

MSK Ultrasound Bites: Tips and Tricks

# MSK Ultrasound: A Powerful Tool for Evaluating and Diagnosing Pectoralis Major Injuries in Healthcare Practice

Robert C. Manske, PT, DPT, MEd, SCS, ATC, CSCS, FAPTA<sup>a</sup>, Chris Wolfe, PT, DPT, OCS, Cert MDT, Phil Page, PT, PhD, ATC, CSCS, FACSM, Michael Voight, PT, DHSC, SCS, OCS, ATC, CSCS, FAPTA

Keywords: MSK Ultrasound, pectoralis major, imaging, diagnostics

<https://doi.org/10.26603/001c.94157>

---

## International Journal of Sports Physical Therapy

Vol. 19, Issue 3, 2024

---

Accurately diagnosing pectoralis major injuries, particularly in athletes, often presents a challenge for healthcare practitioners. Although pectoralis muscle injuries are relatively uncommon, the diagnosis of a tear may be overlooked without careful screening by a thorough physical examination of both the injured and uninjured sides. While magnetic resonance imaging (MRI) has traditionally held the gold standard, musculoskeletal ultrasound (MSKUS) has emerged as a viable alternative. This article delves into the power of MSKUS in evaluating and diagnosing pectoralis major injuries, highlighting its dynamic capabilities, real-time visualization, and cost-effectiveness in comparison to MRI. By equipping healthcare professionals with a thorough understanding of MSKUS's potential, this article aims to empower them to confidently diagnose and manage pectoralis major injuries, ultimately improving patient outcomes and facilitating a faster return to function.

### INTRODUCTION

The pectoralis major is at risk during any activity in which the arm is extended and externally rotated while under maximal contraction.<sup>1</sup> The pectoralis major muscle, a powerhouse of the chest wall responsible for adduction, flexion, and internal rotation of the arm, is frequently exposed to high tensile forces during athletic activities. This vulnerability makes it susceptible to a spectrum of injuries, ranging from mild muscle strains to complete muscle or tendon ruptures. Accurate and timely diagnosis is crucial for guiding appropriate treatment and ensuring optimal recovery. Traditionally, magnetic resonance imaging (MRI) has held the position of the gold standard for diagnosing pectoralis major injuries.<sup>2,3</sup> However, its limitations, including high cost, limited availability, and static imaging, have paved the way for the emergence of musculoskeletal ultrasound (MSKUS) as a compelling alternative.<sup>4-6</sup> This article aims to provide rehabilitation professionals with an understanding of MSKUS in the context of pectoralis major injuries.

Pectoralis major muscle injuries usually occur secondary to weightlifting in nearly 50% of cases.<sup>7,8</sup> The bench press is a common culprit due to the excessive tension put on an eccentrically contracted muscle as the bar is lowered to the chest. Less commonly, injuries occur after direct trauma causing forced abduction and external rotation of the upper extremity.<sup>6,9</sup> Tendon tears occur almost exclu-

sively in males between 20–40 years old and are heavily associated with anabolic androgenic steroid use.<sup>9-11</sup> From a historical perspective, the first case of this injury was described in 1822 by Patisserie in Paris involving a butcher boy who tore his pectoralis major in an attempt to lift a large piece of beef from a hook.<sup>4</sup> The next several reported cases all involved men's arms/shoulders being run over by horse-drawn carts.<sup>5</sup> As athletic activities, particularly weightlifting and the bench press, increased in popularity toward the latter half of the 20th century, sports-related injuries began to outnumber job-related injuries and now account for the majority of all reported pectoralis major ruptures.<sup>5</sup> The ability to detect and treat a pectoralis major rupture is important for both the clinician and the patient and is aided with knowledge of anatomy, the physical examination, and results of imaging studies. MRI has the ability to differentiate the site, grade, and chronicity of injury, it is expensive, time-consuming, while its availability is often limited to the hospital and/or emergency room setting.<sup>12</sup> In contrast, point-of-care ultrasound (POCUS) is commonly available and can be used to help confirm the diagnosis and hasten disposition.<sup>2</sup>

### ANATOMY

The pectoralis major is a complex, fan-shaped muscle comprised of a clavicular head, originating from the medial

