Study: **Proper identification of ribs underlying the rhomboid major and trapezius muscles using palpation.**

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Project summary: This study will determine the accuracy of medical practitioners in locating the posterior ribs underlying the rhomboid major and trapezius muscles in individuals of different Body mass indices.

Project description:

Rationale:

Cervical pain with associated myofascial trigger points is a common musculoskeletal issue with prevalence ranging from 30-85% (Gerwin 1995, Skootsky 1989). Treatment options for myofascial trigger points include both non-invasive and invasive treatments. Non-invasive treatments include deep pressure, massage, heat, TENS, and spray and stretch (de las penas 2005, Hou 2002). More aggressive, invasive treatment options include dry needling, anesthetic injection, or Botulinum toxin A injections (Liu 2015, Cummings 2001, Ho 2006, Scott 2009). Complications associated with dry needling are rare but include infection, bleeding, pain, epidural hematoma, and pneumothorax (Conway 2013, Cummings 2014, Ding 2013, He 2012, Juss 2008, Lee 2011, Karavis 2015, McCutcheon 2011).

Pneumothorax, which is a collapse of the lung, can result from trigger point injections to the muscles in close proximity to the ribs such as rhomboid major, rhomboid minor, trapezius, diaphragm, shoulder muscles, and neck muscles, where the needle is penetrated too deep and passes the pleura. Though the reported incidence of pneumothorax has been reported to be around 1 in 100,000 (Witt 2009, Melchart 2004), there is some thought that pneumothoraces may be underreported for two reasons - patients may have a subclinical pneumothorax or fail to report to their practitioner about shortness of breath or dry cough.

The rhomboid major muscle originates on the spinous processes of the T2-T5 vertebra and inserts on the medial border of the scapula. There has been a study to address the appropriate depth for needle insertion when dry needling or injecting the rhomboid major (Seol 2014). To our knowledge, there have been no studies to investigate a practitioner's ability to properly identify rib location with palpation. In fact, a recent case report outlines a pneumothorax caused by an extremely experienced practioner inserting a needle into the rhomboid (Cummings 2014). Use of an electromyography (EMG) needle for trigger point injection has also been described to help limit the danger of pneumothorax (Botwin 2007). Additionally, ultrasound has been used as a modality to identify safe needling of the diaphragm (Amirjani 2012).

Electromyographers frequently need to insert a needle into the same muscles. The rhomboid major, which is innervated by the dorsal scapular nerve, is one of just a few muscles that is innervated almost exclusively by the C5 nerve root, which can help differentiate levels of a nerve root lesion. For the same reasons as dry needling, improper needle placement of an EMG needle can cause a pneumothorax.

When performing dry needling or EMG of the rhomboid major muscle, proper identification of the ribs provides an anatomic landmark to prevent needle insertion into the pleural space (Seol 2014, Travell/Simons). The technique is often called "blocking," where the practitioner places the index finger in the intercostal space above or below a rib, with the middle finger on the intercostal space on the other side of the rib. This theoretically means that if a needle is inserted too deeply, it will only hit the rib and not go into the intercostal space. However, to our knowledge, this has never been investigated. Anecdotally, this is difficult to perform on someone with a large body habitus.

Objective:

1. Identify the accuracy of palpation guided identification of the ribs underlying the rhomboid major muscles.
2.

Subjects to study:

Inclusion criteria:
Adults >18 years old
Main exclusion criteria:
Prior surgery or scarring to the posterior aspect of the shoulder, which will make accurate localization of the rib using ultrasound difficult.

Methodology:

Subjects will be identified using inclusion criteria and consented. No personally identifiable patient information will be collected. The subject's age, height, weight, and gender will be recorded. The patient will be positioned in the prone or seated position, as per the practitioner's usual custom. The practitioner will then palpate to identify a posterior rib location under the rhomboid major. They will then place a single dot over what they perceive as the midline of the rib using a felt tip, skin-marking pen.

