163.com).

agement framework and monitored patient outcomes following pelvic fracture surgery, intending to provide evidence to optimize nursing strategies and improve prognosis.

Materials and Methods

Recruitment of Study Participants

This retrospective observational study collected clinical data from patients who underwent internal fixation for pelvic fractures at Ganzhou People's Hospital between January 2022 and October 2024. The study population was selected according to the process detailed in the supplementary flowchart (**Supplementary Fig. 1**).

Pre-defined inclusion criteria for patient selection were as follows: (1) age $\geq$18 years; (2) closed pelvic fracture confirmed by radiography and computed tomography (CT), treated with open reduction and internal fixation (ORIF); and (3) availability of complete clinical data. Exclusion criteria included: (1) severe comorbidities (e.g., heart failure, hepatic or renal insufficiency, malignancy); (2) a history of DVT within the past 6 months; and (3) incomplete medical records.

Applying pre-defined inclusion-exclusion criteria, 145 patients were enrolled in this study. Based on the nursing model documented in their medical records, study participants were retrospectively assigned to two groups: the responsibility care group (n = 70), which received the responsibility system management nursing model, and the conventional care group (n = 75), which underwent conventional nursing care.

As a retrospective analysis protecting patient privacy and causing no harm, this study was exempt from ethical approval by Ganzhou People's Hospital per local regulations.

Nursing Interventions

The intervention was initiated within 24 hours after surgery. The responsibility care group received a responsibility system management nursing model as follows:

- Accountability Team: This team was led by the head nurse and senior responsible nurses in coordination with the attending physician. Each patient was managed by a designated responsible nurse from admission to discharge. The responsible nurse conducted structured assessments at least twice daily (during morning and afternoon rounds).
- Development of Individualized Plan: The responsible nurse collaborated with the physician to develop an individualized prevention and rehabilitation plan, documented in a dedicated nursing plan sheet.
- Implementation and Supervision: The implementation and supervision plan included basic prevention, physical prevention, rehabilitation exercise, health education, and psychological support. (a) During basic prevention, patients were instructed and promoted to maintain adequate hydration, quit smoking and alcohol, and perform ankle-pump exercises. They were directed to maintain a daily fluid intake of at least 1500 mL. (b) The responsible nurse assisted patients in physical preventive measures. They were instructed on the correct use of intermittent pneumatic compression (IPC) devices and graduated compression stockings and monitored both the duration and effectiveness of usage beyond merely providing the equipment. (c) Patients received a phased rehabilitation exercise developed and supervised based on postoperative recovery. Daily exercise types and target frequencies were specified, such as ankle pumps at 50 repetitions/set, 5–6 sets/day. (d) Responsible nurses provided health education and psychological support. Repeated DVT education was provided in various formats, such as images and videos. Trained responsible nurses provided emotional support at least three times per week. The Hospital Anxiety and Depression Scale (HADS) was used for brief screening. Support sessions were based on principles of motivational interviewing with pre-defined communication guidelines to address anxiety and depression related to pain and immobility, and to enhance confidence in rehabilitation.

Patients in the conventional care group received routine postoperative orthopedic care, including basic prevention, physical prevention, rehabilitation exercise, health education, and psychological support.

- Basic Prevention: Routine verbal health education was provided regarding the importance of adequate hydration, smoking and alcohol cessation, and ankle pump exercises. However, no specific daily fluid intake was set or consistently monitored, and no dedicated nursing staff was assigned to ensure or document patient adherence.
- Physical Prevention: Intermittent pneumatic compression devices and graduated compression stockings were provided to patients, along with initial instructions on their use. Thereafter, the application, proper fitting, and daily use of these devices were primarily the responsibility of the patient and their family, without systematic verification, supervision, or recording of daily usage duration by nursing staff.
- Rehabilitation Exercise: Patients received rehabilitation guidance according to the physician's general instructions rather than individualized plans. Nurses provided basic, one-time instructions on exercises; however, phased rehabilitation protocols, specified daily exercise frequencies or repetitions, and ongoing supervision or progression based on patient recovery were not implemented.
- Health Education and Psychological Support: Patients received standard, leaflet-based education on DVT prevention and rehabilitation. Reactive psychological support was provided only when patients explicitly reported distress or significant emotional symptoms were observed during routine care. No scheduled psychological assessments or structured support sessions were performed.

