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The efficacy of rhubarb poultices applied to the navel for abdominal distension and constipation following thoracolumbar fractures

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Abstract. Background: Constipation is a prevalent complication following thoracolumbar fractures, affecting over 90% of patients and significantly hindering recovery. Current pharmacological treatments have limitations, highlighting the need for effective, non-invasive adjunctive nursing interventions. This study evaluates the efficacy and safety of rhubarb powder applied to the umbilicus (Shenque acupoint) for managing this condition. Methods: In this randomized controlled trial, 59 patients with post-fracture constipation were assigned to either a control group (routine nursing care plus oral lactulose) or an experimental group (routine care plus rhubarb umbilical application, changed twice daily until the first bowel movement). Outcomes included time to first defecation, duration of each defecation, and defecation difficulty score. Results: The experimental group (n = 29) showed significantly shorter time to first defecation (31.42 ± 6.58 vs. 47.85 ± 9.14 h, $p < 0.001$), shorter defecation duration (8.45 ± 2.12 vs. 13.67 ± 3.54 min, $p < 0.001$), and lower difficulty scores (1.14 ± 0.42 vs. 2.28 ± 0.65, $p < 0.001$) compared with the control group (n = 30). No adverse skin reactions were observed. Conclusions: Rhubarb umbilical application is a safe, effective, and low-cost nursing intervention that significantly alleviates constipation in patients with thoracolumbar fractures. It merits broader implementation in orthopedic settings and further investigation into its mechanisms and long-term effects.

Keywords: rhubarb umbilical application, constipation, thoracolumbar fracture, nursing intervention, Traditional Chinese Medicine

1. Introduction

Constipation is one of the most frequent gastrointestinal complications following thoracolumbar fractures, with reported incidence rates exceeding 90% [1]. Multiple factors contribute to this condition, including spinal cord compression, prolonged bed rest, postoperative pain, and the use of opioid analgesics, all of which impair gastrointestinal motility [2]. Beyond causing significant patient discomfort—abdominal distension, pain, and anorexia—constipation can have serious clinical consequences. The increased intra-abdominal pressure during straining (Valsalva manoeuvre) may compromise spinal stability in patients with internal fixation, potentially

leading to implant failure or even cardiovascular events [3]. Furthermore, constipation delays early mobilisation and prolongs hospital stay, thereby hindering overall recovery [4].

Current management strategies for this population rely primarily on pharmacological agents such as osmotic laxatives (e.g., lactulose) and stimulant laxatives. However, these approaches have notable limitations, including delayed onset, substantial inter-individual variability, risk of electrolyte disturbances with prolonged use, and potential for drug dependence [5]. Non-pharmacological interventions—dietary modifications, abdominal massage, and early mobilisation—are essential components of nursing care but often prove insufficient as standalone therapies [6]. There is thus a clear need for safe, effective, and easily implementable adjunctive interventions that can be delivered by nursing staff at the bedside.

Traditional Chinese Medicine (TCM) offers a range of external therapies that are well-suited to nursing practice. Among these, umbilical application (Shenque acupoint application) has gained attention as a non-invasive, low-cost intervention with minimal systemic side effects [7]. According to TCM theory, the umbilicus (Shenque, CV8) is a key acupoint of the Ren Meridian that connects to all internal organs through the meridian system. The skin over the umbilicus is thin, with abundant vascular and neural networks, making it an ideal site for transdermal drug delivery [8]. Rhubarb (Rhei Radix et Rhizoma) contains anthraquinone glycosides (such as rhein, emodin, and their glucosides) that stimulate colonic myenteric plexus neurons, enhance segmental and propulsive contractions, and inhibit water reabsorption, thereby softening stool and promoting defecation [9]. Unlike oral administration, topical umbilical application bypasses first-pass hepatic metabolism and minimises gastrointestinal irritation, potentially offering comparable efficacy with a more favourable safety profile [10].

