

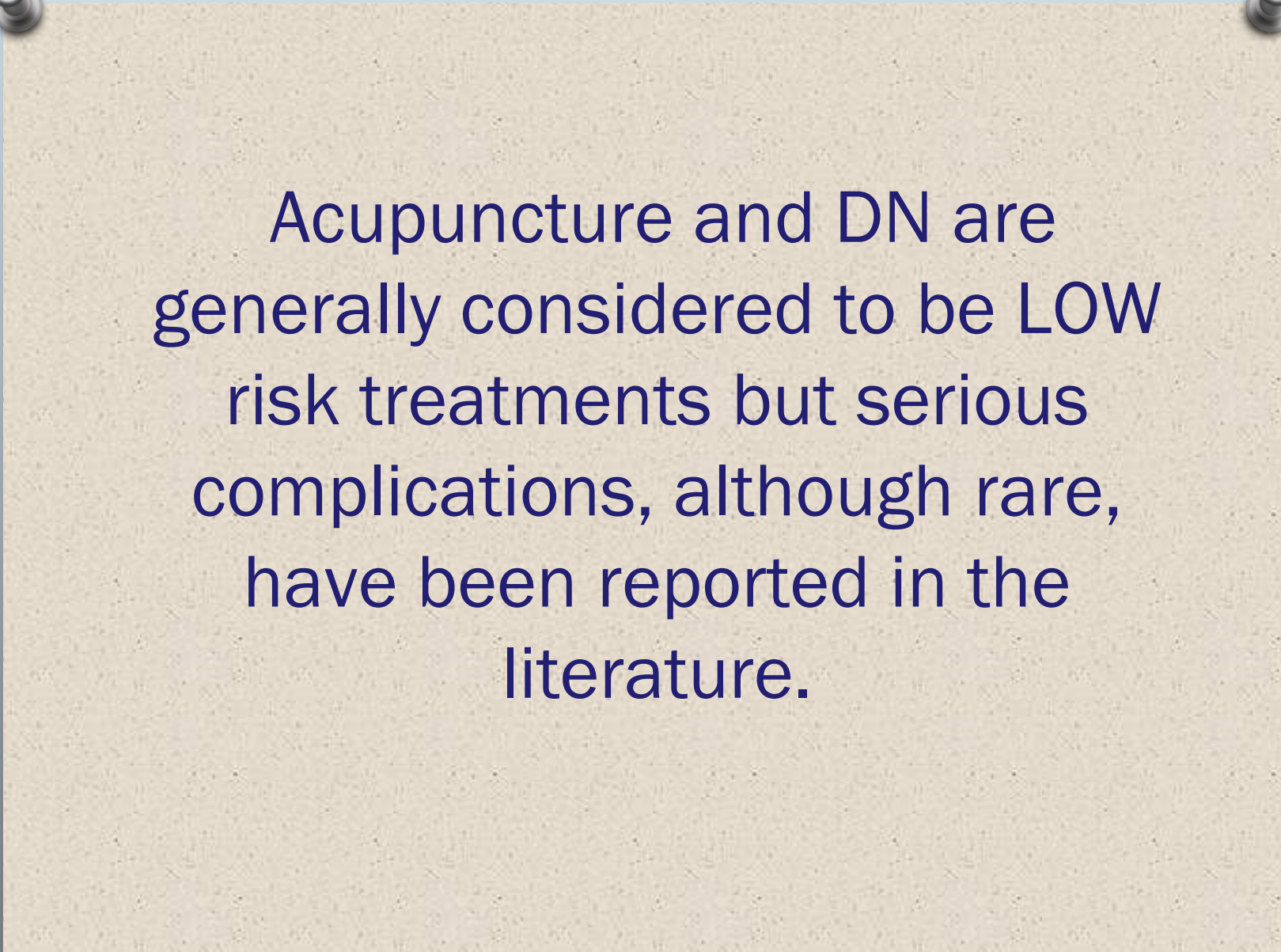
Adverse Events Associated with Dry Needling in Physiotherapy Practice

March 19, 2021

Dr. Vanessa Valdes
DPT, OCS, L.Ac.
Mount Sinai Medical Center, NYC



**Mount
Sinai**



Acupuncture and DN are generally considered to be LOW risk treatments but serious complications, although rare, have been reported in the literature.

