

Research/Technical Note

Chinese Expert Consensus on Ultrasound-Guided Myofascial Trigger Point Hydrodissection Technology

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Abstract

This Chinese Expert Consensus, Addressing the Non-standard Application of Ultrasound-guided Myofascial Trigger Point (MTrP) Hydrodissection, Formulates Recommendations Using the Grading of Recommendations Assessment, Development and Evaluation (GRADE) Method. This Consensus Elaborates on Diagnostic Criteria for MTrP and Efficacy Evaluation, Including Requirements for Operator Qualifications, Training and Quality Control, etc. It Also Offers Detailed Guidance on Procedural Techniques and Solution Preparation for Hydrodissection on Cervical, Thoracic, Lumbar and Gluteal MTrP, with Adverse Reactions and Treatments Sorted Out. This Expert Consensus Expected for Providing Technical Guidance to Clinicians.

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Received: 26 September 2026; **Accepted:** 10 October 2026; **Published:** 29 October 2026



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Keywords

Ultrasound-guided, Myofascial Trigger Point, Hydrodissection Technology, Myofascial Pain Syndrome, Expert Consensus

1. Background and Purpose

Ultrasound-guided hydrodissection is a novel therapeutic technique that has emerged and been innovatively applied in recent years for the treatment of pain caused by myofascial pain syndrome (MPS), specifically myofascial trigger points (MTrPs) [1-3]. Initially, this technique was applied to release perineural adhesions [4-9]. Ultrasound-guided MTrP hydrodissection is a minimally invasive interventional therapy based on dual positioning using imaging and anatomy. It involves the precise injection of normal saline or other isotonic solutions around the MTrP or into interfascial planes to separate adherent muscles and fascia, eliminate local pain-inducing substances, and block the transmission of pain signals, thereby achieving analgesia. This technique provides a novel, visualized, and standardized interventional pathway for MTrP management [1-3]. However, as this is a relatively new field, although numerous clinical reports have confirmed its efficacy, there is a lack of high-level evidence-based medicine, such as large-scale, multicenter, double-blind randomized controlled trials (RCTs). In the absence of "gold standard" evidence, the widespread practical application of this technique has encountered issues including non-standardized procedures, questionable techniques, and a lack of authoritative guidance.

Therefore, formulating an expert consensus on ultrasound-guided MTrP hydrodissection is urgently needed. This expert consensus adopts the internationally recognized Grading of Recommendations Assessment, Development, and Evaluation (GRADE) method [4] for evidence quality grading and recommendation formulation. The consensus covers the technical principles, indications and contraindications, operational specifications, efficacy evaluation, and risk assessment and prevention. Based on the best available evidence and extensive clinical expertise, the formulation of this consensus aims to fill the gap in high-level evidence, consolidate the wisdom and experience of authoritative experts in the field, address the risk of "unregulated" technical growth, curb non-standardized practices through established standards, guide the technology

towards healthy and orderly development, protect patient safety, and uphold the reputation of the profession. The development of this consensus is expected to promote the legal and compliant application of this technology, enhance its clinical safety and efficacy, provide technical guidance for physicians at all levels—especially primary care pain physicians—and ultimately contribute to the overall improvement of medical quality [2, 10].

2. Mechanism of MTrP Hydrodissection

The viscoelastic properties of fascial layers and the hyaluronic acid between them are considered crucial for the function of the musculoskeletal system. Scar tissue between fascial layers may reduce gliding ability and cause pain [2]. MTrP hydrodissection alleviates pain through multiple mechanisms, including:

- 1) Release of myofascial adhesions: utilizing hydraulic mechanical force to separate adherent fascial layers, muscle groups, and pathological adhesions between muscles and nerves, thereby breaking the "pain-muscle spasm-ischemia" cycle, restoring fascial gliding function, and reactivating nerves [5].
- 2) Promotion of angiogenesis: improving local tissue blood flow, alleviating metabolic stress, promoting muscle relaxation, and relieving pain [6].
- 3) Release of nerve entrapment: diluting and reducing inflammatory mediators around nerves (such as Substance P, calcitonin gene-related peptide, etc.), thereby alleviating mechanical and chemical stimulation of nerve endings and blood vessels.
- 4) Restoration of biomechanical balance: improving asymmetric tension in muscle groups.

This consensus adopts the GRADE method to grade evidence quality and recommendation strength, as detailed in Table 1.

Table 1. GRADE Evidence Quality and Recommendation Strength Grading.

Category	Description
Evidence Level	
High (A)	Based on high-quality systematic review results; very confident that the true effect lies close to the estimate. Further research is unlikely to change this confidence.

Category	Description
Moderate (B)	Based on RCTs and high-quality observational studies; moderately confident in the estimate. The true effect is likely close to the estimate, but there is a possibility of substantial difference.
Low (C)	Based on low-quality RCTs and observational studies; confidence in the estimate is limited. Further research is very likely to change the confidence in the estimate.
Very Low (D)	Based on case-control studies or case reports; very little confidence in the estimate. The true effect is likely to be substantially different from the estimate.
Recommendation Strength	
Strong	Recommendation formulated after fully considering evidence quality, as well as the operability, benefits, risks, and costs of the intervention.
Weak	Evidence is variable; recommendation has uncertainty, or the recommendation may entail higher risks or poorer cost-benefit ratios, leaning towards a lower grade recommendation.

Recommendation 1: Practitioners performing ultrasound-guided MTrP hydrodissection must be thoroughly familiar with the principles of hydrodissection. (*Strong recommendation, A-level evidence*).

3. Diagnosis of MTrPs

Essential diagnostic criteria for MTrPs [11, 12]:

Patient's chief complaint of pain or dysfunction aligns with the referred pain pattern of specific muscle groups.

Palpation can reproduce MTrP characteristics: taut band + tenderness + referred pain.

Pain/dysfunction cannot be explained by other diseases.

Supporting criteria:

Ultrasound shows restricted fascial gliding or thickening.

Elastography shows E-value > 50 kPa.

Electromyography (EMG) shows spontaneous potentials in the involved muscle.

Recommendation 2: Practitioners performing ultrasound-guided MTrP hydrodissection must be proficient in the diagnostic criteria for MTrPs. (*Strong recommendation, A-level evidence*).

4. Pain and Efficacy Evaluation

Evaluation of patient pain and the efficacy of hydrodissection involves assessing analgesic effects, functional improvement, and safety. Comprehensive and objective evaluation of post-hydrodissection outcomes is crucial for quantifying treatment effects, guiding subsequent therapy, and comparing different technical approaches.

Recommendation 3: Pre- and post-treatment assessment of pain and efficacy in MTrPs hydrodissection is of significant importance. (*Strong recommendation, A-level evidence*).

4.1. Assessment Methods

- 1) Pain intensity assessment: including visual analogue scale (VAS); numeric rating scale (NRS); McGill Pain Questionnaire (MPQ), etc. The patient's pain relief was evaluated using the above several methods.
- 2) Functional status and quality of life assessment: including Barthel Index [13] (Appendix 2); SF-36 (36-item short form health survey) [13] (Appendix 3); Oswestry disability index (ODI) [14]; Neck disability index (NDI) [15, 16]. These assess the degree of pain relief and functional improvement.
- 3) MTrP-Specific Assessment: Palpation to record the activity status of tender points (whether active trigger points become latent or disappear). Assessing improvement in muscle stiffness via palpation or myotonometer (e.g., taut bands/nodules, changes in pressure pain threshold) [11]. Ultrasound evaluation: whether fascial layer thickness and the hypoechoic oval area [17] associated with MTrPs are reduced or resolved; Patient Global Impression of Change [18].

All above assessments should be performed before treatment, immediately after each treatment session, and at the end of the treatment cycle to determine the efficacy of hydrodissection and guide subsequent treatment planning.

4.2. Assessment Time Points

Establishing a reasonable and standardized timeframe for efficacy assessment is crucial for accurately capturing the trajectory of change. The following framework is suggested: Baseline (T0, within 1 week before treatment): Pain intensity, functional status, and imaging characteristics; Immediately Post-Treatment (T1): Acute responses, pain relief, and functional changes; 2 Weeks Post-Treatment (T2): Pain improvement, functional changes, and trigger point status; 1 Month Post-Treatment (T3): Pain improvement, functional changes,

and quality of life; 3 Months Post-Treatment (T4): Comprehensive assessment of pain, function, tender points, quality of life, etc.

4.3. Efficacy Evaluation Criteria

The efficacy criteria for MTrP hydrodissection should be based on the assessment dimensions and time points mentioned above. Criteria should integrate the magnitude of pain reduction, degree of functional improvement, and improvement in trigger points to form a comprehensive judgment: Markedly Effective: Pain essentially resolved: VAS score decreased by $\geq 50\%$ [19], functional scale improvement $\geq 30\%$, and palpation-related signs essentially resolved; Effective: Pain significantly relieved: VAS score decreased by $\geq 30\%$ but $< 50\%$, functional improvement $\geq 15\%$, and some improvement in palpation signs; Ineffective: No improvement or worsening of pain and function: VAS decrease $< 30\%$ or no change, and no functional improvement.

Recommendation 4: Practitioners must strictly adhere to the assessment protocols for pain, function, and efficacy before and after hydrodissection treatment. (*Strong recommendation, A-level evidence*).

5. Indications for MTrP Hydrodissection

- 1) Chronic MPS (≥ 3 months) with active MTrPs, where conservative treatment has failed [3, 20].
- 2) Post-surgical/traumatic adhesive MPS [21].
- 3) Nerve entrapment combined with MPS (e.g., carpal tunnel syndrome + pronator teres MTrP) [22].
- 4) Fibromyalgia with localized MTrPs [23].
- 5) Overuse MPS in athletes.
- 6) Cancer pain [24] or postherpetic neuralgia [25] with a myofascial pain component.