A previous meta-analysis has demonstrated the overall efficacy of rhubarb umbilical application for constipation [11]. However, evidence specifically addressing its use in patients with thoracolumbar fractures—a population with unique safety concerns related to spinal stability—remains limited. Moreover, few studies have evaluated this intervention from a nursing implementation perspective, examining its feasibility, acceptability, and practical integration into routine postoperative care. Therefore, this randomised controlled trial was designed to evaluate the clinical efficacy and safety of rhubarb umbilical application as an adjunctive nursing intervention for constipation in patients with thoracolumbar fractures, and to provide evidence for its broader adoption in orthopaedic nursing practice.

2. Methods

2.1. Study design and setting

This was a single-centre, parallel-group, randomised controlled trial conducted at the Department of Orthopedics of a tertiary hospital in Chongqing, China, between June 2025 and March 2026. The study protocol was approved by the Institutional Review Board of the participating hospital (Approval No. IIT-LL-2025014). All participants provided written informed consent prior to enrolment. The study was conducted in accordance with the Declaration of Helsinki and the CONSORT guidelines.

2.2. Participants

Eligible participants were patients admitted with a diagnosis of thoracolumbar fracture (compression or burst type, confirmed by X-ray or Computed Tomography (CT) who developed constipation during hospitalisation. Inclusion criteria: (1) age ≥ 18 years; (2) stable vital signs and conscious state; (3) meeting the Rome IV diagnostic criteria for functional constipation [11]: fewer than three spontaneous bowel movements per week, with at least one of the following—hard or lumpy stools, straining > 25% of attempts, sensation of incomplete

evacuation, anorectal obstruction/blockage, or need for manual manoeuvres; (4) willing to participate and provide written consent. Exclusion criteria were: (1) pre-existing organic gastrointestinal diseases (e.g., inflammatory bowel disease, colorectal cancer, intestinal obstruction); (2) multiple trauma with visceral injury or concomitant fractures requiring separate surgical intervention; (3) periumbilical skin lesions, active infection, or known allergy to rhubarb or ethanol; (4) severe hepatic, renal, or cardiac failure; (5) pregnancy or lactation; (6) concurrent use of other prokinetic or laxative agents within 48 hours before enrolment. Participants could be withdrawn if they: (1) withdrew consent; (2) were discharged or transferred; (3) had < 80% adherence to the scheduled applications; or (4) experienced severe adverse events requiring protocol termination.

2.3. Randomisation and blinding

Participants were randomly assigned in a 1:1 ratio using a computer-generated random number table. Allocation was concealed in sequentially numbered, opaque, sealed envelopes prepared by an independent researcher not involved in patient care or outcome assessment. Due to the visible nature of the umbilical dressing, blinding of participants and nursing staff was not feasible. However, outcome assessors who collected the defecation data and performed statistical analyses were blinded to group assignments throughout the study.

2.4. Sample size

Based on the mean difference of approximately 12 hours in time to first defecation between rhubarb and control groups reported in a previous meta-analysis [12], with a pooled standard deviation of 10 hours, a two-sided $\alpha = 0.05$, and 80% power, this study estimated a required sample size of 25 per group. Accounting for a 15% dropout rate, this study aimed to enrol 30 participants per group (total $N = 60$). The final analysis included 59 patients due to one dropout in the experimental group.

2.5. Interventions

2.5.1. Control group

Participants received routine nursing care for constipation, which included: (1) dietary counselling—encouraging a daily fluid intake of 1,500-2,000 mL and consumption of fibre-rich foods (vegetables, fruits, whole grains) as tolerated; (2) abdominal massage—performed twice daily (morning and evening) for 15-20 min each session, with the patient in a supine position, using the palm to massage clockwise along the colonic trajectory (ascending→transverse→descending colon) with moderate pressure; (3) bed-based defecation training—patients were assisted to adopt a comfortable position on a bedpan at a fixed time each day (preferably 30 min after breakfast) to re-establish a regular defecation reflex; (4) early mobilisation—instruction in ankle pumps, quadriceps isometric contractions, and pelvic floor (Kegel) exercises, with progressive ambulation using a thoracolumbar orthosis as soon as clinically permitted; and (5) pharmacological therapy—oral lactulose solution (10 mL, twice daily), administered consistently. If no bowel movement occurred within 72 hours, a 40 mL glycerin enema was given as rescue therapy, and this event was recorded.