To ensure comparability in baseline prophylaxis, all patients in both groups received pharmacological thromboprophylaxis with enoxaparin 40 mg subcutaneously once daily, initiated within 12 hours postoperatively and continued for 14 days, in accordance with the hospital's unified protocol. The above interventions were also implemented during hospitalization.

Observation Indicators

Baseline demographic and clinical characteristics were collected from electronic medical records for all enrolled patients, including age, gender, body mass index (BMI), fracture classification (Tile type), Injury Severity Score (ISS), and comorbidities such as hypertension. ISS was used to assess the overall severity of trauma across the entire body [17,18]. The ISS is calculated based on the Abbreviated Injury Scale (AIS). First, injuries are graded according to the AIS (on a 6-point scale from 1: minor to 6: untreatable) across six body regions (head and neck; face; chest; abdomen and pelvic contents; extremities and pelvic girdle; external). The highest AIS score in each of the three most severely injured body regions is then identified. Each of these three scores is squared and summed to yield the ISS ($\text{ISS} = \text{A}^2 + \text{B}^2 + \text{C}^2$). The ISS ranges from 1 to 75. An ISS of 75 is automatically assigned to any patient with an AIS score of 6 in any region.

DVT incidence was assessed within 14 days postoperatively using scheduled color Doppler ultrasonography on postoperative days 3, 7, and 14, coupled with additional examinations triggered by clinical symptoms suggestive of DVT (e.g., unilateral limb swelling, pain, warmth, or erythema). Ultrasonography examined venous segments from the iliac to the calf and specifically assessed for iliac vein thrombosis. Diagnostic criteria included venous incompressibility and absence of flow. For patients discharged before day 14, ultrasonography was performed before discharge. A standardized institutional pathway was used for managing clinically suspected PE; when symptoms such as acute dyspnea, chest pain, and hypoxia occurred, computed tomography pulmonary angiography (CTPA) was applied as the primary diagnostic tool.

All ultrasonographic images were retrospectively analyzed and interpreted by radiologists who were blinded to the group allocation. Functional recovery was evaluated using the Majeed Pelvic Score, which includes pain, work, sitting, sexual function, and standing, with a total score of 100 (Excellent $>$85; Good 70–84; Fair 55–69; Poor $<$55) [19]. Pain intensity was assessed with a 0-10 Visual Analogue Scale (VAS) at 24 hours postoperatively (baseline assessment, before full implementation of the nursing model) and on the day before discharge (post-management) [20]. Length of stay was defined as days from surgery to discharge. Time to first ambulation was defined as from surgery to first assisted standing or walking. Readmission within 30 days for surgery-related complications was recorded through the hospital's electronic health record system; readmissions to other hospitals may not have been documented.

The duration of mechanical prophylaxis was recorded as the average daily hours of IPC device use during hospitalization. Daily usage duration was automatically recorded by the IPC devices and transcribed by nurses from the device memory at shift change. Nursing satisfaction was assessed on the day before discharge using a hospital-developed 5-point Likert-scale questionnaire [21,22], derived from the Service Quality (SERVQUAL) framework and the core dimensions of patient experience, ensuring content validity. This scale demonstrated good internal consistency (Cronbach's α = 0.85 in a prior pilot study). The total raw score (10–50) was converted to a 0–100 scale using the formula: (raw score / 50) $\times$ 100 (where higher scores indicate greater satisfaction).

Statistical Analysis

Statistical analysis was conducted using SPSS (version 27.0, IBM Corp., Armonk, NY, USA). The normality of continuous data was assessed using the Shapiro-Wilk test. Normally distributed continuous variables were presented as mean $\pm$ standard deviation and compared using independent samples *t*-tests. Non-normally distributed continuous variables were expressed as median (interquartile range) [M (Q_1, Q_3)] and compared using the Mann-Whitney U test. Categorical variables were reported as numbers (percentages) [n (%)] and compared using the Chi-square or Fisher's exact tests, as appropriate. All statistical tests were two-tailed, and a p-value $<$ 0.05 was considered statistically significant.

Reporting Guideline

This study was reported following the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement. The completed checklist is available as a supplementary file (**Supplementary File 1**).

Results

Comparison of Baseline Characteristics Between the Two Groups

As detailed in Table 1, the two groups were comparable at baseline, with no significant differences in age, BMI, gender, fracture classification (Tile B/C), hypertension, or Injury Severity Score (ISS) (all $p > 0.05$).