---

<sup>a</sup> Corresponding author:  
[Robert.Manske@wichita.edu](mailto:Robert.Manske@wichita.edu)

half of the clavicle, and a sternocostal head, originating from the anterior sternum, costal cartilages of ribs 1–7, and the aponeurosis of the external oblique.<sup>2,13</sup> The two heads come together and form a common tendon and insert into the intertubercular sulcus of the humerus.<sup>2,13</sup> Rupture occurs most commonly in patients with a history of weightlifting, causing disruption of the distal humeral enthesis.<sup>7,14</sup>

## IMAGING

A variety of imaging techniques can be utilized in the assessment and management of pectoralis major ruptures. While these supplementary imaging modalities can aid in detecting a pectoralis major rupture, it is imperative to acknowledge that a physical examination is paramount in the identification of such tears, as imaging results can often be inconclusive or inconsistent. It is noteworthy that cases where imaging explicitly indicates a rupture are invariably corroborated by a physical examination. Consequently, although imaging studies contribute to the diagnostic process, the clinical examination should be considered the cornerstone of diagnosis.

MSK ultrasound offers a unique window into the intricate world of muscle and tendon pathology. By interpreting the characteristic features on ultrasound images, healthcare practitioners can accurately diagnose various pectoralis major injuries. In the context of pectoralis major ruptures, ultrasound has emerged as an efficacious and cost-effective diagnostic tool.<sup>15,16</sup> It is advocated for its potential to expedite surgical intervention when a rupture is suspected.<sup>16</sup> In practice, comparing ultrasound images of the uninjured side with the injured side can be particularly informative. An intact pectoralis major appears on ultrasound as a hypoechoic area, representing the muscle tissue, bordered by parallel echogenic lines indicative of the perimysium. The epimysium is discernible as a densely echogenic layer anterior to the muscle. Any deviation from this pattern may suggest a rupture. Tears manifest as hypoechoic (darker) areas within the muscle belly, at the myotendinous junction, or at the humeral insertion. The disruption of the normal muscle fiber pattern is a telltale sign. Tendon abnormalities are characterized by thickening, disruption, or retraction of the pectoralis major tendon visualized on ultrasound suggest tendinitis, partial tears, or complete ruptures. Furthermore, ultrasounds are adept at identifying hematomas, which typically present as large, hypoechoic, well-defined entities within the muscle tissue itself. Therefore, ultrasound serves as a cost-effective and valuable alternative to MRI for the evaluation of pectoralis major ruptures.

## ADVANTAGES OF MSK ULTRASOUND

1. **Real-Time Dynamic Assessment:** MSKUS allows for the evaluation of muscle and tendon movements in real-time, crucial for assessing the pectoralis major.

2. **High-Resolution Imaging:** Enhanced image resolution aids in identifying subtle pathological changes within the muscle fibers and tendinous attachments.
3. **Non-Invasive and Patient-Friendly:** Unlike MRI, MSKUS is non-invasive, does not require exposure to radiation, and is generally more accessible and cost-effective.