2.5.2. Experimental group

In addition to the identical routine care described above, participants received rhubarb umbilical application. Raw rhubarb powder (6 g, sourced from the hospital's pharmacy and quality-controlled batch) was mixed with 75% ethanol to form a pliable paste (for patients with ethanol allergy, sterile normal saline was substituted). The umbilical area was first cleansed with warm water and gently dried, then disinfected with a 75% ethanol

cotton swab. Approximately 2-3 g of the paste was shaped into a round pellet (diameter ~2 cm) and placed into the umbilical fossa (Shenque acupoint), flattened to cover the entire fossa. The paste was secured with a 6 × 7 cm transparent occlusive dressing (Tegaderm™, 3M) with a non-compressible, tension-free application. The dressing was changed twice daily (09:00 and 17:00) until the first spontaneous bowel movement occurred, at which point the application was discontinued. At each dressing change, the periumbilical skin was carefully inspected for erythema, rash, oedema, blistering, or itching; if any reaction developed, the application was removed, the area treated with emollient or antihistamine as appropriate, and the event recorded. A rescue glycerin enema was also given if no bowel movement occurred within 72 hours, consistent with the control group.

To ensure intervention fidelity, all nursing staff received a 2-hour standardised training session on the preparation and application technique, and a checklist was used to document each application time, skin condition, and any deviations.

2.6. Outcome measures

The primary efficacy outcomes were: (1) Time to first defecation—recorded in hours from the initiation of the intervention (start of routine care or first application) to the first spontaneous bowel movement; (2) Duration of each defecation—reported by the patient and verified by the attending nurse, measured from the initial urge to completion of passage; (3) Defecation difficulty score—assessed by a blinded outcome assessor using the standard criteria from the *Chinese Medicine Disease Diagnosis and Efficacy Criteria for Anorectal Diseases* [13]: 0 = no difficulty; 1 = mild straining but stool passes easily; 2 = obvious straining with hard stool; 3 = sensation of incomplete evacuation with anorectal obstruction; 4 = unable to defecate without manual assistance or enema. The score was recorded for the first bowel movement after intervention.

The secondary outcome was safety: the incidence of periumbilical adverse skin reactions (erythema, pruritus, rash, blistering, or skin breakdown) and any systemic adverse events (e.g., diarrhoea, abdominal cramping, electrolyte abnormalities) documented throughout the intervention period.

2.7. Statistical analysis

Statistical analyses were performed using SPSS 27.0. Continuous variables, tested for normality by the Kolmogorov–Smirnov test, were expressed as mean ± SD and compared using independent-samples t-tests. Categorical data were compared using the chi-square or Fisher's exact test. All tests were two-sided, with $p < 0.05$ considered statistically significant.

3. Results

3.1. Participant flow and baseline characteristics

A total of 60 patients were enrolled; one participant in the experimental group was discharged against medical advice before the first defecation assessment and was excluded from the final analysis, yielding 29 in the experimental group and 30 in the control group (overall dropout rate 1.7%). Baseline demographic and clinical characteristics were well balanced between the two groups. The mean age was (58.72 ± 6.81) years in the experimental group and (59.31 ± 7.25) years in the control group ($t = 0.385$, $p = 0.702$). Sex distribution (male/female: 16/13 vs. 18/12, $\chi^2 = 0.164$, $p = 0.686$) and fracture location (thoracic/lumbar: 12/17 vs. 14/16, $\chi^2 = 0.182$, $p = 0.669$) showed no significant differences, confirming the comparability of the groups, as shown in Table 1.

