Efficacy evaluation of traditional Chinese medicine bone-setting technique combined with locking plate internal fixation in the treatment of complex proximal humerus fracture

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Abstract: The treatment of complex proximal humeral fractures presents significant challenges in orthopedics. While simple locking plate surgery involves substantial trauma and multiple complications, traditional bone-setting techniques demonstrate limited reduction capacity for severe comminuted fractures. This systematic review examines the clinical application and efficacy of combining traditional Chinese medicine bone-setting techniques with locking plate internal fixation in managing such cases. The study reveals that this combined approach achieves effective blood supply preservation at fracture sites through preoperative manual closed reduction, thereby reducing surgical complexity and trauma. The robust fixation provided by locking plates further facilitates early functional rehabilitation, achieving an organic integration of "equal emphasis on bone and tendon" with "biomechanical stability."

Keywords: proximal humeral fracture; manipulation; locking plate

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Foreword

The treatment of complex proximal humeral fractures, particularly those involving third and fourth part fractures, has long been a major challenge in orthopedics. While simple locked plate internal fixation provides robust support, it involves significant surgical trauma and substantial blood supply disruption, which may lead to complications such as humeral head necrosis. Traditional Chinese orthopedic manipulation techniques, though minimally invasive, struggle to independently manage severe comminuted fractures. Therefore, developing a therapeutic approach that combines the strengths of both methods has become imperative. This article systematically reviews the theoretical basis, synergistic mechanisms, clinical applications, and efficacy evaluation of combining traditional Chinese orthopedic manipulation with locked plate internal fixation for treating complex proximal humeral fractures. It provides an in-depth analysis of the core advantages and existing challenges, while also outlining future research directions. The aim is to establish a scientific theoretical foundation and evidence-based support for the standardized application and promotion of this integrated Chinese-Western medical therapy.

1 Treatment of complex proximal humeral fractures

1.1 Non-surgical treatment

Non-surgical treatment, as a conventional approach for complex proximal humeral fractures, has relatively limited applicability. It is primarily indicated for elderly patients with minimal fracture displacement, intact articular surfaces, poor physical condition unsuitable for anesthesia or surgery, or low functional demands. The core objective is to maintain fracture stability and create conditions for healing through immobilization. Classic methods include cervical-wrist braces, shoulder-elbow splints, and more rigorous traction immobilization. However, for complex fracture types such as Neer III and IV fractures, non-surgical treatment often yields unsatisfactory results. The main drawback lies in the difficulty of achieving precise anatomical reduction of fracture fragments, particularly the humeral head, tuberosity, and metaphysis, which can easily lead to malunion. This malunion disrupts the biomechanical balance of the rotator cuff, causing sequelae such as subacromial impingement, chronic pain, significantly restricted shoulder range of motion, and reduced upper limb strength, severely impacting patients 'quality of life. Although it avoids surgical risks like infection, nerve damage, and internal fixation failure, the high rates of malunion and functional dissatisfaction have gradually shifted non-surgical treatment from the mainstream approach to a palliative or alternative option for specific populations. Clinical decision-making must rigorously evaluate the patient's fracture type, age, overall condition, and functional expectations.

1.2 Surgical treatment

Surgical intervention has become the primary treatment for complex proximal humeral fractures with significant displacement, aiming to restore the shoulder joint's normal anatomical structure and biomechanical environment through anatomical reduction and robust internal fixation, thereby enabling early functional rehabilitation. Among these techniques, locked plate fixation (e.g., LPHP, PHILOS) stands as one of the most widely used methods. Its angular stabilization design is particularly suitable for osteoporotic fractures and comminuted fractures, effectively maintaining reduction and preventing inversion collapse while significantly reducing the risks of loosening and fracture of traditional plates. However, locked plate surgery also presents challenges, including substantial surgical trauma, high demands for soft tissue dissection, and risks of complications such as avascular necrosis of the humeral head and internal fixation-related issues (e.g., screw dislodgement, subacromial impingement). For elderly patients with severe comminuted fractures, significant disruption of humeral head blood supply, or a high probability of postoperative necrosis in four-part fractures, reverse shoulder arthroplasty offers an alternative critical

treatment option.