6. Contraindications for MTrP Hydrodissection

- 1) Active infection at the puncture site (purulent/cellulitic lesions).
- 2) Severe coagulation disorders: INR > 3.0 or platelet count $< 50 \times 10^9/L$.
- 3) Definite allergy to any component of the injectate (including normal saline).
- 4) Patient refusal or inability to sign informed consent.
- 5) Puncture pathway unable to avoid a malignant tumor area.

Recommendation 5: Practitioners must be familiar with the indications and contraindications for MTrP hydrodissection. (*Strong recommendation, A-level evidence*).

7. Practitioner Qualifications, Training, and Quality Control

7.1. Practitioner Qualifications

Must be a physician with a valid medical practitioner license, registered in a legal medical institution, specializing in Pain Medicine, Rehabilitation Medicine, or Anesthesiology. It is strongly recommended that practitioners have received standardized training in clinical ultrasound-guided precision diagnostic and therapeutic skills, organized by the Capacity Building and Continuing Education Center of the National Health Commission, and possess proficient skills in ultrasound anatomical identification across various body regions.

7.2. Training Requirements

The training should center on systematic and standardized processes, covering the entire theoretical-practical spectrum to eliminate experience-based practices, ensure technical safety and efficacy. Practitioners must master the following key points:

- 1) Understand the mechanisms of analgesia, MTrP diagnosis/efficacy assessment (VAS/NRS, etc.), and indications/contraindications.
- 2) Possess a thorough understanding of local anatomy of the neck, chest, lumbar spine, sacrum, and buttocks; clearly identify the positional relationship between target muscle groups and critical structures such as the vertebral artery and pleura; establish a cognitive link between anatomy and ultrasound imaging.
- 3) Be skilled in probe selection, aseptic technique, identification of characteristic imaging signs (e.g., "boat sign"), and in-plane "needle-tip visualization" technique, optimizing the "water window" effect for enhanced visibility.
- 4) Complete standardized full-procedure operations on simulation phantoms, with emphasis on practicing avoidance of high-risk scenarios.
- 5) After completing ≥ 10 supervised procedures on various body regions without adverse events under the guidance of a qualified instructor, practitioners may apply for independent practice qualifications.
- 6) Stage assessments: theoretical closed-book exam score $\geq 80\%$, ultrasound skills (accurately identify target muscle groups and ≥ 3 critical structures within 10 minutes), and practical exam score $\geq 90\%$.

7.3. Quality Control

- 1) Develop standardized operational manual: clearly defining pre-operative assessment, step-by-step procedures for different body regions, intraoperative risk prevention, and post-operative management processes.
- 2) Establish standardized recording templates: Including

patient demographics, MTrP diagnosis; pre-operative localization, intraoperative puncture, and post-operative diffusion ultrasound images (with annotations and technical parameters); solution preparation and injection records; pre- and post-treatment efficacy scores (VAS/NRS, etc.); and management of adverse events.

- 3) Adverse event reporting system: report adverse events such as local swelling, nerve/vascular injury within 24 hours. Conduct monthly analytical meetings to review and optimize operational protocols.
- 4) Regular quality control: conduct intra-institutional audits quarterly and inter-institutional joint control annually. Randomly inspect 30% of operation records, verifying compliance with standards, image quality, and handling of adverse events. Practitioners failing audits must undergo retraining and reassessment.

Recommendation 6: Practitioners performing hydrodissection must possess formal training and relevant technical qualifications for hydrodissection. (*Strong recommendation, A-level evidence*).

Recommendation 7: Hydrodissection procedures must be performed using standardized and normalized quality control and supervision to prevent adverse events. (*Strong recommendation, A-level evidence*).

8. Hydrodissection Operational Specifications

8.1. Preoperative Preparation

8.1.1. Patient Assessment

- 1) Detailed history taking (pain characteristics, location, nature, aggravating/relieving factors, previous treatments).
- 2) Comprehensive physical examination (range of motion of head/neck/spine/trunk/limbs, tenderness points, myofascial trigger points, neurological examination).
- 3) Imaging evaluation (X-ray, MRI/CT of cervical/thoracic/lumbar spine as relevant), focusing on assessing muscles, tendons, joints, blood vessels, nerves, and spinal canal conditions in areas corresponding to pain.
- 4) Confirm diagnosis and rule out other serious diseases causing local pain (e.g., tumors, intracranial lesions, visceral diseases, rheumatic immune diseases).

Sign informed consent, adequately informing risks, benefits, and alternatives.

8.1.2. Environment and Equipment

- 1) Environment: Treatment room meeting aseptic requirements (operating room or outpatient treatment room).
- 2) Equipment: Ultrasound machine with low-frequency convex or high-frequency linear probe, and coupling gel; Sterile probe cover; Injection needles: recommend fine-

gauge long needles (25G-27G, length 5-9 cm) for precise puncture and angle adjustment; Syringes: 10 ml or 20 ml (for solution); Disinfection supplies: Iodophor, sterile gauze; Sterile drapes and gloves; Emergency equipment and medications (oxygen, manual resuscitation bag, suction device, epinephrine, antihistamines, etc.).

8.1.3. Solution Preparation:

- 1) Basic solution: normal saline 85-90 ml + 2% Lidocaine 10-15 ml (final concentration approx. 0.2-0.33%).
- 2) Betamethasone: 1 ml (1 ml: 7 mg) may be added. (Note: Add based on individualized risk-benefit assessment, especially when operating near nerve roots.)
- 3) Alternative options: triamcinolone (10-20 mg) can be used instead of betamethasone; or plain normal saline/local anesthetic mixture can be used for pure hydrodissection.

Recommendation 8: For MTrP hydrodissection, the type and concentration of the solution can influence onset time, duration of action, and analgesic effect. A solution of 0.33% lidocaine with or without betamethasone, at a volume of 2-3 ml per point, is suggested. (*Weak or moderate recommendation, C-level evidence*).

Recommendation 9: During MTrP hydrodissection, ensure the solution type and concentration are within safe limits, and adjust based on individual patient needs. (*Moderate or weak recommendation, A-level evidence*).

8.2. Operational Procedure Specifications

8.2.1. Perational Procedure for Cervical MTrP Hydrodissection

Example using the Obliquus Capitis Inferior (OCI) muscle: OCI strain-related pathologies (including adhesions, calcification) and abnormal adhesions with adjacent muscles (e.g., semispinalis capitis) are core pathological mechanisms leading to greater occipital nerve (GON) entrapment and cervicogenic headache (CeH). Such pathologies can further affect the C1 segment of the vertebral artery, leading to reduced blood flow velocity and volume, a significant trigger for dizziness.

Ultrasound-guided OCI hydrodissection release is a key technique for treating CeH and vertebral artery-related dizziness. When combined with C2 Dorsal Root Ganglion (DRG) pulsed radiofrequency modulation, efficacy can be significantly enhanced. To ensure homogenization and standardization of OCI procedures, guarantee safety and reproducibility, and minimize complications like vertebral artery and spinal cord injury, the following standardized technical workflow is established.

(i). Positioning

Lateral decubitus position, affected side up. Head supported on a pillow, maintaining the cervical spine in a neutral or

slightly flexed position to fully expose the occipito-cervical region, ensuring patient comfort and stability (Figure 1).

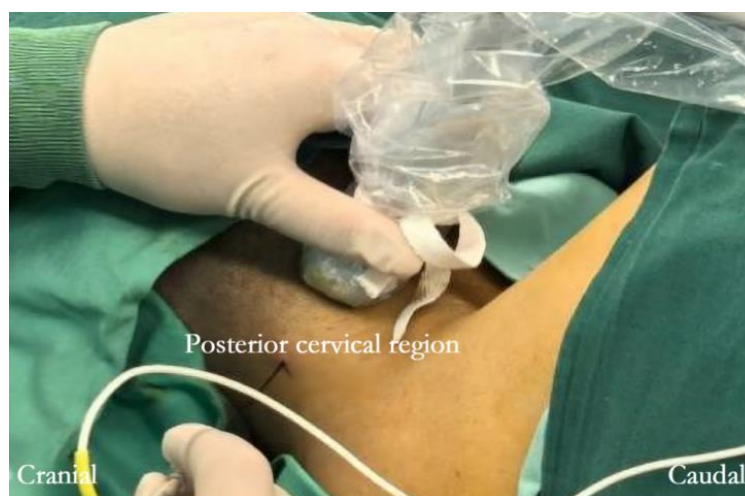


Figure 1. Lateral decubitus position, affected side up, fully exposing the occipito-cervical region.

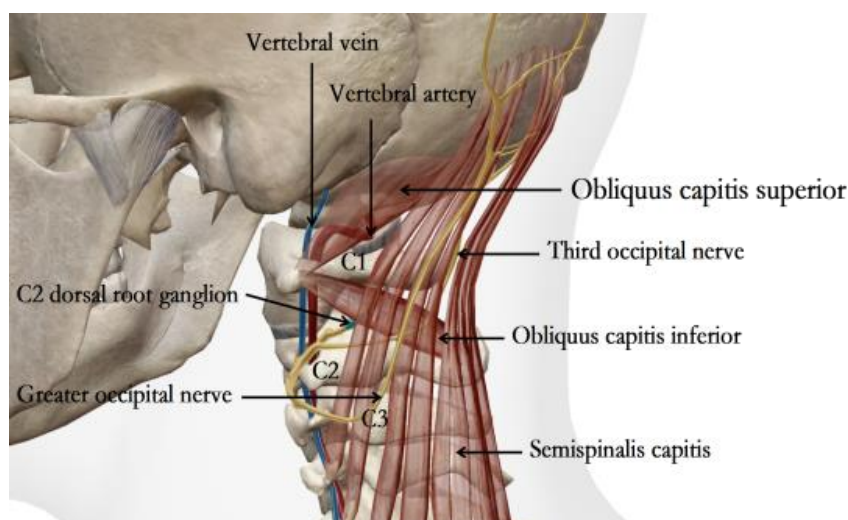
(ii). Operational Steps (Ultrasound-Guided)

A. Aseptic Management: Practitioner wears mask, cap, performs standard handwashing, and wears sterile gloves. The puncture site is disinfected with iodophor and draped. The ultrasound probe is coated with sterile gel and covered with a sterile sheath (same for all procedures below).