Outline of Course

1. Frequency and types of Adverse Events

2. Mild AE:

1. Bleeding and Bruising
2. Pain (during, after)
3. Vasovagal Response

3. Serious and Severe AE:

1. Pneumothorax/Haemothorax
2. Infections
3. Serious Bleeds
4. Cardiac Tamponade
5. Nerve Injuries
6. Miscellaneous concerns:
 1. Pregnancy issues
 2. Broken Needles

Differences between acupuncture and DN

- o Most research looks at acupuncture AE not dry needling AE
 - o DN often involves deeper needle insertion and needle manipulation to obtain a local twitch response. Needle retention may not occur.
 - o Acupuncture needling is inserted to depth of acupuncture point and needle manipulation occurs to get “deqi”. Needling retention is common and may last 15-20 minutes. NOTE: many different schools of acupuncture with varying needle techniques.

What are Adverse Events?

- o “An unexpected and undesired incident directly associated with the care or services provided to the patient; an incident that occurs during the process of providing health care and results in patient injury or death; or an adverse outcome for a patient, including an injury or complication.”
- o From Physiotherapy Alberta College Association Practice Guidelines

How common are AEs?

- No national or international tracking systems of AE's related to DN or acupuncture
- Usual method? *Prospective Studies*
- Frequency is difficult to determine and may be under-reported.

Case Studies

- o How useful are they in determining Adverse Events?
 - o Types and treatments of AE
 - o Frequency of AE...not reliable data

Types of AE

- o SEVERITY:
 - o Mild/Minor
 - o Significant
 - o Serious
- o Duration of symptoms?
- o Avoidable vs. Unavoidable
- o Associated with standard practice or associated with practitioner neglect?

- Large Prospective studies have assessed the safety of acupuncture in other countries (Brazil, Germany, Britain) and have included acupuncture in all areas of the body and have found the incident of AE to be low. The incident of serious side effects like pneumothorax are much greater when needling the thorax.

Frequency of AE: Studies

- o McDowell JM, Johnson GM *Acupuncture Needling Styles and Reports of Associated Adverse Reactions to Acupuncture*. Medical Acupuncture 2014;26(5):271-279

Frequency of AE: Studies

- o Brady S, McEvoy J, Dommerhold J, Doody C *Adverse events following trigger point dry needling: a prospective survey of chartered physiotherapists.* J of Manual and Manipulative Therapy 2014;22(3):134-140

Frequency of AE: Studies

- o Boyce D, Wempe H, Campbell C et al.
*Adverse Events Associated with
Therapeutic Dry Needling.* Int J of Sports
Phys Ther 2020;15(1):103-113

Mild Adverse Events

- o **1. Bleeding and Bruising**
- o 2. Pain during or after treatment
- o 3. Vasovagal response

Bleeding and Bruising

- o Mild bruising or bleeding with needling is common and usually of minimal concern.
- o Bleeding can occur outward or inward as a result of needling
- o Small hematomas are possible in the skin or muscle
- o More serious:
 - o Arterial bleeding
 - o Bleeding into compartments

Managing bleeding/bruising

- o Screen patients for bleeding disorders and use of anticoagulants
 - o McCulloch, Michael, et al. “Acupuncture Safety in Patients Receiving Anticoagulants: A Systematic Review” *Perm J* 2015 Winter;19 (1): 68-73
- o Pressure with cotton ball over needling site sufficient enough to stop bleeding
- o Use of anti-bruising topical products
 - o Arnica Montana
 - o Kousi SAS, Nuzum DS study: *Arnica for bruising and swelling* *Am J of Health Syst Pharm* 2007;64(23): 2434-2443

Case studies related to serious AE involving bleeding

1. Berrigan WA, Whitehair C, Zorowitz R *Acute Spinal Epidural Hematoma as a Complication of Dry needling: A Case Report* Phys Medicine and Rehab 2018;18;S1934-1482
2. Peuker E, Gronemeyer D. *Rare But Serious Complications of Acupuncture: Traumatic Lesions* Acupuncture in Medicine 2001;19(2):103-108

Mild Adverse Events

- o 1. Bleeding and Bruising
- o 2. Pain during or after treatment
- o 3. Vasovagal response