1.3 Application of Traditional Chinese Medicine Orthopedic Techniques

The orthopedic manipulation techniques of Traditional Chinese Medicine (TCM) represent a precious medical heritage developed through the Chinese nation's long-term struggle against diseases. The core therapeutic principles of TCM for fractures originate from the "holistic concept" and "syndrome differentiation and treatment," emphasizing "equal emphasis on tendons and bones, balanced regulation of qi and blood, and integration of movement and stillness." In treating complex proximal humeral fractures, TCM manipulation is not used in isolation but serves as an important auxiliary or combined therapeutic approach. Basic techniques include traction to correct overlapping displacement and shortening deformities, manipulation to realign lateral displacement and angular deformities, and rotational flexion-extension to restore normal alignment. For relatively stable complex fractures with mild displacement, experienced physicians can achieve closed reduction through skilled manipulation, combined with external fixation using small splints, achieving the therapeutic effect of "soft overcoming hard" through gentle yet precise techniques. However, for severe comminuted fractures, intra-articular impingement, or those with significant dislocation, manual reduction alone often fails to achieve satisfactory anatomical alignment, limiting its application. The true value of TCM manipulation in modern orthopedic practice lies in its synergistic role with surgical interventions: preoperative closed reduction improves fracture alignment, creating favorable conditions for surgery while reducing intraoperative reduction difficulty and soft tissue dissection. Postoperatively, specific tendon-relaxation techniques and functional rehabilitation exercises during recovery help promote local blood circulation, release adhesions, accelerate soft tissue repair, and effectively prevent joint stiffness, demonstrating the synergistic advantage of "1+1>2" in integrated Chinese-Western medical treatment.

2 Theoretical basis and synergistic mechanism of traditional Chinese medicine bone-setting technique combined with locking plate internal fixation

2.1 Theoretical principle

The integration of traditional Chinese orthopedic manipulation with locked plate internal fixation for complex proximal humeral fractures demonstrates a profound synthesis of modern medical anatomy-biomechanics and traditional Chinese medicine principles, embodying the advanced concept of integrated Western and Eastern therapies. From a modern medical perspective, this approach strictly adheres to the AO principles (anatomical reduction, stable fixation, preservation of blood supply, early mobilization), while optimizing "blood supply preservation" and "anatomical reduction" through Chinese orthopedic techniques. The closed reduction characteristic of manual manipulation minimizes iatrogenic damage to surrounding soft tissues, particularly the critical blood supply source of the humeral head (such as the anterior brachial artery), providing biological assurance for fracture healing and reduced humeral head necrosis rates. Meanwhile, the angular stability design of the locked plate offers reliable mechanical support for the reduced fracture fragments, meeting the biomechanical requirements for early functional rehabilitation. From a theoretical perspective, this therapy is rooted in the "Qi and Blood Theory" and the core concept of "equal emphasis on tendons and bones." Traditional Chinese medicine posits that "the liver governs tendons, and the kidneys govern bones," with fractures inevitably causing "tendon-bone damage" and "Qi-blood stasis." The key to treatment lies in "activating blood circulation to resolve stasis and restoring tendon-bone continuity." The orthopedic manipulation, characterized by "sensitive touch and precise technique," achieves accurate fracture realignment through a process that naturally unblocks meridians and regulates Qi-blood flow. It not only seeks anatomical alignment of bones but also emphasizes restoring the continuity and tension of tendons (muscles, tendons, ligaments, and other soft tissues), adhering to the principle that "soft tendons ensure proper bone alignment," thereby establishing a solid physiological foundation for subsequent plate fixation and functional rehabilitation.

2.2 synergistic mechanism

The integrated application of traditional Chinese orthopedic manipulation techniques and locked plate internal fixation transcends mere technical stacking, creating a synergistic mechanism across perioperative stages. Preoperative synergy manifests through the "soft before hard" strategy: For fractures with significant displacement, systematic manipulation reduction under anesthesia effectively releases interfragmental impingement, corrects shortening deformities via traction, and initially restores the humeral head's alignment. This approach significantly reduces extensive soft tissue dissection and repeated manipulation required for anatomical reduction during surgery, thereby simplifying procedures, shortening operation time, minimizing intraoperative bleeding, and maximizing preservation of residual humeral head blood supply. Intraoperative synergy demonstrates the wisdom of "combining static and dynamic approaches": Within limited surgical incisions, locked plates provide stable mechanical frameworks. For fractures challenging direct instrument reduction, surgeons can leverage manipulation principles—such as lever-based end-point manipulation or combined traction with rotational flexion-extension—to achieve precise micro-adjustments, ensuring anatomical reduction under plate fixation while avoiding excessive incision expansion. Postoperative synergy proves crucial for functional recovery: Locked plates offer rigid assurance for early mobilization, while traditional Chinese massage, tendon manipulation techniques, and active functional exercises provide the "soft" dynamic force. Timely application of joint manipulation techniques post-surgery can effectively enhance local blood circulation, accelerate blood stasis absorption and swelling reduction, relieve pain, while preventing and releasing adhesions in the joint capsule and surrounding soft tissues. By integrating the rehabilitation principle of "combining movement and rest" and guiding patients through progressive functional exercises, this approach significantly reduces the incidence of complications such as shoulder joint stiffness and limited mobility. Ultimately, it achieves simultaneous maximization of bone healing and functional recovery, delivering a "holistic" therapeutic outcome that restores both physical and mental well-being.