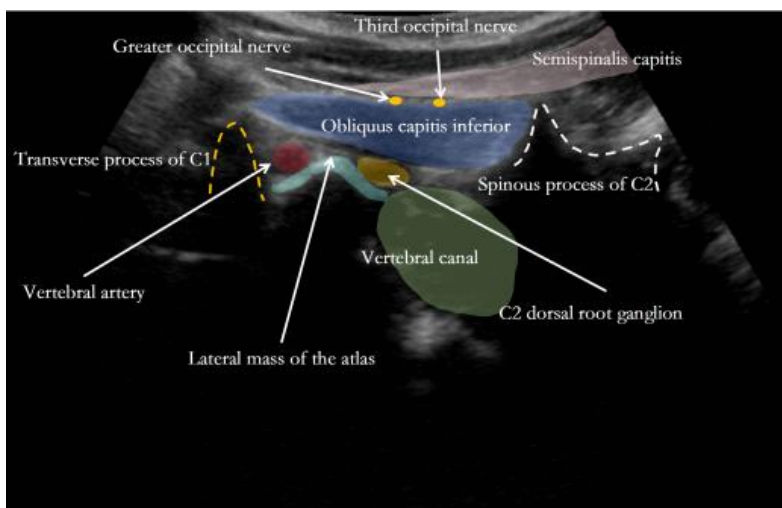
B. Ultrasound Localization and Anatomical Identification: Use a low-frequency convex probe. Preferred scanning is the posterior paramedian oblique short-axis view. Clearly identify key structures [26-28]:

- 1) C1 transverse Process: deep strong echogenic bony shadow, relatively superficial.
- 2) C2 spinous process bifid: strong echogenic bony shadow slightly caudal to the midline.

- 3) OCI: oblique muscle bundle (medium echogenicity) located between the C1 transverse process and the C2 spinous process, resembling a boat shape - termed the "boat sign."
- 4) Vertebral artery (VA): located deep to the OCI, between the C1 and C2 transverse foramina. Seen as an anechoic tubular structure with pulsation; Doppler confirmation is crucial.
- 5) C2 DRG: located posterior to the C1-C2 facet joint, deep and medial to the OCI, often appearing as a hypoechoic oval structure.
- 6) Spinal canal/dural sac: deepest layer, must be avoided.
- 7) Determine Target Puncture Path: Avoid the VA, C2 DRG, and spinal canal. **Figure 2.**

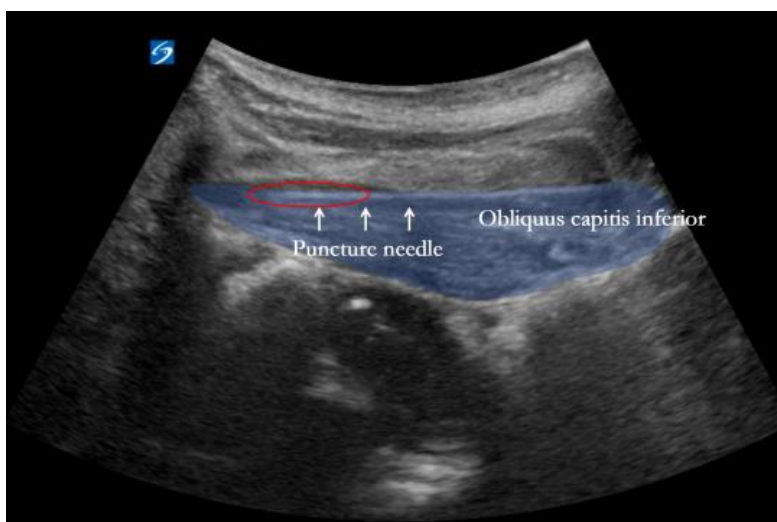


2A

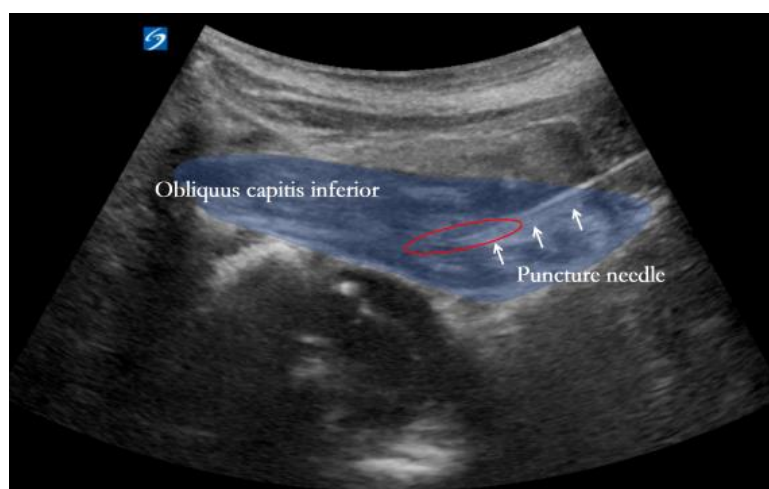


2B

Figure 2. 2A-2B Schematic diagrams of the OCI muscle.



3A



3B

Figure 3. 3A-3B Ultrasound images showing OCI and puncture needle.

Recommendation 10: Ultrasound guidance is recommended for MTrP hydrodissection; blind puncture based solely on surface landmarks is not recommended. (*Strong recommendation, A-level evidence*).

Recommendation 11: Practitioners performing cervical MTrP hydrodissection under ultrasound guidance must possess foundational ultrasound knowledge and follow standardized procedures. High-frequency linear probes are often preferred. Blind puncture is not recommended. (*Strong recommendation, C-level evidence*).

C. Puncture and "Hydrodissection":

Use an in-plane approach, inserting the needle slightly lateral to the posterior midline on the affected side. Aim the needle tip cranially and anteriorly (towards the OCI between the C1 transverse process and C2 spinous process). Under real-time ultrasound guidance, advance the needle slowly while injecting solution in increments of 0.5-1 ml. The solution spreading in the fascial plane creates a "water window" effect (hydrodissection). This serves to: ① optimize visualization: reduce acoustic impedance differences in superficial tissues, enhancing visualization of deep structures. ② improve needle visibility: the fluid-filled anechoic area surrounds the needle, improving its conspicuity. ③ risk mitigation: expanding tissue planes helps displace neurovascular bundles. ④ core therapeutic action: hydraulic mechanical force separates soft tissue and muscle adhesions. ⑤ concurrent anesthesia: local anesthetic in the solution provides immediate analgesia.

Target needle positions: ① primary target (fascial interface release): needle tip reaches the superficial fascial layer of the OCI. Avoid advancing too fast to prevent puncturing the GON and Third Occipital Nerve (TON). ② secondary target (intralesional release): if ultrasound shows echogenic calcifications, fibrosis, or definite adhesions within the OCI or adjacent muscles (e.g., semispinalis capitis), the needle tip can be precisely advanced into the lesion under real-time guidance.

Recommendation 12: During cervical MTrP hydrodissection, attention must be paid to avoiding blood vessels, nerves, and the spinal canal. (*Strong recommendation, C-level evidence*).

Recommendation 13: For cervical MTrP hydrodissection, both primary and secondary targets should be addressed to ensure thorough release of MTrP adhesions. (*Moderate or weak recommendation, C-level evidence*).

D. Solution Injection and Release:

After the needle tip is correctly positioned, aspirate to confirm no blood or cerebrospinal fluid (CSF). ① fascial release: inject 5-10 ml of solution onto the superficial fascia of the OCI. Observe solution spreading within the fascial planes. Ideally,

it should surround the target nerves (GON, TON) and muscle. ② intralesional release: if targeting internal lesions, inject 5-10 ml of solution. During injection, gently and slowly move the needle tip back and forth ("shuttling" technique) to use the fluid's mechanical force to further release adhesions and fibrous bands. The total volume per side should not exceed 30 ml.

Recommendation 14: For cervical MTrP hydrodissection, using 5-10 ml of solution and the shuttling technique is suggested. (*Moderate or weak recommendation, C-level evidence*).

E. Needle Withdrawal and Compression:

After injection, withdraw the needle slowly. Apply compression with sterile gauze over the puncture site for 3-5 minutes to prevent hematoma formation. Apply a sterile dressing.

8.2.2. Operational Procedure for Thoracic MTrP Hydrodissection

(i). Anatomical Structure of the Thoracic Outlet

The thoracic outlet is the region between the clavicle and the first rib, extending from the supraclavicular fossa to the axilla. It contains three critical structures susceptible to compression: the brachial plexus, subclavian artery, and subclavian vein. Compression can occur in three different regions of the thoracic outlet: the scalene triangle, the costoclavicular space, and the retropectoralis minor space [29, 30], leading to Thoracic Outlet Syndrome (TOS) symptoms due to vascular and/or neurological compression. Neurogenic TOS is the most common (95%), vascular (mainly venous) accounts for about 5%, and arterial is rare. Neurogenic TOS typically presents with persistent upper extremity weakness, numbness, paresthesia, and non-radicular pain aggravated by sustained arm activity. Characteristic signs include hand intrinsic muscle atrophy and sensory changes in the medial forearm and ulnar side of the hand.

- 1) Scalene Triangle: Bordered anteriorly by the anterior scalene muscle, posteriorly by the middle scalene muscle, and inferiorly by the first rib. It contains the upper, middle, and lower trunks of the brachial plexus and the subclavian artery. It is the most common site of compression in neurogenic TOS. The proximal fibers of the scalene muscles completely envelop the C5 and C6 nerve roots, and their interaction can cause dynamic nerve compression, leading to upper trunk brachial plexopathy symptoms (Figure 4).