Increased pain during or post treatment

- Increased pain is more commonly associated with dry needling compared with acupuncture treatments
- Brady et al (2014): AE frequency of pain during DN treatment (3.01%) and pain after DN treatment (2.19%)
- Pain may be the result of neuromuscular injury or hemorrhagic and inflammatory changes caused by the needle

Marin-Pintado-Zugasti et al. *Post-needling soreness after myofascial trigger point dry needling: Current status and future research* J of Bodywork & Mvmt Ther 22(2018)941-946

- o The number of needle insertions and pain perceived during the needling had a positive correlation to pain post treatment
- o No relationship found between LTRs elicited and post needling soreness
- o Post treatment pain is described as a constant pressure or a dull aching
- o Duration of post needling soreness is usually less than 72 hours

Marin-Pintado-Zugasti et al study continued...

- o Simons et al (1999) recommended avoidance of strenuous activities for 2- 3 days if post injection soreness occurs but no studies to support this
- o Patients with a low baseline myofascial pain show reduced tolerance to post treatment soreness compared with those with high myofascial trigger point pain levels pre-treatment
- o Further research into presenting post needling soreness as a positive sign (Dummerhold et al 2015)
- o Additional therapies that might decreased post needling soreness: percutaneous electrical nerve stimulation, low load exercises, ultrasound, “spray and stretch”, ischemic compression, hot packs, TENS, kinesiotape

Mild Adverse Events

- o 1. Bleeding and Bruising
- o 2. Pain during or after treatment
- o 3. Vasovagal response

Vasovagal response (VVR)

- o What is it? (AKA neurally mediated syncope)
- o Signs and symptoms?
- o How common is it?
 - o Christensen KA, Gosse BJ, Hildebrand C, Gershan LA. *Acupuncture-associated Vasovagal response: Revised Terminology and Hospital Experience*. Med Acupunct. 2017 Dec 1;29(6): 366-367

Frequency of VV response

- o A relatively rare occurrence:
.02 – 7% of acupuncture treatments
- o Be aware of history of fainting associated with pain or the sight of blood
- o Many potential patients have a fear of needles
 - o Increased risk of VVR if patient is stressed or nervous, poorly rested, fatigued, hungry, dehydrated, have a weak constitution or are having these treatments for the first time



Prevention of VVR

o “PEACHES” acronym to prevent VVR related to DN/acupuncture:

- o **P**osition
- o **E**xperience
- o **A**nxiety
- o **C**onstitution
- o **H**ydration and Feeding
- o **E**nvironment
- o **S**ymptom recognition

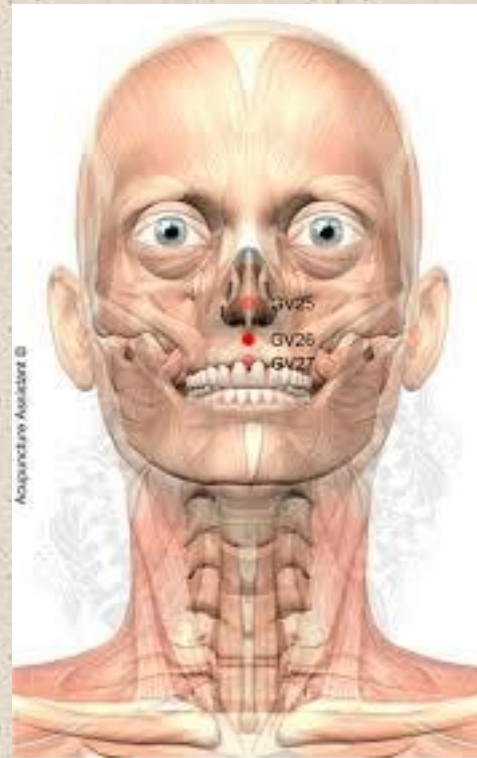


Treatment of VVR

- o Acronym **RIPC**ORD
 - o Recognize
 - o Initiate ABC
 - o Position
 - o Communicate
 - o Order treatments (acupressure can be helpful)
 - o Reassess
 - o Document
- o “Be Laid Back”

Acupuncture points for revival associated with VVR

- o GV 26 (Du 26)
- o ST 36 (if using upper quadrant points)
- o LI 4 (if using lower quadrant points)
- o PC 6-9
- o Jing Well points
- o Stimulate with nail, guide tube or needle