A second practitioner, trained in ultrasound identification, will then use a linear probe on an ultrasound machine to obtain a clear view of the ribs in a perpendicular alignment over the placed skin marking. The linear probe has a line signifying the middle of the probe, which will be placed directly over the center of the skin marking. This will be done with the rib in short axis to the ultrasound probe. Images will be saved for review, and will be analyzed for skin-to-rib depth as well as the rib location (e.g. middle 50%, outer 25% of the rib).

Data management and analysis:

Data will be collected in an Excel spreadsheet file. As there will be no personally-identifiable information contained, it will not be password-protected. Our primary outcome will be a simple percentage of accurate vs. inaccurate rib identifications. Secondarily, data will be examined for normality by Kolmogorov-Smirnov testing. Logistic regression testing will be used to examine a relationship between BMI & accuracy and between depth & accuracy.

Sample size needed for the study:

As no data has been published on this study, we are using clinical opinion. Anecdotally, we feel that on patients with a normal BMI, the inaccuracy rate will be almost zero. However, in obese subjects, this value is probably much larger. We would estimate that 10% of overweight individuals would have inaccurate readings. For a p value of 0.05, this would require 46 overweight subjects. If we make the assumption that half of subjects are overweight, we should recruit 92 total subjects.

Ethical considerations:

Recruitment plans: Participants will be recruited for participation from patients in our musculoskeletal clinics at the University of Utah.

Compensation: None

Risks of the study: There is minimal risk associated with participation in the study. There is a very low risk of a local reaction to the skin-marking ink or ultrasound gel.

Benefits of the study: There is no benefit to the participants in this study.

Informed consent: Informed consent will be obtained

IRB approval: ***

References:

1. Al-Shekhlee A, Shapiro BE, Preston DC. Iatrogenic complications and risks of nerve conduction studies and needle electromyography. *Muscle Nerve.* May 2003;27(5):517-526.
2. Amirjani N, Hudson AL, Butler JE, Gandevia SC. An algorithm for the safety of costal diaphragm electromyography derived from ultrasound. *Muscle Nerve.* Dec 2012;46(6):856-860.
3. Botwin KP, Patel BC. Electromyographically guided trigger point injections in the cervicothoracic musculature of obese patients: a new and unreported technique. *Pain Physician.* Nov 2007;10(6):753-756.
4. Conway N, Sreenivasan S. The acupunctured lung. *Am. J. Emerg. Med.* Jan 2014;32(1):111 e111.
5. Cummings M, Ross-Marrs R, Gerwin R. Pneumothorax complication of deep dry needling demonstration. *Acupunct. Med.* Dec 2014;32(6):517-519.