3 Clinical application and efficacy evaluation of traditional Chinese medicine bone-setting

technique combined with locking plate internal fixation

3.1 Surgical operation procedures and key technical points

The surgical protocol for traditional Chinese orthopedic manipulation combined with locked plate internal fixation represents a standardized approach that integrates classical reduction techniques with modern surgical methods. This core methodology is implemented throughout the perioperative period. During preoperative preparation, clinicians conduct precise fracture type assessment using imaging data (X-rays, 3D CT reconstruction) to develop personalized manual reduction plans. After anesthesia administration, the procedure begins with systematic TCM orthopedic manipulation. Surgeons utilize "hand-to-heart" tactile assessment to detect fracture displacement, applying traction and manipulation techniques to correct shortening and angular deformities. Subsequent maneuvers including end-point lifting, rotation, and flexion-extension are performed to restore anatomical alignment between the humeral head, greater tubercle, and surgical neck, with initial reduction confirmed via C-arm fluoroscopy. During the surgical phase, a deltoid-pectoralis major gap approach is typically adopted while protecting the brachiocephalic vein. Under limited exposure, the locked plate is positioned approximately 5-8mm below the greater tubercle's inferior margin and 2-10mm posterior to the intertubercular groove. This phase demonstrates the synergistic role of orthopedic manipulation, where minor post-plate displacement can be fine-tuned through percutaneous Kirschner wire adjustment or manual assistance to ensure precise restoration of the humeral head's anteversion and posteroversion angles. The key technique involves leveraging the anatomical configuration of the plate and the angular stability of locking screws to provide stable fixation. In osteoporotic bone, optimal screw length and distribution within the humeral head must be ensured to maximize grip strength. Postoperative treatment should be guided by the principle of "combining movement and rest" in traditional Chinese medicine. Under the condition of effective analgesia, patients should be instructed to perform pendulum-like movements and passive activities at an early stage, and be supplemented with oral and external Chinese herbal medicine to promote blood circulation, resolve stasis, reduce swelling and relieve pain, which will lay a foundation for subsequent functional recovery.

3.2 Clinical efficacy evaluation indicators

The evaluation of the efficacy of this combined therapy must employ a multidimensional and comprehensive indicator system to fully reflect its therapeutic outcomes. Imaging assessment serves as the foundation, primarily evaluated through postoperative and follow-up X-rays and CT scans. Key indicators include: fracture reduction quality (assessed against Neer et al. 's criteria for alignment and reduction), position and stability of internal fixation devices, fracture healing time, and long-term complications such as avascular necrosis of the humeral head, internal fixation loosening or fracture, and incidence of traumatic arthritis. Functional assessment is central, aiming to quantify the degree of shoulder joint function recovery. Internationally recognized and highly valid scales include: the Constant-Murley Score (CMS) for comprehensive evaluation of pain, daily activities, range of motion, and muscle strength; the American Shoulder and Elbow Surgeons' Score focusing on patient-reported subjective experiences and functional capacity; and the Disability-Adjusted Functioning, Activity, and Health Status (DASH) Scale for comprehensive assessment of upper limb functionality in daily activities. These scales provide objective, quantifiable data facilitating inter-study comparisons. Pain and quality of life assessment serve as crucial supplements, typically using visual analog scale (VAS) to evaluate dynamic changes in pain intensity and standardized quality of life scales like the SF-36 to assess treatment impacts on overall physical and mental health. Complication statistics are pivotal for safety evaluation, requiring systematic documentation and analysis of all treatment-related complications such as incision infections, neurovascular injuries, subacromial impingement syndrome, and heterotopic ossification. Only through comprehensive monitoring and analysis of these indicators can we evaluate the clinical value of the combination therapy scientifically and objectively.