## ULTRASOUND TECHNIQUES FOR PECTORALIS MAJOR EVALUATION

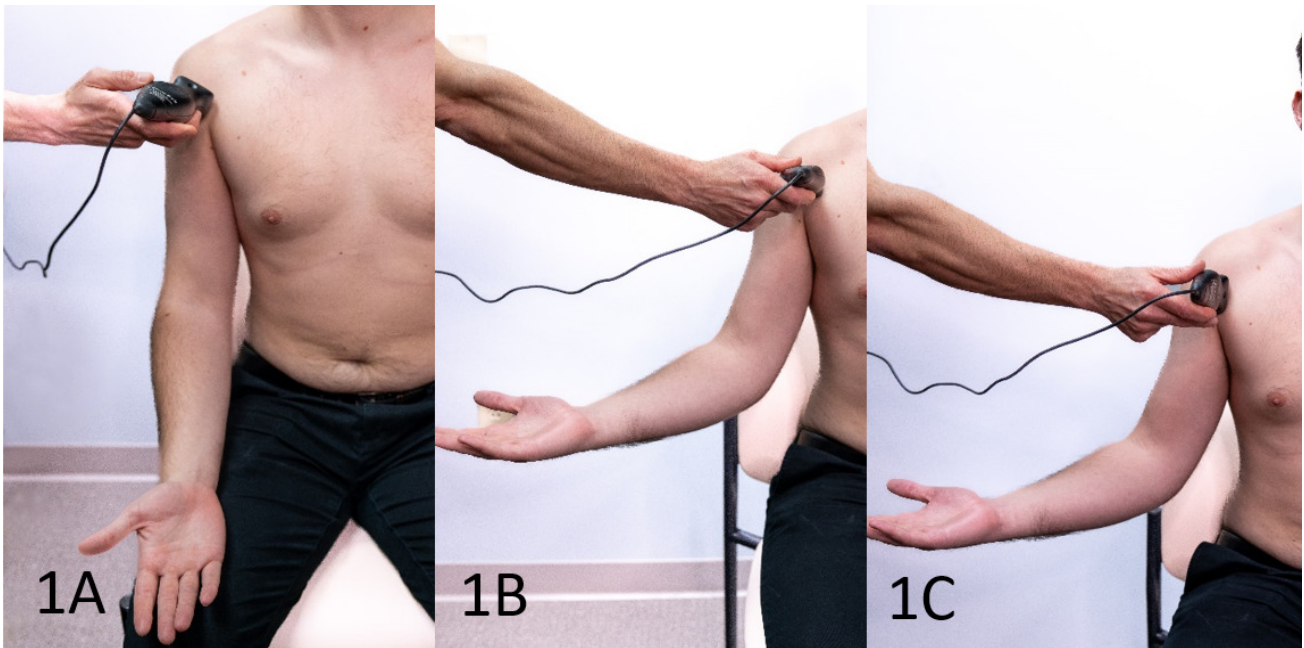
1. **Transducer Positioning and Scanning Techniques:** The article describes optimal transducer placement and scanning protocols for comprehensive visualization of the pectoralis major.
2. **Identifying Pathologies:** Techniques for identifying common injuries such as muscle strains, tears, and tendon avulsions.
3. **Comparative Analysis:** Emphasis on comparing the injured side with the uninjured side to identify discrepancies in muscle morphology and dynamics.

## INTEGRATION INTO REHABILITATION PRACTICE

1. **Tailoring Rehabilitation Protocols:** Utilizing ultrasound findings to customize rehabilitation strategies based on the specific nature and extent of the injury.
2. **Monitoring Progress:** The role of follow-up ultrasound examinations in monitoring the healing process and adjusting rehabilitation plans accordingly.
3. **Patient Education and Engagement:** Enhancing patient understanding and involvement in their rehabilitation journey through visual feedback from ultrasound imaging.

**Conclusion:** Prompt evaluation, radiographic confirmation, and surgical intervention are key in ensuring positive outcomes in active patients with pectoralis major tears. Diagnostic MSKUS represents a significant advancement in the evaluation of pectoralis major injuries. Its real-time, non-invasive nature makes it an invaluable tool for rehabilitation providers. However, its efficacy is dependent on the skill of the operator and should be seen as a complementary tool to a comprehensive clinical assessment.

© The Author(s)