6. Cummings TM, White AR. Needling therapies in the management of myofascial trigger point pain: a systematic review. *Arch. Phys. Med. Rehabil.* Jul 2001;82(7):986-992.
7. de las Peñas CF, Campo MS, Carnero JF, Page JCM. Manual therapies in myofascial trigger point treatment: A systematic review. *J. Bodyw. Mov. Ther.* 2005;9(1):27-34.
8. Ding M, Qiu Y, Jiang Z, Tang L, Jin C. Acupuncture-associated pneumothorax. *J. Altern. Complement. Med.* Jun 2013;19(6):564-568.
9. Gerwin R. A study of 96 subjects examined both for fibromyalgia and myofascial pain. *J Musculoskel Pain.* 1995;3(Suppl 1):121.
10. He W, Zhao X, Li Y, Xi Q, Guo Y. Adverse events following acupuncture: a systematic review of the Chinese literature for the years 1956-2010. *J. Altern. Complement. Med.* Oct 2012;18(10):892-901.
11. Ho KY, Tan KH. Botulinum toxin A for myofascial trigger point injection: a qualitative systematic review. *Eur. J. Pain.* Jul 2007;11(5):519-527.
12. Honet JC. Pneumothorax and EMG. *Arch. Phys. Med. Rehabil.* Feb 1988;69(2):149.
13. Honet JE, Honet JC, Cascade P. Pneumothorax after electromyographic electrode insertion in the paracervical muscles: case report and radiographic analysis. *Arch. Phys. Med. Rehabil.* Sep 1986;67(9):601-603.
14. Hou CR, Tsai LC, Cheng KF, Chung KC, Hong CZ. Immediate effects of various physical therapeutic modalities on cervical myofascial pain and trigger-point sensitivity. *Arch. Phys. Med. Rehabil.* Oct 2002;83(10):1406-1414.
15. Hsueh TC, Yu S, Kuan TS, Hong CZ. Association of active myofascial trigger points and cervical disc lesions. *J. Formos. Med. Assoc.* Mar 1998;97(3):174-180.
16. Juss JK, Speed CA, Warrington J, Mahadeva R. Acupuncture induced pneumothorax - a case report. *Acupunct. Med.* Sep 2008;26(3):193-196.
17. Karavis MY, Argyra E, Segredos V, Yiallouroy A, Giokas G, Theodosopoulos T. Acupuncture-induced haemothorax: a rare iatrogenic complication of acupuncture. *Acupunct. Med.* Jun 2015;33(3):237-241.
18. Lee JH, Lee H, Jo DJ. An acute cervical epidural hematoma as a complication of dry needling. *Spine.* Jun 2011;36(13):E891-893.
19. Liu L, Huang QM, Liu QG, et al. Effectiveness of Dry Neeedling for Myofascial Trigger Points Associated with Neck and Shoulder Pain: A Systematic Review and Meta-analysis. *Arch. Phys. Med. Rehabil.* Jan 7 2015.
20. McCutcheon L, Yelland M. Iatrogenic pneumothorax: safety concerns when using acupuncture or dry needling in the thoracic region. *Phys. Ther. Rev.* 2011;16(2):126-132.
21. Melchart D, Weidenhammer W, Streng A, et al. Prospective investigation of adverse effects of acupuncture in 97 733 patients. *Arch. Intern. Med.* Jan 12 2004;164(1):104-105.
22. Miller J. Pneumothorax. Complication of needle EMG of thoracic wall. *N. J. Med.* Aug 1990;87(8):653.
23. Peuker E. Case report of tension pneumothorax related to acupuncture. *Acupunct. Med.* Mar 2004;22(1):40-43.
24. Reinstein L, Twardzik FG, Mech KF, Jr. Pneumothorax: a complication of needle electromyography of the supraspinatus muscle. *Arch. Phys. Med. Rehabil.* Sep 1987;68(9):561-562.

25. Scott NA, Guo B, Barton PM, Gerwin RD. Trigger point injections for chronic non-malignant musculoskeletal pain: a systematic review. *Pain Med.* Jan 2009;10(1):54-69.
26. Seol SJ, Cho H, Yoon do H, Jang SH. Appropriate depth of needle insertion during rhomboid major trigger point block. *Ann Rehabil Med.* Feb 2014;38(1):72-76.
27. Skootsky SA, Jaeger B, Oye RK. Prevalence of myofascial pain in general internal medicine practice. *West. J. Med.* 1989;151(2):157.
28. Unluer EE, Akyol PY, Karagoz A, Bilgin S. A deadly complication of superficial muscular needle electromyography: bilateral pneumothoraces. *Case Rep Med.* 2013;2013:861787.
29. Vilke GM, Wulfert EA. Case reports of two patients with pneumothorax following acupuncture. *J. Emerg. Med.* Mar-Apr 1997;15(2):155-157.
30. Wassinger CA, Osborne H, Ribeiro DC. Traumatic pneumothorax sustained via fine-wire electromyography insertion at the shoulder. *Physiotherapy.* Dec 2011;97(4):357-359.
31. Witt CM, Pach D, Brinkhaus B, et al. Safety of acupuncture: results of a prospective observational study with 229,230 patients and introduction of a medical information and consent form. *Forschende Komplementärmedizin/Research in Complementary Medicine.* 2009;16(2):91-97.