Serious Adverse Events

- o Pneumothorax/Haemothorax
- o Infections
- o Serious bleeds
- o Cardiac Tamponade
- o Nerve Injuries (CNS/PNS)
- o Miscellaneous:
 - o Pregnancy concerns
 - o Broken and Lost needles

Pneumothorax and Haemothorax

- o Definition: the presence of air or gas (or blood in the case of a haemothorax) in the pleural cavity (the potential space between the visceral and the parietal lung pleura).
- o The most serious complication of acupuncture or DN as many areas around the thorax are needed for the treatment of musculoskeletal pain.
- o Very rare in clinical practice: 0.01/10,000 treatments
- o Most fully recover and mortality is rare but prevention is essential.

Types of Pneumothorax

- o Spontaneous Pneumothorax:

- o Primary -
 - o Associated with smokers
 - o More common with males (6:1)
 - o Other risk factors
- o Secondary -

- o Traumatic Pneumothorax:

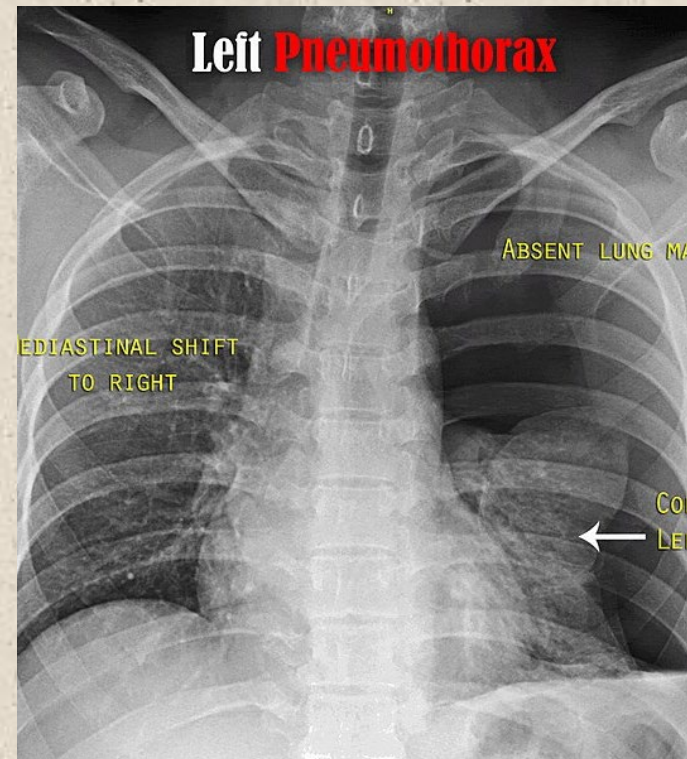
- o Non-iatrogenic (includes trauma, rib fractures, and high risk sports like SCUBA and flying)
- o Iatrogenic: (i.e. from needling into area)

Clinical Features of Pneumothorax

- o Importance of early recognition
- o Acupuncture induced iatrogenic pneumothorax may take several hours to develop and not be evident initially.
- o Signs and Symptoms: SOB on exertion, increased respiratory rate, chest pain, dry cough, cyanosis, diaphoresis, decreased breath sound on auscultation, mediastinal shift
- o *Tension* pneumothorax
- o Diagnosis: by ultrasound or x-ray

Treatment of pneumothorax

- If suspected, prompt referral for medical follow up is essential.
- Degree of lung collapse will dictate treatment.
 - If mild (<20%) in healthy patient...monitoring is usually sufficient as lung will re-inflate.
 - In cases of moderate (20-40% collapse) or severe (>40% collapse), oxygen supplementation may be needed if oxygen saturation levels are low. May require a chest drain.



Case Study: Acupuncture related Pneumothorax

o Grusche F, Egerton-Warbuton D. *Traumatic Pneumothorax Following Acupuncture: A Case Series*. Clin Pract Cases Emerg Med. 2017;1(1):31-32

- o This Australian case study looked at three cases in traumatic pneumothorax following acupuncture/DN.
- o All three patients had received needling for shoulder and upper back area for musculoskeletal complaints.
- o All had low BMIs.