## Pectoralis Major

### Figure 1A: Patient Position and Initial Transducer Placement in Short Axis (SAX):

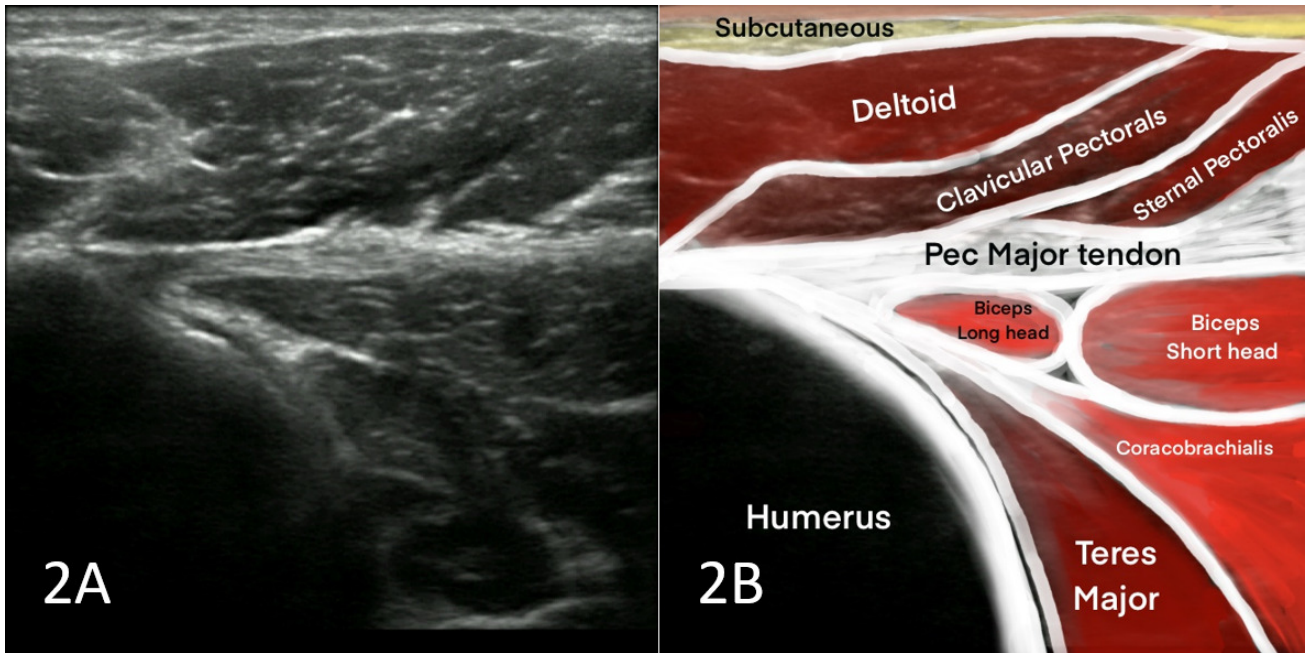
The patient may assume either a seated or supine position. The shoulder should initially be maintained at 0 degrees of abduction, accompanied by a flexed elbow and supinated forearm. Following the initial scan in this relaxed posture, the subject's arm can be externally rotated and slightly abducted, introducing heightened tension across the pectoralis tendon for further evaluation.

### Figure 1B: Short Axis (SAX) Transducer Placement:

The transducer is strategically placed in a transverse orientation on the proximal anterior aspect of the shoulder. It is precisely focused on the long head of the biceps tendon within the bicipital groove and then moved progressively downward to cover the insertion point of the pectoralis tendon. During this process, the subject's arm can be externally rotated and slightly abducted, creating increased tension on the pectoralis tendon, facilitating a more thorough evaluation.

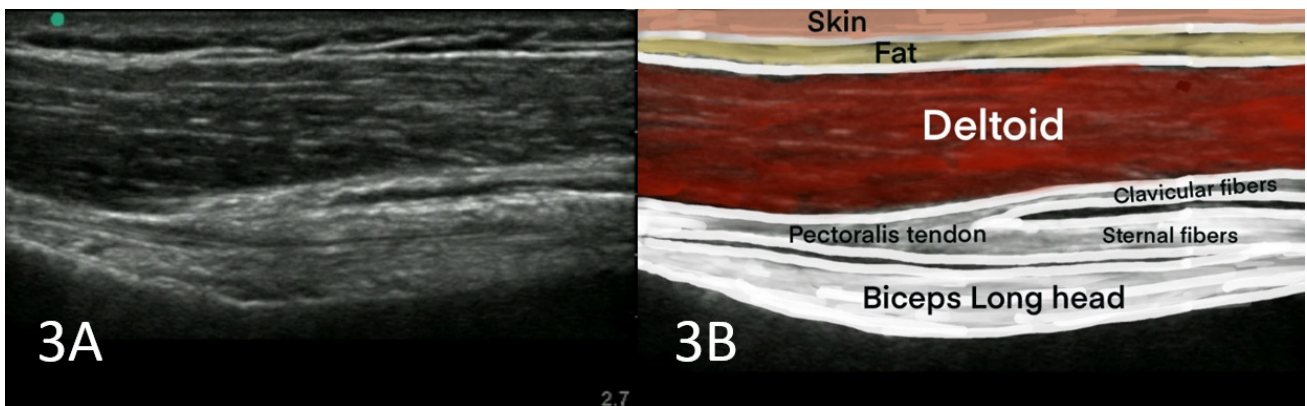
### Figure 1C: Long Axis (LAX) Transducer Placement

The transducer is positioned in the long-axis plane, running parallel to the biceps tendon to guarantee it is perpendicular to the fibers of the pectoralis tendon. During this imaging procedure, the subject's arm can be externally rotated and slightly abducted, generating increased tension across the pectoralis tendon, thereby enabling a more detailed evaluation.