Comparison of DVT Incidence Between the Two Groups

The incidence of postoperative DVT was 4.29% (3/70) in the responsibility care group, significantly lower than the 17.33% (13/75) in the conventional care group (χ^2 = 6.28, p = 0.012, Table 2).

Table 1. Comparison of baseline characteristics between the two groups.

Variable	Total (n = 145)	Conventional care (n = 75)	Responsibility care (n = 70)	Statistic	*p*-value
Age (years), M (Q_1, Q_3)	45.00 (40.00, 50.00)	46.00 (40.00, 50.00)	44.00 (41.00, 49.00)	Z = –1.34	0.180
BMI (kg/m^2), M (Q_1, Q_3)	24.90 (24.20, 25.60)	25.00 (24.25, 26.00)	24.75 (24.22, 25.37)	Z = –1.51	0.132
ISS (scores), M (Q_1, Q_3)	18.00 (16.00, 22.00)	18.00 (15.00, 22.00)	19.00 (16.00, 21.75)	Z = –1.06	0.287
Gender, n (%)				χ^2 = 0.10	0.754
Male	62 (42.76)	33 (44.00)	29 (41.43)		
Female	83 (57.24)	42 (56.00)	41 (58.57)		
Fracture classification, n (%)				χ^2 = 0.36	0.551
B	70 (48.28)	38 (50.67)	32 (45.71)		
C	75 (51.72)	37 (49.33)	38 (54.29)		
Hypertension, n (%)				χ^2 = 0.08	0.774
Yes	66 (45.52)	35 (46.67)	31 (44.29)		
No	79 (54.48)	40 (53.33)	39 (55.71)		

ISS, Injury Severity Score; BMI, body mass index; M (Q_1, Q_3), median (interquartile range).

Table 2. Comparison of postoperative DVT incidence between the two groups.

Variable	Total (n = 145)	Conventional care (n = 75)	Responsibility care (n = 70)	Statistic	Effect size (95% CI)	*p*-value
DVT, n (%)				χ^2 = 6.28	RD: 0.130 (0.033 to 0.228) RR: 0.247 (0.074 to 0.831)	0.012
Yes	16 (11.03)	13 (17.33)	3 (4.29)			
No	129 (88.97)	62 (82.67)	67 (95.71)			

DVT, deep vein thrombosis; RD, Risk Difference; RR, Relative Risk; CI, confidence interval.

Table 3. Comparison of Majeed scores between the two groups.

Variable	Total (n = 145)	Conventional care (n = 75)	Responsibility care (n = 70)	Statistic	Effect size (95% CI)	*p*-value
Pre-management, M (Q_1, Q_3)	52.00 (49.00, 57.00)	51.00 (48.00, 55.00)	53.00 (49.00, 57.00)	Z = –1.44	NA	0.151
Post-management, M (Q_1, Q_3)	76.00 (71.00, 81.00)	71.00 (66.00, 74.00)	81.00 (77.25, 85.00)	Z = –9.61	Median Difference: 10.000 (7.436 to 12.564)	<0.001
Statistic		Z = –10.58	Z = –10.22			
p-value		<0.001	<0.001			

NA, Not applicable.

Comparison of Majeed Scores Between the Two Groups

A within-group comparison revealed that Majeed scores significantly increased from pre- to post-management in both the conventional care group ($p < 0.001$) and the responsibility care group ($p < 0.001$). No significant difference was observed in pre-management Majeed scores between the two groups ($p > 0.05$). However, post-management scores improved in both groups, with the responsibility care group demonstrating greater improvement. The median post-management Majeed score was also significantly higher in the responsibility care group ($p < 0.001$). A comparison of Majeed scores between the two experimental groups is shown in Table 3.

Comparison of VAS Scores Between the Two Groups

A within-group comparison demonstrated that VAS scores significantly decreased from pre- to post-management in both the conventional care group ($p < 0.001$) and the responsibility care group ($p < 0.001$). Pre-management VAS scores did not differ between the two groups ($p > 0.05$). However, post-management scores decreased in both groups, with a significantly greater decrease in the responsibility care group. Moreover, the median post-management VAS score was significantly lower in the responsibility care group ($p < 0.001$, Table 4).

Comparison of Postoperative Recovery Between the Two Groups

Regarding postoperative recovery, the responsibility care group had a significantly shorter length of stay and achieved earlier first ambulation compared to the conventional care group ($p < 0.001$). Additionally, the readmission rate was also significantly lower in the responsibility care group ($p = 0.022$, Table 5).