Case Study: Bilateral Pneumothorax

- Tagami R, Moriy T, Kinoshita K, et al
Bilateral tension pneumothorax related to acupuncture. *Acupuncture in Medicine* 2013;31:242-244
- Bilateral tension pneumothorax most commonly associated with inheritable disorders like Marfan syndrome, a spontaneous sub pleural bleb rupture or trauma.

Case Study: Dry Needling related Pneumothorax

- o Uzar T, Turkmen I, et al. *A case with iatrogenic Pneumothorax due to deep dry needling* Radiol Case Rep 2018 ec;13(6):1246-1248
- o needling of the trigger point associated with the serratus anterior, rhomboids, supraspinatus, iliocostalis and the lower cervical paraspinals can result in pneumothorax.

Case Study: Haemothorax caused by Acupuncture

- o Karavis, et al. *Acupuncture-induced Haemothorax: a rare iatrogenic complication of acupuncture*. *Acupunct Med* 2015;33(3):237-241
- o Risk factors include thin body status, atrophic neck and thoracic muscles, history of chronic respiratory diseases and heavy chronic smoking

Case Study: Pneumothorax sustained during acupuncture training

- o Martins da Encamaco, et al. *Pneumothorax Sustained during Acupuncture Training: a Case Report*. *Acupunct Med* 2014;32:514-516.
 - o Occurred when learning to needle anterior scalene muscle in class

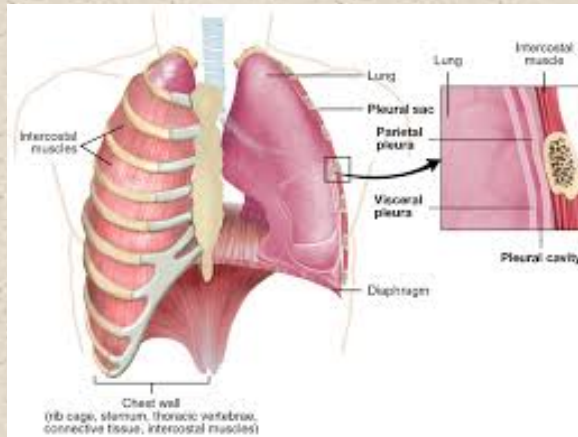
Prevention of iatrogenic pneumothorax

- Reducing risk requires good surface and functional anatomical knowledge of the area
- Needling into the supraclavicular and parasternal regions have the greatest risk of pneumothorax due to proximity of lungs
- Needling into the thoracic paravertebral and rib cage areas also has high risk

Prevention of iatrogenic pneumothorax

- o Avoid needling directly over intercostal spaces
- o Beware of congenital foramen possibility in infraspinous and supraspinous areas
- o Mitchell UH, Johnson AW, et al *Positional changes in distance to the pleura and in muscle thickness for dry needling.* Physiotherapy 2018 Aug 18. Pii:S0031-9408(18)30190-1.

Anatomical Consideration: The Lung



- The Lung: Apex extends 2-3 cm above the clavicular line (close to GB 21 area).
- With smokers, additional care required when needling cephalad to the 1st rib or in the supraclavicular region to avoid puncturing a bulla or bleb
- At mid clavicular line: lungs extend to 6th rib. At mid axillary line: 8th rib, posterior to 10th rib. The pleura extends a further two rib levels below.

Congenital Foramina

- o Congenital foramina of the infraspinous fossa:
..8 - 5.4% of population with diameters of 2-5 mm.
 - o Near SI 11 point, Infraspinatus *TTP*
- o Similar foramina of the supraspinous fossa can also occur:
 - o Near SI 12-13 points, supraspinatus *TTP*
- o Congenital sternal foramen can be present in 5 - 8% of population (see cardiac Tamponade section)

- o Practitioners must have in-depth knowledge of anatomy of these areas
- o Technique-related skills involving needle placement, needle direction and angle, patient positioning and palpation skills are essential to learn
- o BMI effect shows that needle insertion depth must be modified to each patient
 - o Obesity factors
 - o Low BMI

Most dangerous acupuncture points associated with pneumothorax

- o Infraclavicular area: Lung 1, Lung 2, Kidney 27, ST 13
- o Supraclavicular area: ST 11, ST 12, GB 21
- o Parasternal region: KI 22- 27
- o Mid-clavicular line: ST 12 -18
- o Medial Scapular area: UB 41- 54