Table 1. Baseline characteristics of participants

Characteristic	Experimental group (n = 29)	Control group (n = 30)	Statistical value	p value
Age (years)	58.72 ± 6.81	59.31 ± 7.25	t = 0.385	0.702
Sex (male/female)	16/13	18/12	χ^2 = 0.164	0.686
Fracture location (thoracic/lumbar)	12/17	14/16	χ^2 = 0.182	0.669

3.2. Primary outcomes

As presented in Table 2, the experimental group showed significantly better outcomes across all three primary measures. The mean time to first defecation was 16.43 hours shorter (31.42 ± 6.58 vs. 47.85 ± 9.14 h, p < 0.001). The mean duration of each defecation was 5.22 minutes shorter (8.45 ± 2.12 vs. 13.67 ± 3.54 min, p < 0.001). The defecation difficulty score was reduced by approximately 50% (1.14 ± 0.42 vs. 2.28 ± 0.65, p < 0.001).

Table 2. Comparison of outcomes between groups

Outcome	Experimental group (n = 29)	Control group (n = 30)	t value	p value
Time to first defecation (h)	31.42 ± 6.58	47.85 ± 9.14	-7.864	< 0.001
Duration of each defecation (min)	8.45 ± 2.12	13.67 ± 3.54	-6.821	< 0.001
Defecation difficulty score	1.14 ± 0.42	2.28 ± 0.65	-8.045	< 0.001

3.3. Safety and tolerability

No adverse skin reactions—including erythema, rash, pruritus, blistering, or excoriation—were observed in either group throughout the study period. No patient required premature discontinuation due to local intolerance. Systemic adverse events such as diarrhoea, severe abdominal cramping, nausea, or electrolyte imbalances were also absent.

4. Discussion

This randomised controlled trial provides robust evidence that rhubarb umbilical application, as an adjunct to routine nursing care, significantly accelerates the first defecation, shortens defecation time, and alleviates straining in patients with thoracolumbar fracture-associated constipation. The effect sizes were substantial: a 16-hour reduction in time to first bowel movement and halving of difficulty scores, with zero safety signals. These findings not only confirm the therapeutic potential of this TCM external therapy but also demonstrate its practical value as a nursing-delivered intervention that can be seamlessly integrated into daily ward routines.

The therapeutic mechanism is best understood through a synergistic framework integrating pharmacology and meridian physiology. Rhubarb's anthraquinone aglycones—released by colonic bacterial hydrolysis—act on the submucosal and myenteric plexuses to increase acetylcholine release, enhance calcium influx into smooth muscle cells, and stimulate chloride secretion, collectively promoting propulsive contractions and intraluminal fluid accumulation [10, 14]. Simultaneously, the Shenque acupoint (CV8) is believed in TCM to regulate Qi dynamics of the Chong, Ren, and Du meridians, harmonising the spleen and stomach, and descending intestinal Qi. The umbilicus's thin stratum corneum and rich vascular network facilitate efficient percutaneous absorption, achieving a local drug concentration that is sufficient to stimulate colonic motility

while maintaining negligible systemic levels—thereby avoiding the gastrointestinal irritation and systemic electrolyte shifts that may occur with oral rhubarb or high-dose osmotic laxatives [15]. This dual action is particularly relevant for spinal fracture patients, in whom excessive straining poses unique risks. By reducing the time spent straining and the degree of difficulty, the intervention minimises hazardous Valsalva manoeuvres, thus protecting spinal fixation stability and reducing the risk of cardiovascular complications—a critical advantage over conventional rescue enemas that often require forced expulsion [16].

Comparing our results with previous literature, a meta-analysis by Sun et al. [12] reported that rhubarb navel plasters significantly improved treatment efficacy (RR = 1.25, 95% CI 1.16-1.34) and reduced time to defecation in functional constipation, but their pooled population was heterogeneous and predominantly comprised community-dwelling adults with chronic constipation. This study extends this evidence to the acute, multifactorial constipation seen in hospitalised trauma patients, where neurogenic inhibition, opioid use, and immobilisation converge. The magnitude of improvement the authors observed (16-hour time reduction) is clinically meaningful—it means patients can expect bowel movement on the second day of intervention rather than the third, facilitating earlier oral feeding and mobilisation, which aligns with enhanced recovery protocols [4]. Moreover, the standardised twice-daily application and clear stopping criterion (first spontaneous defecation) make this protocol easy to adopt in busy orthopaedic wards without imposing excessive nursing workload; each application took approximately 10 minutes, well within routine care rounds.