**NORMAL VIEW IN SHORT AXIS (SAX)**

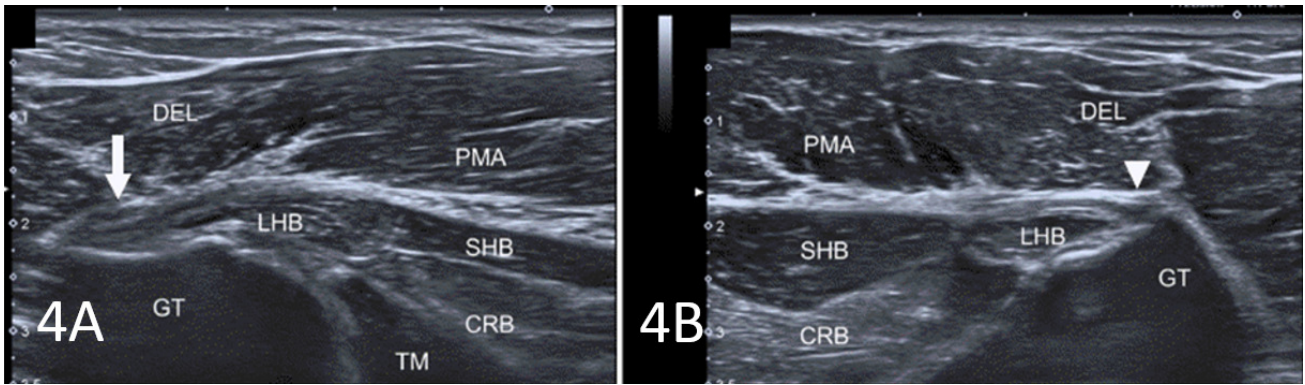
**Figures 2A and 2B Short Axis View:** In the tendon attachment onto the humerus, there is seen a fused portion of the tendon where the clavicular and sternal portions of the pectoralis tendon have come together. This fused tendon covers primarily the long head of the biceps tendon and somewhat covers the biceps tendon short head and coracobrachialis. Special attention is directed towards the distal part, ensuring thorough coverage. During this short axis view, the examiner should initially locate the long head of the biceps tendon and superior to this can begin to note the direction of the pectoralis tendon fibers. The fibers coursing in an inferolateral direction contribute to the anterior tendon layer. The superolateral directed fibers contribute to the posterior layer.



**NORMAL VIEW IN LONG AXIS (LAX)**

**Figures 3A and 3B Long Axis View:** In the Long Axis view, evaluate the sternal and clavicular insertions thoroughly. This perspective offers insight into the long axis of the biceps brachii long head tendon and reveals the fused layers of the sternal and clavicular segments of the pectoralis muscle, presenting as a cohesive tendon. The sternal myotendon may exhibit slight undulations, while the clavicular portion typically appears superior to the sternal segment.





#### PARTIAL TEAR IN SHORT AXIS (SAX)

**Figures 4A and 4B:** In image 4A of the right proximal region, there is a noticeable loss of the fibrillar pattern and an increased thickness in the pectoralis major tendon (indicated by arrow) near its insertion on the humerus. On the unaffected side, as shown in image 4B, the pectoralis major tendon (indicated by arrowhead) exhibits a normal thickness and fibrillar pattern. The labeled structures include CRB (coracobrachialis muscle), DEL (deltoid muscle), GT (greater tubercle), LHB (long head of the biceps muscle), SHB (short head of the biceps muscle), TM (teres major muscle), and PMA (pectoralis major muscle).<sup>17</sup>



This is an open-access article distributed under the terms of the Creative Commons Attribution 4.0 International License (CCBY-NC-4.0). View this license's legal deed at <https://creativecommons.org/licenses/by-nc/4.0> and legal code at <https://creativecommons.org/licenses/by-nc/4.0/legalcode> for more information.