Mechanical Prophylaxis Duration and Nursing Satisfaction Between the Two Groups

Regarding nursing process indicators, the daily effective usage time of mechanical prophylaxis devices was signifi-

Table 4. Comparison of VAS scores between the two groups.

Variable	Total (n = 145)	Conventional care (n = 75)	Responsibility care (n = 70)	Statistic	Effect size (95% CI)	p-value
Pre-management, M (Q_1, Q_3)	6.00 (5.00, 6.00)	6.00 (5.00, 6.00)	6.00 (5.00, 6.00)	Z = –1.84	NA	0.066
Post-management, M (Q_1, Q_3)	2.00 (2.00, 3.00)	3.00 (3.00, 4.00)	2.00 (1.00, 2.00)	Z = –10.20	Median Difference: –1.000 (–1.326 to –0.674)	<0.001
Statistic		Z = –10.87	Z = –10.50			
p-value		<0.001	<0.001			

VAS, Visual Analogue Scale.

Table 5. Comparison of postoperative recovery indicators between the two groups.

Variable	Total (n = 145)	Conventional care (n = 75)	Responsibility care (n = 70)	Statistic	Effect size (95% CI)	p-value
Length of stay (d), M (Q_1, Q_3)	16.00 (14.00, 19.00)	19.00 (16.00, 21.00)	14.00 (13.00, 15.00)	Z = –10.07	Median Difference: –5.000 (–6.225 to –3.775)	<0.001
First ambulation (d), M (Q_1, Q_3)	4.00 (3.00, 5.00)	5.00 (4.00, 5.00)	3.00 (2.00, 4.00)	Z = –9.33	Median Difference: –2.000 (–2.520 to –1.480)	<0.001
Readmission, n (%)				χ^2 = 5.23	RD: 0.105 (0.018 to 0.191) RR: 0.214 (0.049 to 0.944)	0.022
Yes	12 (8.28)	10 (13.33)	2 (2.86)			
No	133 (91.72)	65 (86.67)	68 (97.14)			

Table 6. Comparison of mechanical prophylaxis duration and nursing satisfaction between the two groups.

Variable	Total (n = 145)	Conventional care (n = 75)	Responsibility care (n = 70)	Statistic	Effect size (95% CI)	p-value
Mechanical prophylaxis devices (h), M (Q_1, Q_3)	18.40 (14.40, 20.10)	14.50 (12.80, 16.85)	20.10 (19.00, 21.50)	Z = –10.01	Median Difference: 5.600 (4.512 to 6.688)	<0.001
Nursing satisfaction (scores), M (Q_1, Q_3)	81.00 (72.00, 89.00)	72.00 (68.00, 78.00)	89.00 (86.00, 91.75)	Z = –10.40	Median Difference: 17.000 (14.366 to 19.634)	<0.001

cantly longer in the responsibility care group ($p < 0.001$). Furthermore, nursing satisfaction scores were significantly higher in the responsibility care group ($p < 0.001$), as detailed in Table 6.

Discussion

This retrospective observational study demonstrates that the responsibility system management nursing model significantly reduces the incidence of DVT and promotes functional recovery following internal fixation for pelvic fractures. Compared with the conventional care group, the responsibility care group showed a significantly lower DVT rate, higher Majeed scores, lower VAS scores, shorter hospital stays, earlier ambulation, and lower readmission rates. Moreover, the responsibility care group demonstrated better compliance with mechanical prophylaxis and higher nursing satisfaction. These results indicate that the responsibility system management model systematically improves postoperative care quality and has clear clinical significance for broader implementation.

The significantly lower DVT incidence in the responsible care group underscores the significance of effective implementation of prophylactic measures. Our finding aligns with Stannard *et al*. [23], who reported that mechanical prophylaxis is highly effective for reducing DVT risk after major orthopedic trauma. Our study extends this principle by elucidating the mechanism through which the nursing model translates this potential into practice. In the conventional care group, despite the availability of intermittent pneumatic compression devices, inadequate supervision and accountability resulted in significantly shorter daily usage, thereby undermining efficacy. Conversely, the responsibility system management model directly addressed this implementation gap: dedicated nurses provided supervision, assistance, and verification, resulting in substantially longer and likely more accurate daily use of mechanical prophylaxis. Therefore, the reduction in DVT incidence indicates not merely the presence of mechanical prophylaxis, but the model's assurance of its consistent and effective application. This highlights that the fidelity of execution, facilitated by a structured nursing approach, is as crucial as the preventive intervention itself.