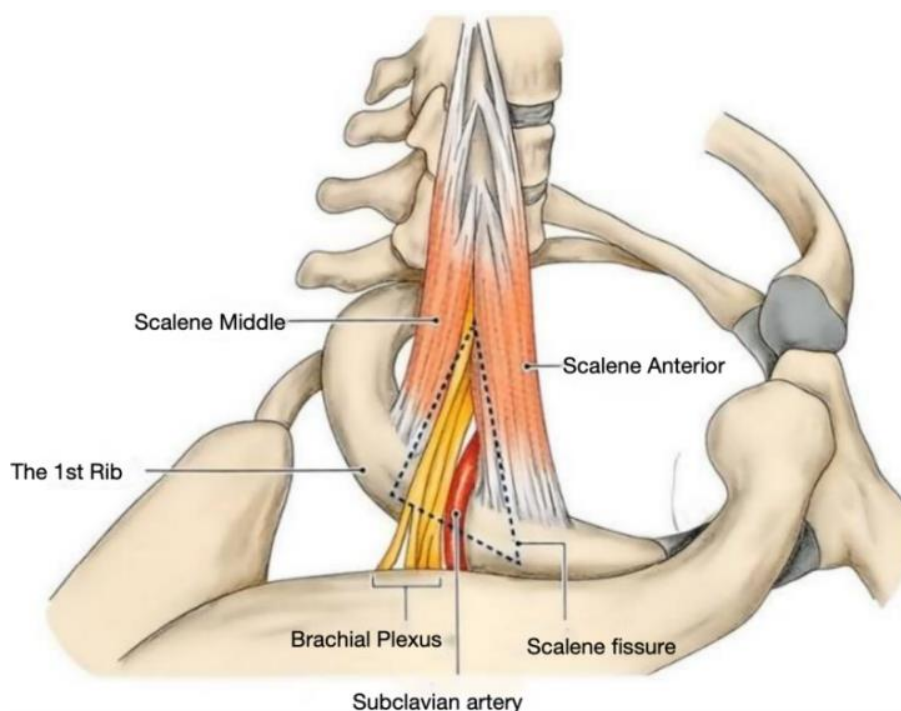


Figure 4. Schematic diagram of anterior scalene muscle compressing the brachial plexus and vessels.

2) Costoclavicular space: bordered anteriorly by the clavicle, subclavius muscle, and costocoracoid ligament; posteriorly by the first rib and anterior/middle scalene muscles; laterally by the scapula. It contains the divisions of the brachial plexus, the subclavian artery, and vein (Figures 7A and B). It is the most common site of compression for arterial TOS. The subclavian artery lies anterior to the subclavian vein and is surrounded by the three cords of the brachial plexus. Hypertrophy or excessive

tension of the subclavius muscle, or prominence of its clavicular attachment, can narrow the space, causing "costoclavicular syndrome." Drooping shoulders lower the superior surface of the costoclavicular space; arm elevation causing posterior rotation of the clavicle moves the costocoracoid ligament (anterior wall) posteriorly, compressing the neurovascular bundle and causing pain and numbness. [Figure 5.](#)

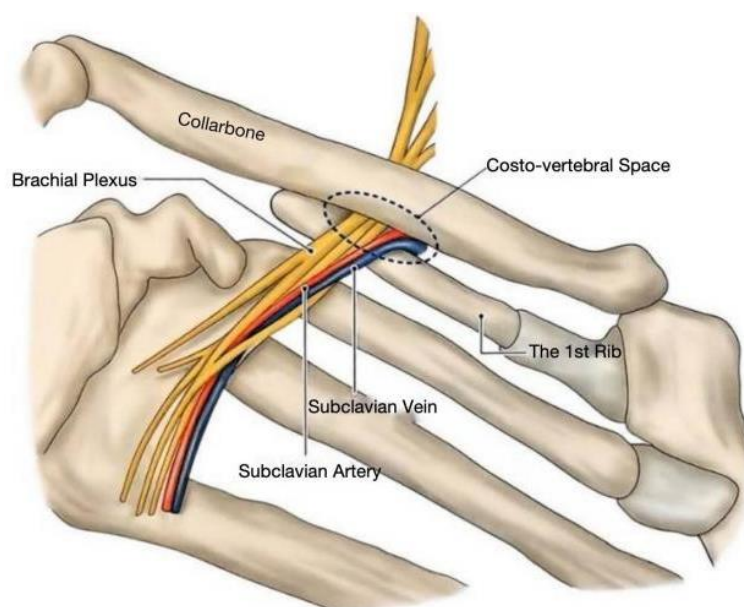


Figure 5. The costoclavicular space shows the subclavius muscle and the brachial plexus, axillary artery and vein.

3) Posterior space of the pectoralis minor muscle: Located below the coracoid process, bordered anteriorly by the pectoralis minor muscle, posteriorly by the subscapularis muscle, and inferiorly by the 2nd-4th ribs. It contains the cords of the brachial plexus and the axillary artery and vein. The pectoralis minor forms a "bridge" over the neurovascular structures passing from the thorax to the upper limb. Besides protecting them, the pectoralis minor acts as a scapular extensor, stabilizing the scapula through downward traction [31, 32]. Occupational and daily activities involving forceful, repetitive upper limb movements (e.g., rowing, swimming, baseball, volleyball, throwing, weightlifting) can strain the pectoralis minor and create myofascial trigger points, further shortening the muscle. This can also press the humeral head against vascular structures, causing intimal damage,

thrombosis, and nerve compression, leading to pain from pectoralis minor and neurovascular compression [33, 34].

Recommendation 15: Practitioners performing thoracic MTrP hydrodissection under ultrasound guidance must have knowledge of thoracic local anatomy and adhere to standardized procedures. Blind puncture based on surface landmarks is not recommended. (*Strong recommendation, A-level evidence*).

(ii). Positioning

Supine position, with a thin pillow under the shoulders to maintain slight cervical hyperextension, fully exposing the anterior neck muscles, ensuring patient comfort and stability (Figure 6).

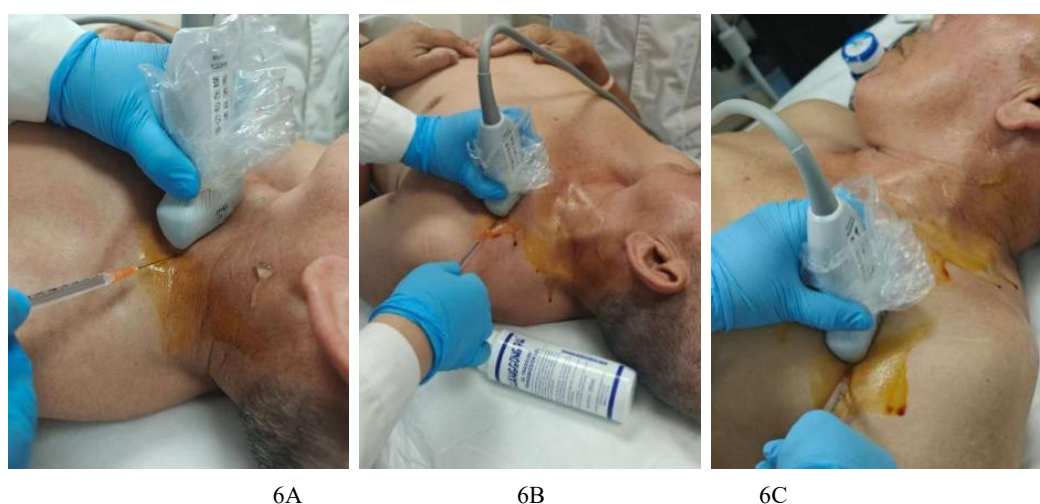


Figure 6. 6A-6C Patient supine, head turned to contralateral side.

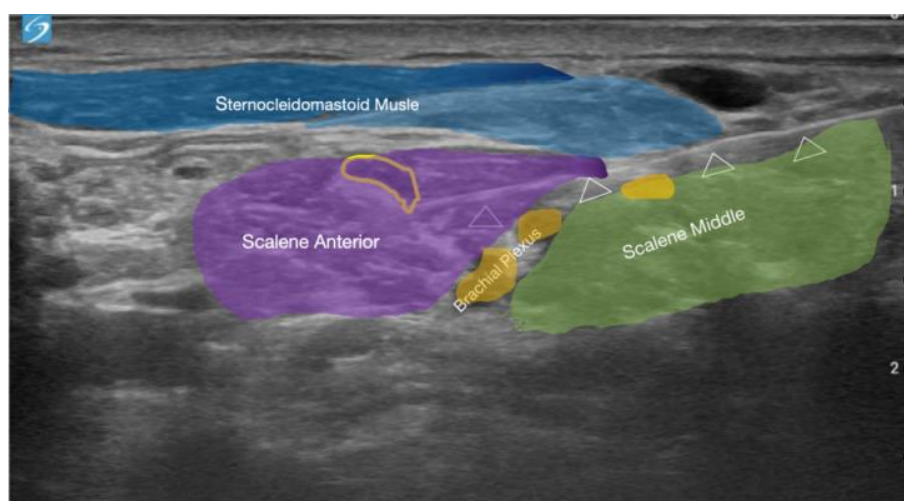


Figure 7. Anterior Scalene Hydrodissection.

(iii). Operational Steps (Ultrasound-Guided)

A. Ultrasonic localization and anatomical identification

Scalene Muscle Hydrodissection Technique: A high-frequency linear probe is often used. The probe is placed over the supraclavicular fossa to visualize the subclavian artery, then moved along the transverse axis of the neck to identify the interscalene groove, the C7 level, and adjacent brachial plexus structures (internal jugular vein and carotid artery visible). Injection is performed using an in-plane technique with the needle at approximately a 45° angle (Figure 9), directed into the anterior scalene muscle.

B. Puncture and 'Water Separation' Anesthesia / Water Separation

- 1) **Subclavius Muscle Hydrodissection Technique:** The probe is placed at the mid-to-lateral one-third of the lower border of the clavicle. This allows visualization of the pectoralis major, subclavius muscle, axillary artery/vein, and the cords of the brachial plexus located lateral to the axillary artery (lateral, posterior, and medial cords situated superolateral, lateral, and inferolateral to the artery, respectively). Injection is performed in-plane with the needle at approximately a 45° angle (Figure 8), directed into the subclavius muscle.