## REFERENCES

1. Manske RC, Prohaska D. Pectoralis major tendon repair post-surgical rehabilitation. *N Am J Sports Med.* 2007;2(1):22-33.
2. Franks N, Gress J, Joseph R. Point-of-care ultrasound for suspected pectoralis major rupture: a case report. *Clin Practice Cases Emerg Med.* 2021;5(1):93-96.
3. Rehman A, Robinson P. Sonographic evaluation of injuries to the pectoralis muscles. *Am J Roentgenol.* 2005;184(4):1205-1211. [doi:10.2214/ajr.184.4.01841205](https://doi.org/10.2214/ajr.184.4.01841205)
4. Lee YK, Skalski MR, White EA, et al. US and MR imaging of pectoralis major injuries. *Radiographics.* 2017;37(1):176-189. [doi:10.1148/rg.2017160070](https://doi.org/10.1148/rg.2017160070)
5. Lee SJ, Jacobson JA, Kim SM, et al. Distal pectoralis major tears: sonographic characterization and potential diagnostic pitfalls. *J Ultrasound Med.* 2013;32(12):2075-2081. [doi:10.7863/ultra.32.12.2075](https://doi.org/10.7863/ultra.32.12.2075)
6. Chadwick N, Weaver JS, Shultz C, Morag Y, Patel A, Taljanovic MS. High-resolution ultrasound and MRI in the evaluation of pectoralis major injuries. *J Ultrasound.* Published online 2023:e202-e213.
7. Moore KL, Dalley AF, Agur A. *Clinically Oriented Anatomy.* Wolters Kluwer; 2014.
8. Wolfe SW, Wickiewicz TL, Cavanaugh JT. Ruptures of the pectoralis major muscle: An anatomic and clinical analysis. *Am J Sports Med.* 1992;20(5):587-593. [doi:10.1177/036354659202000517](https://doi.org/10.1177/036354659202000517)
9. Provencher CMT, Handfield K, Boniquit NT, Reiff SN, Sekiya JK, Romeo AA. Injuries to the pectoralis major muscle: Diagnosis and management. *Am J Sports Med.* 2010;38(8):1693-1705. [doi:10.1177/0363546509348051](https://doi.org/10.1177/0363546509348051)
10. Arciero RA, Crusier DL. Pectoralis major rupture with simultaneous anterior dislocation of the shoulder. *J Shoulder Elbow Surg.* 1997;6(3):318-320. [doi:10.1016/s1058-2746\(97\)90024-0](https://doi.org/10.1016/s1058-2746(97)90024-0)
11. Haley CA, Zacchilli MA. Pectoralis major injuries: evaluation and treatment. *Clin Sports Med.* 2005;33(4):739-756. [doi:10.1016/j.csm.2014.06.005](https://doi.org/10.1016/j.csm.2014.06.005)
12. Bak K, Cameron EA, Henderson IJP. Rupture of the pectoralis major: a meta-analysis of 112 cases. *Knee Surg Sports Traumatol Arthrosc.* 2000;8(2):113-119. [doi:10.1007/s001670050197](https://doi.org/10.1007/s001670050197)
13. Kanayama G, DeLuca J, Meehan WPI, et al. Ruptured tendons in anabolic-androgenic steroid users: a cross-sectional cohort study. *Am J Sports Med.* 2015;43(11):2638-2644. [doi:10.1177/0363546515602010](https://doi.org/10.1177/0363546515602010)
14. Connell DA, Potter HG, Sherman MF, Wickiewicz TL. Injuries to the pectoralis major muscle: evaluation with MR imaging. *Radiology.* 1999;210(3):785-791. [doi:10.1148/radiology.210.3.r99fe43785](https://doi.org/10.1148/radiology.210.3.r99fe43785)
15. Beloosesky Y, Grinblat J, Hendel D, Sommer R. Pectoralis major rupture in elderly patients: clinical and sonographic findings. *Clin Imaging.* 2003;27(4):261-264. [doi:10.1016/s0899-7071\(02\)00548-x](https://doi.org/10.1016/s0899-7071(02)00548-x)
16. Pavlik A, Csépai D, Berkes I. Surgical treatment of pectoralis major rupture in athletes. *Knee Surg Sports Traumatol Arthrosc.* 1998;6(2):129-133. [doi:10.1007/s001670050085](https://doi.org/10.1007/s001670050085)
17. Lin TY, Chang KV, Wu WT, Özçakar L. Right arm pain after strength training: ultrasound imaging for pectoralis major tendon strain. *J Yeungnam Med Sci.* 2023;40(1):109-111. [doi:10.12701/jyms.2022.00626](https://doi.org/10.12701/jyms.2022.00626)