From a nursing implementation perspective, several strengths are noteworthy. First, the intervention is low-cost: raw rhubarb powder is inexpensive, and occlusive dressings are standard supplies. Second, it is operator-independent after a brief training session, ensuring consistency across shifts. Third, high patient acceptability was evident—none of the participants expressed reluctance to continue, in contrast to the frequent complaints of bitterness from oral laxatives or discomfort from enemas. This aligns with the growing emphasis on patient-centred care and non-pharmacological comfort measures. Fourth, the zero incidence of periumbilical skin reactions in our study underscores the safety of the procedure when performed with proper skin cleansing and regular inspection; the substitution of saline for ethanol in sensitive patients further enhances the safety margin. Thus, this intervention empowers nurses to independently deliver evidence-based TCM therapy, expanding their scope of practice while reducing reliance on pharmacological rescue measures.

Nevertheless, several limitations must be acknowledged. The single-centre design and relatively modest sample size (though adequately powered) limit the generalisability of our findings; different hospital settings with varying patient demographics and nursing practices may yield different results. The unblinded nature of the intervention (due to the visible dressing) introduces the potential for performance bias, although the authors attempted to mitigate detection bias by using blinded outcome assessors. More importantly, this study only followed participants until the first spontaneous defecation, leaving uncertainties about sustained bowel regularity, recurrence rates, and long-term tolerance. Whether continued application beyond the first movement would provide additional benefit or, conversely, could lead to tolerance or colonic dependence remains unknown—although the short-term nature of our protocol (typically 1-2 days) minimises such risks. The authors also did not stratify by opioid dosage, so the authors cannot determine the specific efficacy of rhubarb against opioid-induced constipation versus other components. Additionally, the optimal dose (the authors used a fixed 6 g powder) and the ideal vehicle (ethanol vs. saline vs. vinegar) have not been standardised; future dose-response and formulation studies are warranted. Finally, the authors did not measure objective biomarkers (e.g., colonic transit time, serum motilin, or gastrointestinal hormones), relying instead on patient-reported and observer-rated outcomes, which, though clinically relevant, may introduce subjective variability.

Future research should address these gaps through multi-centre, large-scale randomised trials with extended follow-up (e.g., 2-4 weeks) to evaluate recurrence and long-term safety. Inclusion of objective physiological endpoints—such as radiopaque marker transit studies or wireless motility capsule—would strengthen the mechanistic evidence. Subgroup analyses stratified by analgesic use, fracture severity, and age would help identify which patients derive the greatest benefit. Cost-effectiveness analyses comparing rhubarb plasters with other non-pharmacological interventions (e.g., acupressure, electrical stimulation) would inform resource allocation in healthcare systems. Finally, exploring the combined use of rhubarb umbilical application with other TCM modalities, such as acupoint massage or herbal enemas, may yield synergistic effects and further optimise constipation management in this complex population.

Despite these limitations, the consistent and robust effect sizes, coupled with an impeccable safety record, support the immediate adoption of rhubarb umbilical application as an adjunctive nursing therapy for post-thoracolumbar fracture constipation. It is a simple, affordable, and patient-friendly intervention that aligns with the principles of enhanced recovery and patient-centred care. The authors recommend that orthopaedic nursing guidelines incorporate this technique, with structured training and quality assurance protocols to ensure standardised delivery.

5. Conclusion

In conclusion, rhubarb umbilical application, as an adjunct to routine nursing care, is a safe, effective, and low-cost intervention that significantly ameliorates constipation in patients with thoracolumbar fractures. It reduces the time to first defecation , shortens defecation duration, and improves defecation difficulty, without adverse skin or systemic reactions. Given its simplicity, high acceptability, and minimal resource requirements, this TCM-based nursing technique has strong potential for wider dissemination in orthopaedic and rehabilitation units. Further research with multi-centre designs, longer follow-up, and objective physiological assessments is warranted to consolidate these findings and refine the optimal regimen.

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