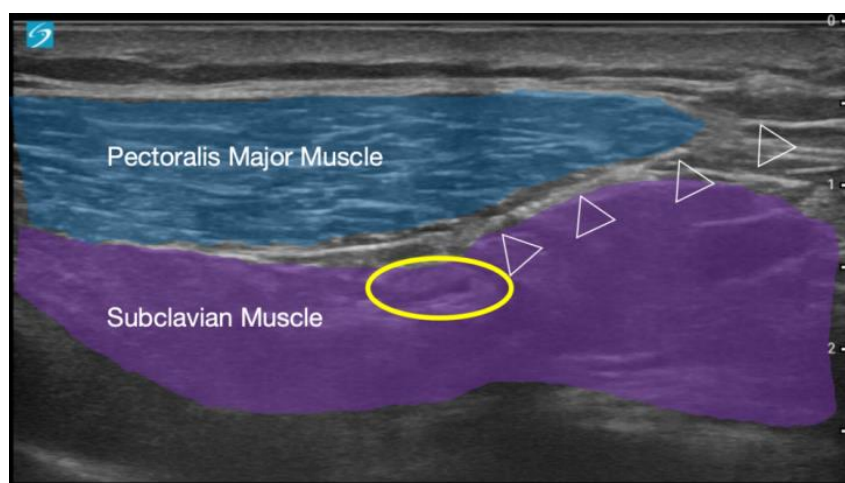


Figure 8. Subclavius Muscle Hydrodissection.

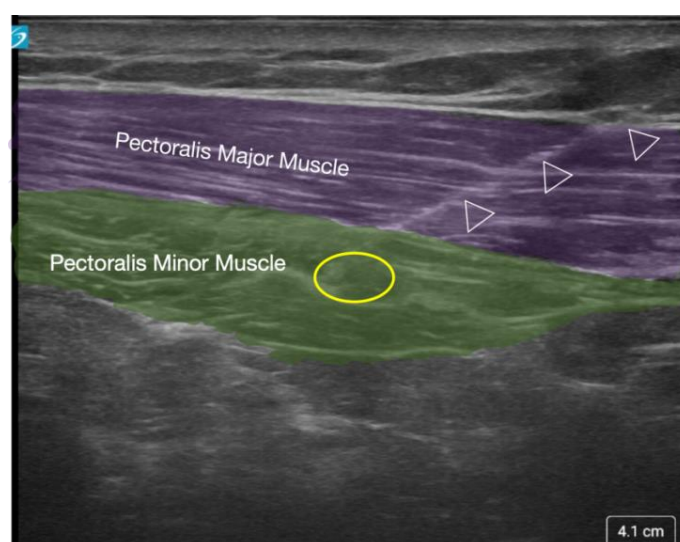


Figure 9. Pectoralis minor hydrodissection.

- 2) **Pectoralis Minor Muscle Hydrodissection Technique:** The probe is placed 1-2 cm inferior and lateral to the midpoint of the clavicle, in the clavipectoral groove. A

long-axis scan reveals the pectoralis major, with the pectoralis minor deep to it, and the neurovascular bundle deep to the pectoralis minor. Injection is performed in-

plane with the needle at approximately a 45° angle (**Figure 9**) directed towards the maximal tender point. Needle gauge varies according to muscle depth. In-plane visualization of the needle is possible (**Figure 9**). Evaluate for anatomical variants, pectoralis minor thickness, and its relationship to surrounding structures.

Recommendation 16: Practitioners performing thoracic MTrP hydrodissection under ultrasound guidance must have knowledge of thoracic local anatomy and adhere to standardized procedures. High-frequency linear probes are often preferred. Blind puncture is not recommended. (*Strong recommendation, A-level evidence*).

Recommendation 17: Practitioners performing thoracic MTrP hydrodissection under ultrasound guidance must ensure needle-tip visualization throughout the procedure and pay attention to avoiding puncture of the pleura, blood vessels, and nerves. (*Strong recommendation, A-level evidence*).

8.2.3. Operational Procedure for Lumbar MTrP Hydrodissection

The lumbar core muscles (lumbar erector spinae, quadratus lumborum, psoas major) are crucial for maintaining lumbar stability and regulating pelvic biomechanics. Strain-related

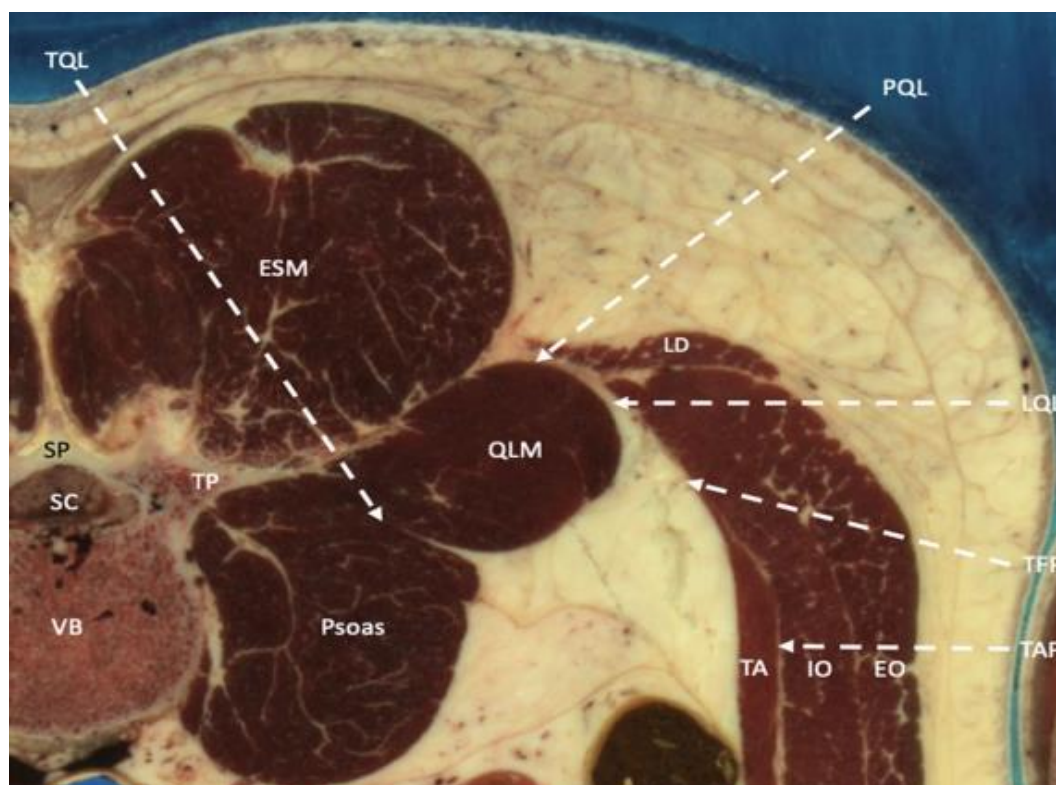
pathologies and abnormal adhesions with adjacent nerves are core pathological mechanisms leading to chronic low back pain and lumbosacral radicular referred pain. Specifically, lumbar erector spinae (ESL) pathology can compress the lumbar medial branch nerves, causing lumbosacral radiating pain. Quadratus lumborum (QL) abnormalities can strain the sacroiliac joint, inducing dysfunction. Psoas major (PM) spasm or adhesions may entrap the femoral nerve, causing groin and anterior thigh pain. Lumbar myofascial hydrodissection, besides using hydraulic force to separate adhesions and break the pain-spasm-ischemia cycle, can also improve muscle group asymmetry, correct lumbar scoliosis and pelvic tilt, reduce disc and sacroiliac joint load, and alleviate nerve entrapment symptoms.

(i). Positioning

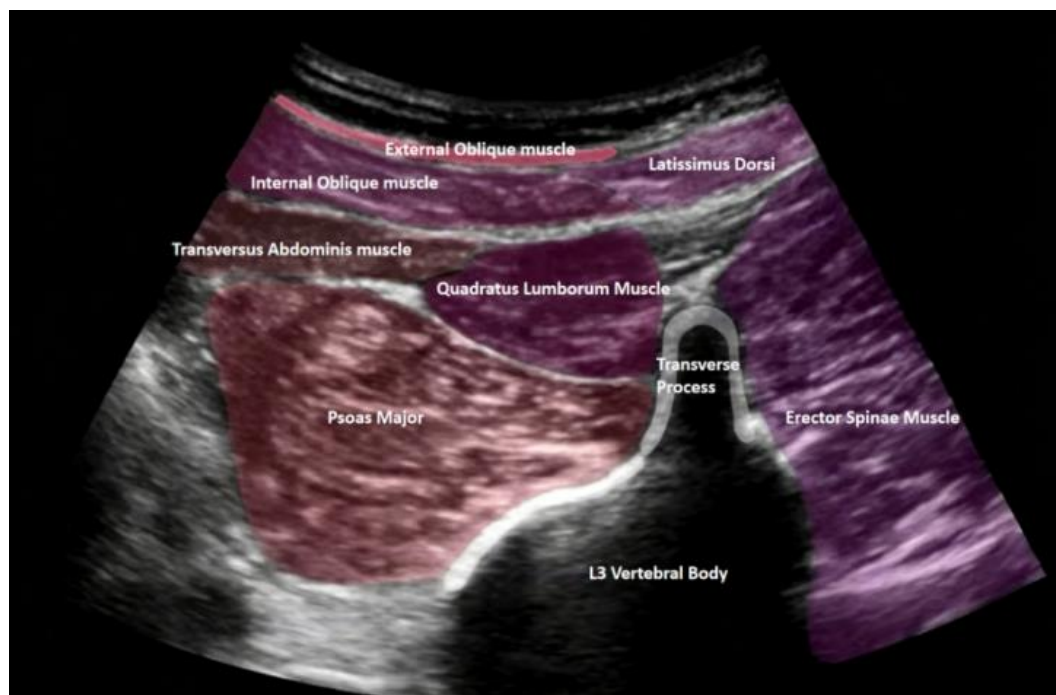
Lumbar erector spinae / quadratus lumborum: prone position; quadratus lumborum / psoas major: lateral decubitus position.