Dry needling in thorax

- o Muscles in medial scapulae region frequently treated with dry needling:
 - o RHOMBOID MAJOR AND MINOR
 - o LEVATOR SCAPULAE
 - o UPPER TRAPEZIUS
 - o ILIOCOSTALIS THORACIS
 - o SERRATUS POSTERIOR SUPERIOR
 - o SPLENIUS CERVICUS
 - o SEMISPINALIS THORACIS, CERVICUS AND CAPITIS

Serious Adverse Events

- o Pneumothorax/Haemothorax
- o Infections
- o Serious bleeds
- o Cardiac Tamponade
- o Nerve Injuries (CNS/PNS)
- o Miscellaneous:
 - o Pregnancy concerns
 - o Broken and lost needles

Infections

- o A rare but serious side effect associated with needling
- o Acupuncture and DN can be “complicated by infections caused the microorganisms on the patients’ own skin flora”
- o Universal precautions
- o “Clean Needle Technique Manual” development
 - o <http://www.ccaom.org/cntmanual.asp>



Signs and symptoms of infection

- o A percutaneous infection at the needle entry site will show the signs of redness, swelling, pain and local heat.
- o Severe infections can also be accompanied by fever.
- o Most related to mycobacterial or methicillin-resistance *S. Aureus* (MRSA)
- o Autogenous infections vs. Cross-infections

Studies related to infection and needling

- o Hoffman P: *Skin disinfection and acupuncture*. Acupunct Med 2001;19(2):112-116

More Case studies of infection related to needling

- o Woo PCY et al *Relatively Alcohol-Resistant Mycobacteria Are Emerging Pathogens in Patients Receiving Acupuncture Treatment*
Journal of Clinical Microbiology 2002;40 (4);
1219-1224

Recent case studies

- 1. Kim DC, Glenzer S, Johnson A, Nimityongskul P. *Deep Infection Following Dry Needling in a Young Athlete: An Underreported Complication of an Increasingly Prevalent Modality: A Case Report* J Bone Joint Surg Am. 2018 Jul-Sep;8(3):e73. doi: 10.2106/JBJS.CC.18.00097.

2. Callan AK, Bauer JM, Martus JE

*Deep Spine Infection After Acupuncture
in the Setting of Spinal Instrumentation.*

Spine Deform. 2016 Mar;;4(2):156-161

doi:10.1016/j/jspd.2015.09.045

3. Stenntjes K, de Vries LM, Ridwan BU,
Wijgman AJ

*[Infection of a hip prosthesis
after dry needling].*

Ned Tijdschr Geneeskd 2015;160:A9364.

Prevention of Infection

- o WHO guidelines include:
 - o Maintaining clean working environment
 - o Clean hands
 - o Preparation of needling sites
 - o Sterilization and storage of needles and equipment
 - o Aseptic technique

Serious Adverse Events

- o Pneumothorax/Haemothorax
- o Infections
- o Serious bleeds
- o Cardiac Tamponade
- o Nerve Injuries (CNS/PNS)
- o Miscellaneous:
 - o Pregnancy concerns
 - o Broken and lost needles

Cardiac Tamponade

- o Defined: a compression of the heart that occurs when blood or fluid builds up around the pericardium resulting in heart compression
- o Needling in the area of the sternum has risks as result of a possible sternal foramen
 - o Acupuncture: CV 17
 - o DN: sternalis and Pectoralis major

Sternal Foramen

A rare congenital abnormality is the result of an incomplete fusion of the sternal plates

Usually at level of 4th intercostal space (around area of CV 17)