3.3 Review of relevant clinical studies at home and abroad

In recent years, clinical studies both domestically and internationally on the combined use of traditional Chinese orthopedic manipulation techniques and locked plate internal fixation for treating complex proximal humeral fractures have been increasing, providing evidence-based medical support for the efficacy of this therapeutic approach. Most domestic research has focused on retrospective case-control studies. Extensive literature reports indicate that compared with simple locked plate surgery, the combined therapy group demonstrates significant advantages in intraoperative indicators (such as operative time and intraoperative blood loss) and early postoperative functional recovery. Studies suggest that preoperative manual reduction can effectively simplify surgical procedures, minimize soft tissue interference, thereby reducing postoperative pain and swelling, and creating conditions for patients to begin functional exercises earlier. Some studies have also confirmed through follow-up data that the combined therapy can reduce the incidence of postoperative shoulder stiffness and improve the final excellent rate of functional outcomes such as the Constant-Murley score. However, domestic research also has some common limitations, such as being predominantly single-center, small sample sizes, lack of long-term follow-up data, and inconsistent descriptions and standardization of specific manipulation techniques. In contrast, foreign studies rarely report systematic research on "traditional Chinese orthopedic manipulation" as an independent technique, but its philosophy aligns with modern orthopedic principles of "closed reduction and minimally invasive fixation." Foreign research tends to focus more on comparing biomechanical and clinical effects of different internal fixation devices, surgical approaches, and reduction techniques.

4 Discuss

4.1 Core Advantages and Clinical Value Analysis of Combination Therapy

The core strength of the combined therapy lies in its seamless integration of "biological" and "biomechanical" principles. Its clinical value is demonstrated through: preoperative closed reduction via orthopedic manipulation, which maximally preserves blood supply to the

fracture site and reduces the risk of humeral head necrosis, showcasing the biological benefits of minimally invasive techniques; combined with the angular stability of the locking plate, it provides robust mechanical support for fracture healing and meets the needs of early functional rehabilitation. This "soft before hard, equal emphasis on tendons and bones" strategy not only simplifies surgery and reduces trauma but also, through postoperative TCM rehabilitation, effectively promotes functional recovery, minimizes complications like joint stiffness, and achieves comprehensive optimization from bone healing to functional rehabilitation, significantly enhancing patients' overall treatment outcomes and quality of life.

4.2 Discussion on the key factors affecting the efficacy of combination therapy

The efficacy of combined therapy is influenced by multiple factors. First, the surgeon's expertise is critical, requiring both advanced locking plate techniques and profound traditional Chinese orthopedic skills with tactile sensitivity—both being indispensable. Second, the fracture type is a decisive factor. For severe comminuted fractures or those with articular surface collapse that cannot be stabilized manually, the therapeutic value may be limited. Finally, patient compliance is key to ensuring effectiveness. Whether patients can follow a physician-guided, scientific, and systematic rehabilitation program directly impacts the final recovery of shoulder joint function. Any oversight in this process may compromise treatment outcomes.

4.3 Future research directions and prospects

Future research should prioritize addressing existing gaps. The foremost task is to conduct rigorously designed multicenter randomized controlled trials (RCTs) to generate higher-level evidence-based medical data. Secondly, efforts should focus on quantifying, standardizing, and visualizing orthopedic manipulation techniques, such as developing repeatable and scalable operational protocols through integration with 3D dynamic navigation technology. Concurrently, a comprehensive evaluation system should be established that integrates imaging, functional assessment, and TCM syndrome analysis. Finally, leveraging modern molecular biology approaches, we must delve into the underlying mechanisms of combined therapies for fracture healing. This will facilitate theoretical-practical synergy and advance the scientific development of integrated Chinese-Western orthopedics.

5 Conclusion

The integrated approach of traditional Chinese orthopedic manipulation combined with locked plate internal fixation for complex proximal humeral fractures demonstrates complementary advantages and remarkable therapeutic efficacy. This innovative treatment model synergizes the minimally invasive philosophy of TCM orthopedics—prioritizing joint and bone preservation while safeguarding blood circulation—with the biomechanical strengths of modern locked plates, which ensure stable fixation and early mobilization. The combined therapy has shown unique clinical value in improving fracture reduction accuracy, minimizing surgical trauma, reducing complication rates, and facilitating shoulder joint function recovery. Although current research has limitations, existing evidence strongly supports its clinical potential. Through standardized studies and mechanistic exploration, this integrated approach is poised to become one of the most promising standardized protocols for treating complex proximal humeral fractures, warranting further clinical promotion and application.

Reference

[1] Lin Pingping, Pang Na. Clinical efficacy analysis of traditional Chinese medicine bone-setting technique combined with external fixation in treating intertrochanteric fractures in elderly patients [J]. Contemporary Medical Tribune, 2025,23(11):46-48.

[2] Huang Shiwei, Huang Yingru, Yin Wei, et al. Clinical effect of ultrasound-guided combined with traditional Chinese medicine bone-setting technique and plaster fixation in the treatment of distal radius fracture [J]. China Contemporary Medicine, 2025,32 (30):80-83+88.

[3] Zhang Caijun. Application of Traditional Chinese Medicine (TCM) Orthopedic Manipulation Combined with Small Plaster Fixation in the Treatment of Elderly Patients with Distal Radius Fracture [J]. Modern Medicine and Health Research Electronic Journal, 2025,9(15):117-120.