(ii). Operational Steps (Ultrasound-Guided)

A. *Ultrasound localization and anatomical identification* (**Figure 10**):



10A



10B

Figure 10. (10A) Anatomical diagram of the lumbar erector spinae muscle; (10B) Cross-sectional anatomical ultrasound image of the lumbar erector spinae muscle.

Figure 10A shows a cross-sectional anatomical diagram of the lumbar erector spinae muscle, and Figure 10B shows a cross-sectional anatomical ultrasound image of the lumbar erector spinae muscle. In the figures, TQL refers to the anterior layer of the thoracolumbar fascia, PQL refers to the posterior layer of the thoracolumbar fascia, LQL refers to the middle layer of the thoracolumbar fascia, TFP refers to the transversus abdominis plane (fascial plane), TAP refers to the transversus abdominis plane, QL refers to the quadratus lumborum, Psoas refers to the psoas major, ESM refers to the erector spinae muscle, TA refers to the transversus abdominis, IO refers to the abdominal internal oblique muscle, EO refers to the abdominal external oblique muscle, LD refers to the latissimus dorsi, VB refers to the lumbar vertebral body, TP refers to the transverse process, SC refers to the spinal cord, SP refers to the spinous process, and L3VB refers to the third lumbar vertebral body.

B. Lumbar erector spinae (ESL): use a high-frequency linear probe. The primary scanning plane is the short-axis view adjacent to the lumbar spinous process. Identify key structures:

① superficial layer of thoracolumbar fascia: covers the ESL, appearing as an "arc-like" hyperechoic band wrapping around it on short-axis view. ② target muscle (ESL): ultrasound features: appears as a "three-layered concentric ring" medium-echogenicity structure (from inside out: spinalis, longissimus, iliocostalis muscles, separated by thin hyperechoic fascial lines). On short-axis view, it appears "rounded," located 2-3 cm lateral to the spinous process, lying deep to the thoracolumbar fascia and superficial to the lumbar transverse processes. ③ anatomical boundaries: medial, near the spinous process; lateral, adjacent to the QL; attaches to the lumbar transverse processes and spinous processes. ④ deep critical structures: lumbar medial branch nerves: located deep to the ESL, at the lateral edge of the transverse process. Lumbar arteries: located deep to the PM and medial to the QL. Spinal canal: located at the midline, contains anechoic CSF; the puncture path should be strictly confined to the lateral 1/2 of the ESL to avoid medial deviation. Figure 11.

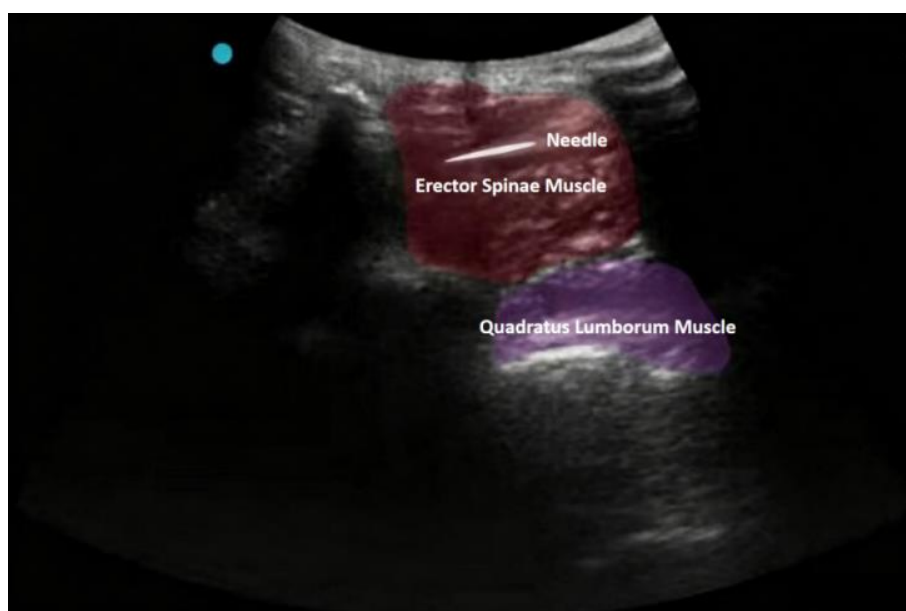


Figure 11. Lumbar erector spinae.

C. Quadratus Lumborum (QL): Use a low-frequency convex probe. The scanning plane is the posterolateral oblique axial view of the lumbar spine. Identify key structures: ① erector spinae: appears as "longitudinal cord-like," located posterior to the QL; a thin fascia separates it from the QL. ② target muscle (QL): ultrasound features: located lateral to the lumbar transverse processes, anterior to the erector spinae, and

posterior to the psoas major. It forms a "trifolium" shape together with the erector spinae and psoas major. ③ anatomical boundaries: originates from the 12th rib superiorly and inserts on the iliac crest inferiorly. ④ deep critical structures: kidney located deep and lateral to the QL. Lumbar arteries located between the QL and the transverse processes. Lumbar medial branch nerves located deep to the QL, lateral to the transverse processes. [Figure 12](#).

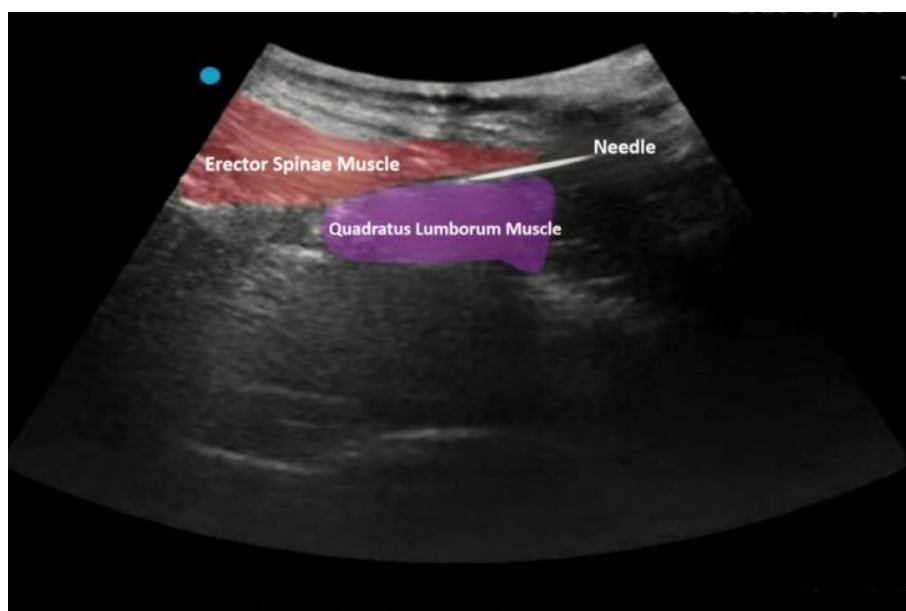


Figure 12. Quadratus lumborum.

D. Psoas major (PM): use a low-frequency convex probe. The scanning plane is the longitudinal axial view of the lateral

abdomen. Identify key structures: ① external/internal

oblique muscles: superficial layer of the lateral abdomen; peritoneum separates them from the PM. Kidney located superficial and lateral to the PM. ② target muscle (PM): ultrasound features: on longitudinal axis, muscle fibers extend from the lumbar vertebral bodies to the iliac fossa; on short-axis, it appears "oval." It forms a "trifolium" shape with the erector spinae and QL. ③ anatomical boundaries: medially attaches to the lateral aspects of the lumbar vertebral bodies and transverse process roots; laterally adjacent to the QL; inferiorly

converges into the iliac fossa, joining the iliacus to form the iliopsoas. ④ deep critical structures: femoral nerve: located deep within the PM, within its muscle fibers. Lumbar artery branches: located between the PM and the vertebral bodies. Retroperitoneal vessels: located deep and medial to the PM; puncture path should be strictly confined to the lateral 1/3 of the PM to avoid medial deviation. [Figure 13](#).



Figure 13. Psoas major.

Recommendation 18: Practitioners performing lumbar MTrP hydrodissection under ultrasound guidance must have knowledge of lumbar local anatomy and adhere to standardized procedures. Low-frequency convex probes are often preferred. Blind puncture is not recommended. (*Strong recommendation, A-level evidence*).

(iii). Puncture and Hydrodissection

Use an in-plane technique for full needle-tip visualization. Approach for ESL: insert needle adjacent to the spinous process, aiming for the muscle belly. Approach for QL: insert needle from lateral to medial, avoiding the kidney. Approach for PM: insert needle from the lateral abdomen, away from the kidney and femoral nerve. Advance the needle slowly while injecting 0.5 ml of solution incrementally to create a "water window," optimizing visualization and avoiding critical structures.

(iv). Solution Injection and Release

After correct needle tip placement, aspirate. Inject in different zones: ESL/QL: inject 3-5 ml at the fascial layer and 5-8

ml into the muscle belly. Use the "shuttling" technique to release adhesions. PM: Inject 5-8 ml, avoiding proximity to the kidney and femoral nerve.

Recommendation 19: For lumbar MTrP hydrodissection, injecting 3-5 ml at the fascial layer and 5-8 ml into the muscle belly using the "shuttling" technique is suggested. (*Moderate or weak recommendation, C-level evidence*).