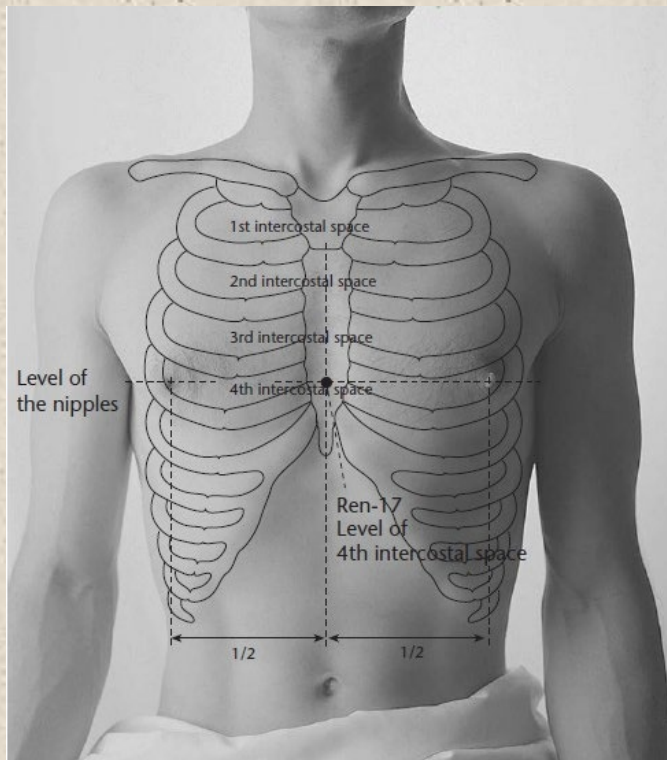
Occurs in 5-8% of the population

It cannot be reliably palpated



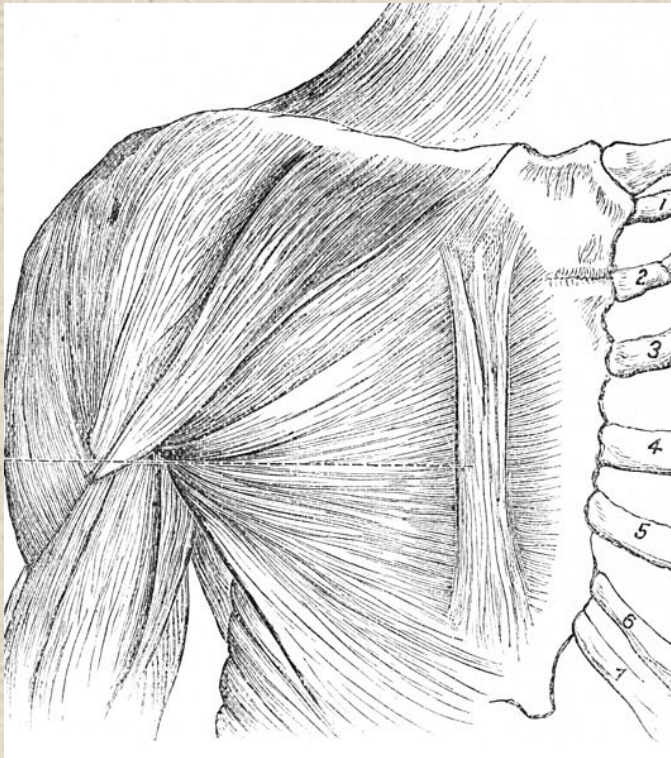
CV 17 (REN 17):

On the midline of the sternum, in a depression level with the junction of the 4th intercostal space and the sternum



- o Peter Deadman: “A Manual of Acupuncture”: page 517
- o Needling:
 - o i. transverse insertion directed superiorly or inferiorly along the channel .5 – 1 cun
 - o li. Transverse insertion directed laterally toward the breast, 1 – 1.5 cun for breast disorders

DN of Sternalis/Pectoralis Major



- Sternalis muscle is highly variable in presence and laterality
- McCutcheon and Yelland paper: Needling must be performed in an oblique cephalad direction

Serious Adverse Events

- o Pneumothorax/Haemothorax
- o Infections
- o Serious bleeds
- o Cardiac Tamponade
- o Nerve Injuries (CNS/PNS)
- o Miscellaneous:
 - o Pregnancy concerns
 - o Broken and lost needles

Nerve Injuries (PNS/CNS)

- o Many reports in medical literature of hypodermic needles causing neurological damage during intramuscular needling
- o Signs and symptoms dependent on type of nerve injury: neuropraxia, axontomesis or neurotomesis
- o Most common as a result of DN/acupuncture: neuropraxia
- o Prognosis?