Regarding functional recovery, the postoperative Majeed scores were significantly higher in the responsibility care group ($p < 0.05$), indicating that responsibility system management nursing effectively promotes pelvic functional recovery. This finding aligns with Zhang *et al*. [24], who revealed that systematic, continuous rehabilitation guidance delivered through smart healthcare enhances outcomes following pelvic fracture. Although certain Majeed score domains have limited short-term sensitivity, administering the full scale at discharge provides a meaningful baseline of functional burden. The superior scores in the responsibility group highlight the model's capability to alleviate early limitations, supporting its value both as a comparative metric and an indicator of early functional benefit.

By implementing phased, individualized rehabilitation plans, making timely adjustments, and offering psychological support, the responsible nurse enhanced patient confidence and compliance, minimized delays in rehabilitation, and ultimately led to comprehensive improvements in functional outcomes. The responsibility care group also had shorter hospital stays, earlier ambulation, and lower readmission rates, reflecting the comprehensive benefits of the responsibility system management model to enhance recovery after surgery (ERAS). Strengthened nurse-patient communication and established continuity of care facilitated early identification and management of postoperative complications, which is highly consistent with the transitional care framework proposed by Coleman *et al*. [25]. Beyond clinical benefits, this model supports more efficient use of healthcare resources by increasing bed turnover.

Furthermore, the significantly longer daily use of mechanical prophylaxis in the responsible care group indicates the crucial role of accountability in improving adherence to medical orders, as evidenced by the lower DVT rate. The significant improvement in nursing satisfaction reflects the implementation of a "patient-centered" approach philosophy in clinical practice. By providing coordinated and comprehensive nursing care, responsible nurses effectively addressed patients' informational, emotional, and management needs, thereby establishing a more collaborative nurse-patient relationship and supporting rapid recovery to an optimal state.

While this study demonstrates promising findings, several limitations should be acknowledged. First, the nonrandomized, retrospective design, despite comparable baseline characteristics and pharmacological prophylaxis between groups, cannot fully eliminate the likelihood of selection bias or unmeasured confounding factors. Second, the follow-up period was limited to hospitalization and the early post-discharge phase. While the design efficiently captures in-hospital DVT and short-term functional status, it precludes long-term thromboembolic risk or functional evolution that typically unfold over months. Future studies with extended follow-up, for instance, assessments at 3 and 6 months, would clarify the durability of the effect. Third, while the sample size was sufficient for the primary outcome as indicated by a post-hoc power analysis, a larger cohort would provide more robust insights into secondary endpoints. Fourth, the pharmacological thromboprophylaxis regimen (enoxaparin for 14 days) adhered to institutional protocol and is shorter than the 28–35 days recommended by some contemporary guidelines for high-risk pelvic fractures. This may have missed late, post-discharge Venous Thromboembolism (VTE) events. Therefore, the reported DVT rate should be interpreted as the early, in-hospital period.

The successful implementation of this model also raises questions about its feasibility and generalizability. The requirement for a dedicated, responsible nurse to provide continuous, personalized care is resource-demanding, and the observed benefits likely depend upon the model's fidelity and sufficient nursing capacity, which may limit adoption in high-volume or resource-limited settings. Therefore, these findings should be interpreted as proof-of-concept for structured, accountable nursing. Future research should focus on the model's core components, develop a streamlined or tiered version for broader application, and formally evaluate cost-effectiveness. Additionally, because the intervention was implemented as a comprehensive care bundle, the observed benefits cannot be attributed to any single component of the model, such as enhanced supervision of mechanical prophylaxis, earlier rehabilitation, or psychological support.

In summary, the responsibility system management model integrates clear nursing roles, individualized interventions, and comprehensive management to unify DVT prevention, pain control, rehabilitation, and psychological support. It significantly reduces DVT risk, promotes functional recovery, and enhances nursing quality and patient satisfaction following internal fixation for pelvic fractures. Beyond these applications, the model provides a valuable framework for postoperative management in other major orthopedic surgeries and warrants broader clinical adoption.

Conclusions

In this retrospective study, the responsibility system management model was associated with a lower incidence of early DVT, improved short-term pelvic function at discharge, and higher patient satisfaction following internal fixation for pelvic fractures. These findings suggest potential in-hospital improvements, but broader clinical implementation needs further validation and confirmation from studies with longer follow-up and more robust designs.