8.2.4. Operational Procedure for Gluteal MTrP Hydrodissection

The deep gluteal space is the interval deep to the gluteus maximus muscle. Its boundaries are: anteriorly, the posterior aspect of the acetabulum, hip joint capsule, and proximal femur; posteriorly, the gluteus maximus; laterally, the lateral lip of the linea aspera and gluteal tuberosity; medially, the sacrotuberous ligament and falciform fascia; superiorly, inferior margin of the sciatic notch; inferiorly, the proximal hamstring attachment at the ischial tuberosity. The deep gluteal space contains the sciatic nerve, piriformis, quadratus femoris, and the obturator internus-gemellus complex. Pathology in any of these structures can lead to a spectrum of symptoms, including

buttock pain, lower extremity pain/numbness, and even anorectal/perineal pain.

Ultrasound-guided hydrodissection of the deep gluteal space is a key technique for treating Deep Gluteal Syndrome (DGS). Current clinical practice faces potential complications: ① inferior gluteal artery injury, hemorrhage, hematoma; ② sciatic nerve injury. Therefore, standardized procedures for DGS hydrodissection are essential for homogenization, ensuring safety and reproducibility.

For patients with a confirmed diagnosis of DGS (sciatic nerve entrapment by surrounding muscles in the deep gluteal space causing buttock and posterior hip pain), including subtypes like piriformis syndrome, ischiofemoral impingement syndrome, and hamstring syndrome, DGS hydrodissection can relieve muscle/fascial adhesions, release the entrapment, and achieve analgesia.

(i). Positioning

Prone position. A soft pillow can be placed under the abdomen to ensure patient comfort and stability (Figure 14).



Figure 14. Patient prone, pillow under abdomen.

(ii). Operational Steps (Ultrasound-Guided)

A. Ultrasound Localization and Anatomical Identification:

Use a low-frequency convex probe. The preferred scan is the short-axis (transverse) view. Clearly identify key structures: ① piriformis muscle (PM): located deep to the gluteus maximus (GMM), running obliquely from the anterior sacrum (S2-S4) to the greater trochanter of the femur. It appears less echogenic than the gluteus maximus (Figure 15). ② obturator internus-gemellus complex: located inferior to the piriformis and deep to the sciatic nerve (Figure 16). ③ quadratus femoris muscle (QFM): located between the ischial tuberosity and the intertrochanteric line of the femur, deep to the sciatic nerve (SN) (Figures 16, 17). ④ sciatic nerve: the thickest peripheral nerve. Located deep to the piriformis and superficial to the obturator internus-gemellus complex and quadratus femoris. Note the inferior gluteal artery runs medial to it; careful puncture is needed to avoid injury (Figure 18). ⑤ determine target puncture path: avoiding the inferior gluteal

artery (IGA) and sciatic nerve.

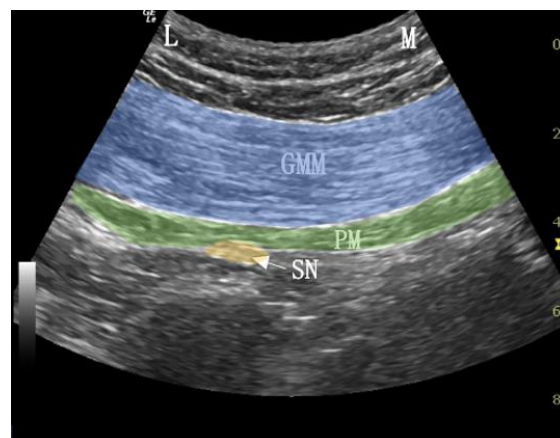


Figure 15. Ultrasound images of piriformis (green).

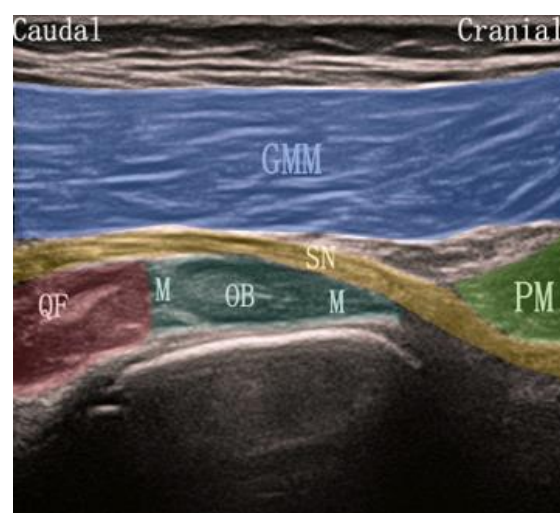


Figure 16. Ultrasound images of obturator internus-gemellus Complex.

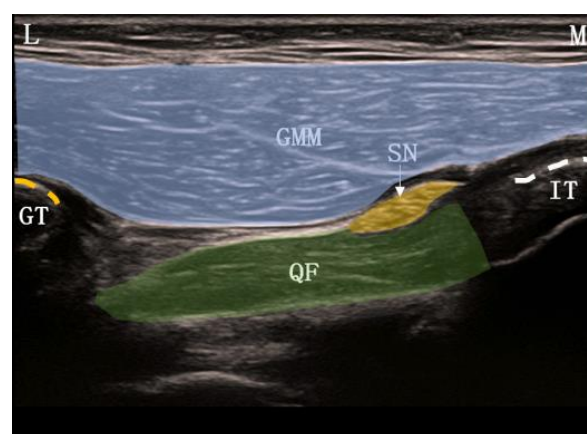


Figure 17. Ultrasound images of quadratus femoris (green).

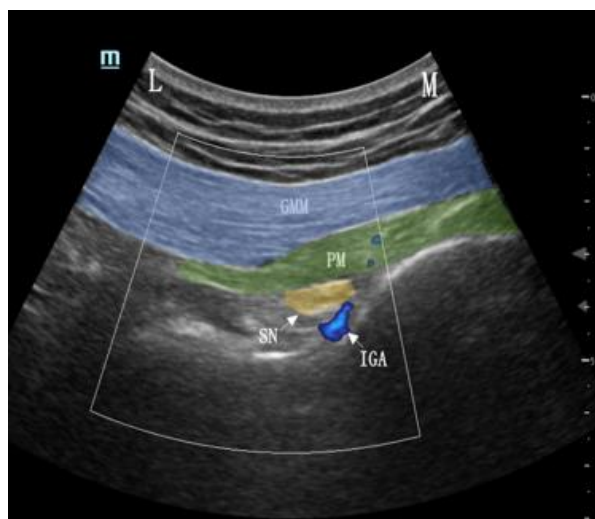


Figure 18. Ultrasound images of sciatic nerve and inferior gluteal artery.

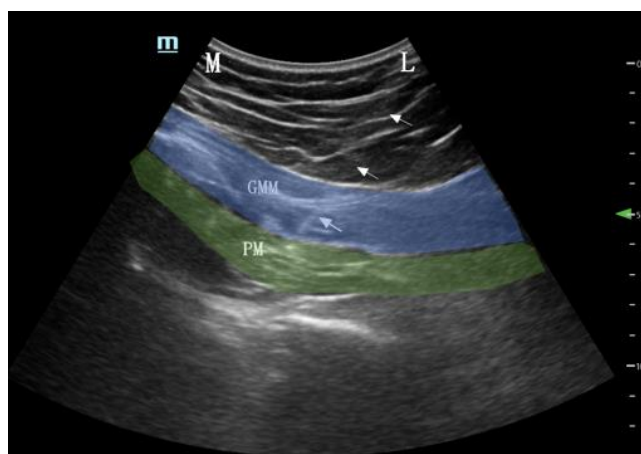


Figure 19. In-plane puncture approach for deep gluteal space.

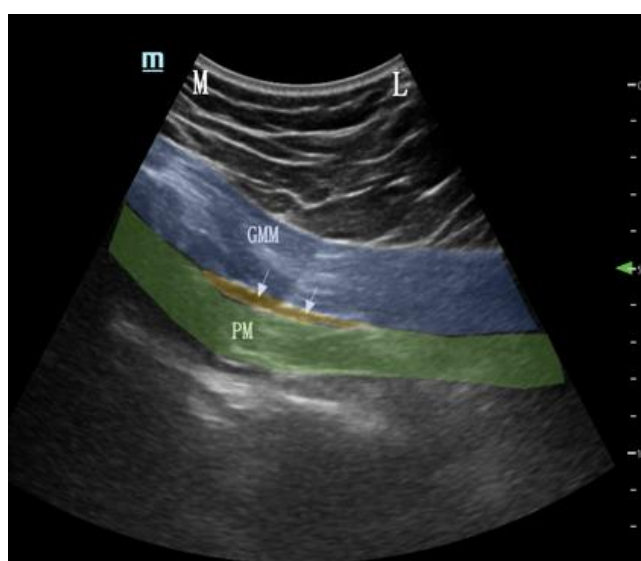


Figure 20. Injection around the sciatic nerve.

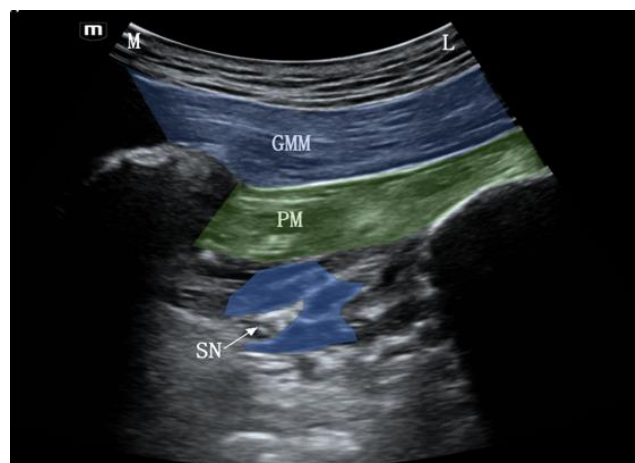


Figure 21. Ideal spread of solution surrounding the sciatic nerve.

Recommendation 20: Practitioners performing gluteal MTrP hydrodissection under ultrasound guidance must have knowledge of gluteal local anatomy and adhere to standardized procedures. Low-frequency convex probes are often preferred. Blind puncture is not recommended. (*Strong recommendation, A-level evidence*).