Availability of Data and Materials

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

Author Contributions

MLD and LH designed the research study. MLD and LH performed the research. MLD and LH analyzed the data. MLD contributed to drafting the manuscript. Both authors contributed to the critical revision of the manuscript for important intellectual content. Both authors read and approved the final manuscript. Both authors have participated sufficiently in the work and agreed to be accountable for all aspects of the work.

Ethics Approval and Consent to Participate

As a retrospective analysis protecting patient privacy and causing no harm, this study was exempt from ethical approval by Ganzhou People's Hospital per local regulations. The study conformed to the provisions of the Declaration of Helsinki. All participants provided written informed consent.

Acknowledgment

Not applicable.

Funding

This research received no external funding.

Conflict of Interest

The authors declare no conflict of interest.

Supplementary Material

Supplementary material associated with this article can be found, in the online version, at https://doi.org/10.62713/aic.4364.

References

[1] Grotz MRW, Allami MK, Harwood P, Pape HC, Krettek C, Giannoudis PV. Open pelvic fractures: epidemiology, current concepts of management and outcome. Injury. 2005; 36: 1–13. https://doi.org/10.1016/j.injury.2004.05.029.

[2] Chen HT, Wang YC, Hsieh CC, Su LT, Wu SC, Lo YS, *et al*. Trends and predictors of mortality in unstable pelvic ring fracture: a 10-year experience with a multidisciplinary institutional protocol. World Journal of Emergency Surgery: WJES. 2019; 14: 61. https://doi.org/10.1186/s13017-019-0282-x.

[3] Rinne PP, Laitinen MK, Kannus P, Mattila VM. The incidence of pelvic fractures and related surgery in the Finnish adult population: a nationwide study of 33,469 patients between 1997 and 2014. Acta Orthopaedica. 2020; 91: 587–592. https://doi.org/10.1080/17453674.2020.1771827.

[4] Rovere G, Perna A, Meccariello L, De Mauro D, Smimmo A, Proietti L, *et al*. Epidemiology and aetiology of male and female sexual dysfunctions related to pelvic ring injuries: a systematic review. International Orthopaedics. 2021; 45: 2687–2697. https://doi.org/10.1007/s00264-021-05153-8.

[5] Ruan Y, Wang F, Du X, Sun S. Rehabilitation nursing after lower limb fracture: Preventing deep vein thrombosis and enhancing quality of life. Medicine. 2023; 102: e36180. https://doi.org/10.1097/MD.0000000000036180.

[6] Wang AY, Vavilala MS, Rivara FP, Johnsen NV. The effect of sexual dysfunction on health-related quality of life in men following traumatic pelvic fractures. The Journal of Trauma and Acute Care Surgery. 2021; 91: 325–330. https://doi.org/10.1097/TA.0000000000003187.

[7] Gambrah HA, Hagedorn JC, Dmochowski RR, Johnsen NV. Sexual Dysfunction in Women after Traumatic Pelvic Fracture Negatively Affects Quality of Life and Mental Health. The Journal of Sexual Medicine. 2022; 19: 1759–1765. https://doi.org/10.1016/j.jsxm.2022.08.198.

[8] Falck-Ytter Y, Francis CW, Johanson NA, Curley C, Dahl OE, Schulman S, *et al*. Prevention of VTE in orthopedic surgery patients: Antithrombotic Therapy and Prevention of Thrombosis, 9th ed: American College of Chest Physicians Evidence-Based Clinical Practice Guidelines. Chest. 2012; 141: e278S–e325S. https://doi.org/10.1378/chest.11-2404.

[9] Montgomery KD, Potter HG, Helfet DL. The detection and management of proximal deep venous thrombosis in patients with acute acetabular fractures: a follow-up report. Journal of Orthopaedic Trauma. 1997; 11: 330–336. https://doi.org/10.1097/00005131-199707000-00006.

[10] National Guideline Centre (UK). Venous thromboembolism in over 16s: Reducing the risk of hospital-acquired deep vein thrombosis or pulmonary embolism. National Institute for Health and Care Excellence (NICE): London. 2018.

[11] Anglen JO, Goss K, Edwards J, Huckfeldt RE. Foot pump prophylaxis for deep venous thrombosis: the rate of effective usage in trauma patients. American Journal of Orthopedics (Belle Mead, N.J.). 1998; 27: 580–582.

[12] Anderson DR, Morgano GP, Bennett C, Dentali F, Francis CW, Garcia DA, *et al*. American Society of Hematology 2019 guidelines for management of venous thromboembolism: prevention of venous thromboembolism in surgical hospitalized patients. Blood Advances. 2019; 3: 3898–3944. https://doi.org/10.1182/bloodadvances.2019000975.

[13] Papasotiriou AN, Prevezas N, Krikonis K, Alexopoulos EC. Recovery and Return to Work After a Pelvic Fracture. Safety and Health at Work. 2017; 8: 162–168. https://doi.org/10.1016/j.shaw.2016.10.003.

[14] Leonenko M, Drach-Zahavy A. "You are either out on the court, or sitting on the bench": understanding accountability from the perspectives of nurses and nursing managers. Journal of Advanced Nursing. 2016; 72: 2718–2727. https://doi.org/10.1111/jan.13047.

[15] Shi W, Liu F, Yuan M, Liu H. The Effect and Influence of the Responsibility System Rehabilitation Nursing Model in the Nursing of Patients with Ischemic Stroke. Alternative Therapies in Health and Medicine. 2024; 30: 309–317.

[16] Wang Y, Wang Y, Wang J. Analysis of the integrated nursing management mode of grid responsibility system in improving the quality of nursing in the hospital. Panminerva Medica. 2023; 65: 418–419. https://doi.org/10.23736/S0031-0808.22.04735-8.

[17] Baker SP, O'Neill B, Haddon W, Jr, Long WB. The injury severity score: a method for describing patients with multiple injuries and evaluating emergency care. The Journal of Trauma. 1974; 14: 187–196.

[18] Tarabadkar N, Alton T, Gorbaty J, Nork S, Taitman L, Kleweno C. Trends in Orthopedic Fracture and Injury Severity: A Level I Trauma Center Experience. Orthopedics. 2018; 41: e211–e216. https://doi.org/10.3928/01477447-20180103-01.

[19] Martin MP, 3rd, Rojas D, Dean CS, Lockwood W, Nadeau J, Maertens A, *et al*. Psychological outcomes affect functional outcomes in patients with severe pelvic ring fractures. Injury. 2021; 52: 2750–2753. https://doi.org/10.1016/j.injury.2020.02.071.

[20] Liu ZF, Qiu ZY, Zhang Y, Fu J, Ma XW. Correlation of diclofenac sodium sustained-release capsules in conjunction with function training and VAS score after ankle fracture surgery. European Review for Medical and Pharmacological Sciences. 2023; 27: 10852–10859. https://doi.org/10.26355/eurrev_202311_34452.

[21] Goodman SM, Mehta BY, Kahlenberg CA, Krell EC, Nguyen J, Finik J, *et al*. Assessment of a Satisfaction Measure for Use After Primary Total Joint Arthroplasty. The Journal of Arthroplasty. 2020; 35: 1792–1799.e4. https://doi.org/10.1016/j.arth.2020.02.039.

[22] Kahlenberg CA, Gibbons JAB, Mehta BY, Antao VC, Lai EY, Do HT, *et al*. Satisfaction With the Process vs Outcome of Care in Total Hip and Knee Arthroplasty. The Journal of Arthroplasty. 2022; 37: 419–424.e2. https://doi.org/10.1016/j.arth.2021.11.010.

[23] Stannard JP, Riley RS, McClenney MD, Lopez-Ben RR, Volgas DA, Alonso JE. Mechanical prophylaxis against deep-vein thrombosis after pelvic and acetabular fractures. The Journal of Bone and Joint Surgery. American Volume. 2001; 83: 1047–1051. https://doi.org/10.2106/00004623-200107000-00010.

[24] Zhang H, Sun F, Li Y. Application of Smart Healthcare in Comparative Analysis of Effect of Early External Fixator and Plate Internal Fixation Treatment on Postoperative Complications and Lower Limb Function Recovery of Patients With Unstable Pelvic Fracture. Frontiers in Public Health. 2022; 10: 887123. https://doi.org/10.3389/fpubh.2022.887123.

[25] Coleman EA, Parry C, Chalmers S, Min SJ. The care transitions intervention: results of a randomized controlled trial. Archives of Internal Medicine. 2006; 166: 1822–1828. https://doi.org/10.1001/archinte.166.17.1822.