B. Puncture and Hydrodissection:

Use an in-plane technique, advancing the needle from lateral to medial. Direct the needle tip towards the piriformis, quadratus femoris, obturator internus-gemellus complex, and/or sciatic nerve, depending on the clinically identified target lesion.

Target needle positions: ①primary target (fascial interface release): needle tip reaches the superficial fascial layer of the piriformis, quadratus femoris, or obturator internus-gemellus complex. Avoid advancing too fast to prevent puncturing the sciatic nerve or inferior gluteal artery. ②secondary Target (Intralesional Release): if ultrasound shows echogenic calcifications, fibrosis, or definite adhesions within the piriformis, quadratus femoris, or obturator internus-gemellus complex, the needle tip can be precisely advanced into the lesion under real-time guidance.

C. Solution Injection and Release:

After the needle tip is correctly positioned, aspirate to confirm no blood. ①fascial interface release: inject 5-10 ml of solution onto the superficial fascia of the target muscle. observe the spread. ideally, it should surround the sciatic nerve and the muscle. ②intralesional release: if targeting internal lesions, inject 5-10 ml of solution. During injection, gently and slowly move the needle tip back and forth ("shuttling" technique) to use the fluid's mechanical force to further release adhesions and fibrous bands.

Recommendation 21: For deep gluteal MTrP hydrodissection, injecting 5-10 ml for fascial interface release and 5-10 ml for intralesional release using the "shuttling" technique is suggested. (*Moderate or weak recommendation, C-level evidence*).

(iii). Treatment Course

Typically, 2-3 sessions constitute one treatment course, with an interval of 1-2 weeks between sessions. Subsequent treatment decisions should be based on the patient's response and efficacy assessment.

Recommendation 22: For ultrasound-guided MTrP hydrodissection in treating MPS, a course of 2-3 sessions at 1-2 week intervals is suggested. (*Weak recommendation, B-level evidence*).

(iv). Intraoperative Precautions and Risk Prevention

1) Nerve Safety

When operating near the sciatic nerve, strictly control the concentration of lidocaine (recommended $\leq 0.25\%$) to avoid weakness in the lower extremity on the affected side due to high concentrations of local anesthetics. This is particularly important for outpatients, who are at increased risk of falls. Maintain clear, continuous visualization of the needle tip throughout the entire procedure to prevent injury to nerves and blood vessels.

2) Prevention of Vascular Injury

Use Doppler ultrasound to identify and continuously avoid the inferior gluteal artery throughout the needling process. Aspirate before, during, and after injection.

3) Infection Prevention

Strictly adhere to aseptic technique.

4) Corticosteroid-Related Risks

Inform patients of the potential adverse effects of corticosteroids (the risk of local skin hypopigmentation/atrophy, blood glucose fluctuations, and Cushing's syndrome is very low but possible). Exercise additional caution when evaluating the need for steroid use near nerves.

5) Pain Response

Patients may experience transient worsening of pain during injection (due to solution expansion pressure or stimulation of the lesion). This should be explained in advance, and the procedure should be performed gently.

6) Real-Time Ultrasound Guidance

The entire puncture and injection process must be performed under real-time, dynamic ultrasound monitoring.

9. Safety, Adverse Reactions, and Management of MTrP Hydrodissection

9.1. Safety

The safety of ultrasound-guided myofascial hydrodissection is significantly higher than that of nerve blocks and perineural hydrodissection. This is primarily reflected in three aspects: the operational technique, the mechanism of separation, and the injectate.

9.1.1. Operational Safety

Operators can precisely monitor the needle tip position to ensure accurate target delivery [35-37]. The in-plane approach offers higher safety, significantly reducing the risk of nerve and vascular injury [38, 39].

9.1.2. Safety of the Physical Separation Mechanism

Utilizes hydraulic pressure to separate adherent tissues, effectively avoiding needle contact with nerves. This significantly reduces the risk of nerve or vascular injury [40] and enhances patient comfort [41].

9.1.3. Safety of the Injectate

Hydrodissection achieves tissue separation through physical means, independent of pharmacological effects. This reduces the risk of drug-related adverse reactions, such as neurotoxicity or tendinopathy, associated with high concentrations of local anesthetics or corticosteroids [42-45].

9.2. Adverse Reactions

Although ultrasound-guided MTrP hydrodissection has a high safety profile, the potential for injury to nerves, blood vessels, the dural sac, or the spinal cord cannot be completely eliminated, especially for beginners. Therefore, procedures must be performed under real-time dynamic ultrasound monitoring. Related complications include local pain or discomfort [42], swelling and bruising, transient nerve irritation symptoms, nerve injury, intravascular injection and systemic toxicity, infection, and rarely, compartment syndrome or allergic reactions [46].

Recommendation 23: During ultrasound-guided MTrP hydrodissection, attention must be paid to preventing injury to nerves, blood vessels, and intraspinal structures, as well as infection, intravascular injection, and pain responses. All procedures must be performed under real-time ultrasound guidance. (*Strong recommendation, A-level evidence*).

9.3. Management Measures

- 1) Pain and Swelling: Apply cold compresses; oral NSAIDs may be used if necessary. If persistent nerve irritation symptoms or pain lasts > 48 hours, infection/nerve injury must be ruled out.
- 2) Persistent Nerve Symptoms: Mild cases may not require specific treatment. For persistent numbness or motor weakness, neurotrophic therapy should be considered.
- 3) Infection: Local cleaning and disinfection, oral antibiotics.
- 4) Local Anesthetic Toxicity: Stop injection immediately, secure airway, administer oxygen via mask, intubate if necessary.
- 5) Allergic Reaction: Stop procedure immediately; administer corticosteroids or pinephrine (0.3-0.5 mg).

- 6) Compartment Syndrome: If diagnosed, refer immediately to the relevant department for treatment, perform fasciotomy if necessary.

Recommendation 24: Ultrasound-guided MTrP hydrodissection offers high safety and mostly mild adverse reactions. However, strict aseptic technique, avoidance of high-pressure injection, and caution in patients with coagulation abnormalities or on anticoagulants are required. Appropriate symptomatic treatment should be given for complications. (*Strong recommendation, A-level evidence*).

10. Conclusion

10.1. Limitations of MTrP Hydrodissection

Although the clinical application of Ultrasound-guided Myofascial Hydrodissection (US-FHD) is increasing, demonstrating significant advantages and high safety, its evidence base has notable limitations:

- 1) Insufficient number of high-quality RCTs; most studies are small-sample, single-center [47-49].
- 2) Lack of long-term follow-up and safety data.
- 3) Treatment protocols are not yet standardized.
- 4) Significant variation in key parameters (injectate type, volume, treatment frequency), affecting comparability of results.
- 5) Optimal injection anatomical layers remain unclear.
- 6) Mechanism of action studies are limited, mostly theoretical, lacking human tissue and molecular-level validation.

Furthermore, health economic evaluations are completely absent. Considering the need for high-resolution ultrasound equipment and specialized operators, the implementation cost is high, and health economic studies are urgently needed to support its inclusion in clinical pathways.

10.2. Summary and Outlook

Ultrasound-guided myofascial hydrodissection is an emerging, minimally invasive, and precise therapeutic modality showing promising prospects in various myofascial pain and nerve entrapment syndromes [37]. However, its evidence-based foundation remains in its infancy, with notable issues such as a scarcity of high-quality evidence, lack of standardization, and unclear long-term efficacy. This consensus represents the first practical clinical guideline for MTrP hydrodissection in China, integrating the wisdom and extensive experience of leading experts in the field. The recommendations and evidence grades were formulated through repeated discussions and voting by the working group. The development of this consensus will aid physicians specializing in clinical pain management in understanding and appropriately utilizing this technique, promoting standardized and homogenized clinical application. However, given the current lack of clinical evidence supporting some recommendations, future efforts must

focus on conducting large-sample, multicenter, long-term follow-up RCTs, systematically optimizing injection parameters, and advancing this technique from "experience-based" to "evidence-based standards." This will ultimately facilitate its integration into clinical pathways, enabling precision and individualized treatment.

Abbreviations

MPS	Myofascial Pain Syndrome
MTrP	Myofascial Trigger Points
RCT	Randomized Controlled Trials
GRADE	Grading of Recommendations Assessment Development and Evaluation
EMG	Electromyography
VAS	Visual Analogue Scale
NRS	Numeric Rating Scale
MPQ	McGill Pain Questionnaire
SF-36	36-Item Short Form Health Survey
ODI	Oswestry Disability Index
NDI	Neck Disability Index
OCI	Obliquus Capitis Inferior
GON	Greater Occipital Nerve
CeH	Cervicogenic Headache
DRG	Dorsal Root Ganglion
VA	Vertebral Artery
TON	Third Occipital Nerve
CSF	Cerebrospinal Fluid
TOS	Thoracic Outlet Syndrome
TFP	Transversus Fascial Plane
ESL	Lumbar Erector Spinae
QL	Quadratus Lumborum
PM	Psoas Major
TAP	Transversus Abdominis Plane
QL	Quadratus Lumborum
PM	Psoas Major
ESM	Erector Spinae Muscle
TA	Transversus Abdominis
IO	Internal Oblique Muscle
EO	External Oblique Muscle
LD	Latissimus Dorsi
VB	Vertebral Body
TP	Transverse Process
SC	Spinal Cord
SP	Spinous Process
DGS	Deep Gluteal Syndrome
GMM	Gluteus Maximus
PM	Piriformis Muscle
SN	Sciatic Nerve
QF	Quadratus Femoris Muscle
OB	Obturator
IGA	Inferior Gluteal Artery
US-FHD	Ultrasound-guided Myofascial Hydrodissection
RCT	Random Controlled Trial

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Li Song: Methodology, Resources, Writing – original draft, Writing – Reviewing & Editing
Dongyang Liu: Methodology, Resources, Writing – original draft
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Li Wan: Conceptualization, Supervision, Writing – reviewing & editing

Conflicts of Interest

The authors declare no conflicts of interest.

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