Case reports: PNS injuries associated with acupuncture

- o From Peuker E, Gronemeyer D. *Rare But Serious Complications of Acupuncture: Traumatic Lesions Acupuncture in Medicine* 2001;19(2):103-108:
 - o Median nerve injury:
 - o PC 6 or 7 acupuncture point
 - o Discussed case of broken needle causing median nerve neuropathy
 - o Peroneal nerve palsy:
 - o GB 34 point
 - o Needling area around fibular head caused peroneal nerve palsy with resultant drop foot
 - o The common peroneal nerve has a variable course. In 10-20% it has a high course and intersects with the GB 34 point
 - o GB 39 and UB 40 have close location to common peroneal and tibial nerve

McManus R, Cleary M

Radial nerve injury following dry needling

BMJ Case Rep. 2018;2018:bcr2017221302

- o Irish case study
- o 27 year old woman developed a neuropraxia of her left radial nerve at the level of the spiral groove after DN for shoulder pain
- o Developed left hand muscle spasm and then progressed to a wrist drop
- o Despite intensive hand therapy and splinting, patient continued to present with left wrist drop. Follow up nerve conduction and EMG studies showed no sign of recovery.

Case reports: CNS injuries associated with acupuncture

- o From Peuker E, Gronemeyer D. *Rare But Serious Complications of Acupuncture: Traumatic Lesions Acupuncture in Medicine* 2001;19(2):103-108:
- o Reviewed 10 cases of injury to the spinal cord or spinal nerve roots. 4 cases occurred as a result of needle fragments and 6 were the result of direct injury
- o Injuries occurred in both the cervical and lumbosacral areas
- o Severity of injury varied from focal neurological signs to paraplegia.
- o Distance from skin to nerve roots or spinal cord vary from 25-45 mm depending on the size of the person
- o Deep needling of the inner bladder line (BL 11-20) appears to be the most likely area where complications can occur.

Good reference articles for anatomy reviews

- o Peuker E, Cummings M *Anatomy for the Acupuncturist – Facts & Fiction 1: The head and neck region* Acup in Medicine 2003;21(1-2):2-8.
- o Peuker E, Cummings M *Anatomy for the Acupuncturist – Facts & Fiction 2: The Chest, Abdomen and Back* Acup in Medicine 2003;21(3):72-79.
- o Peuker E, Cummings M *Anatomy for the Acupuncturist – Facts & Fiction 3: Upper and Lower Extremity* Acup in Medicine 2003;21(4):122-132

Serious Adverse Events

- o Pneumothorax/Haemothorax
- o Infections
- o Serious bleeds
- o Cardiac Tamponade
- o Nerve Injuries (CNS/PNS)
- o Miscellaneous:
 - o Pregnancy concerns
 - o Broken and lost needles

Acupuncture and Dry Needling during Pregnancy



- o Low back pain and pelvic girdle pain are common during pregnancy
- o “Forbidden” acupuncture points:
 - o Historical concern?
 - o What does the evidence show?

“Forbidden” Points during Pregnancy

- o Historically, these acupuncture points are either thought to be dangerous (because of location) or are associated with stimulating uterine contraction
- o Inconsistencies exist on exact points on this list
- o Veracity has not been proven because of avoidance of these points clinically during pregnancy

Forbidden points have two areas of concern

Segmental effects on the uterus via somatovisceral reflexes

- o SP 6
- o LI 4
- o GB 21
- o UB 60
- o UB 67
- o Lu 7
- o UB 32/33
- o UB 27-34
- o HJ T12-S1

Possible inadvertent uterine penetration

- o CV 3-7
- o CV 12 (after 12 weeks of pregnancy)

Carr David John *The safety of obstetric acupuncture:
forbidden points revisited* Acupunct Med 2015
Oct;33(5):413-419

- o Conclusion: Lack of evidence of harm
 - o 1. Acupuncture at forbidden points did not increase the risk of adverse pregnancy outcomes in controlled trials
 - o 2. Acupuncture at forbidden points did not increase the risk of adverse pregnancy outcomes in observational studies
 - o 3. Acupuncture at forbidden points does not induce miscarriage or labor
 - o 4. Acupuncture at forbidden points was did not cause harm to healthy pregnant rats

JM McDowell, SH Kohut and D Betts. *Safe acupuncture and dry needling during pregnancy: New Zealand physiotherapists' opinion and practice.* J of Integrative Medicine <https://doi.org/10.1061/i.joim.2018.11.006>)

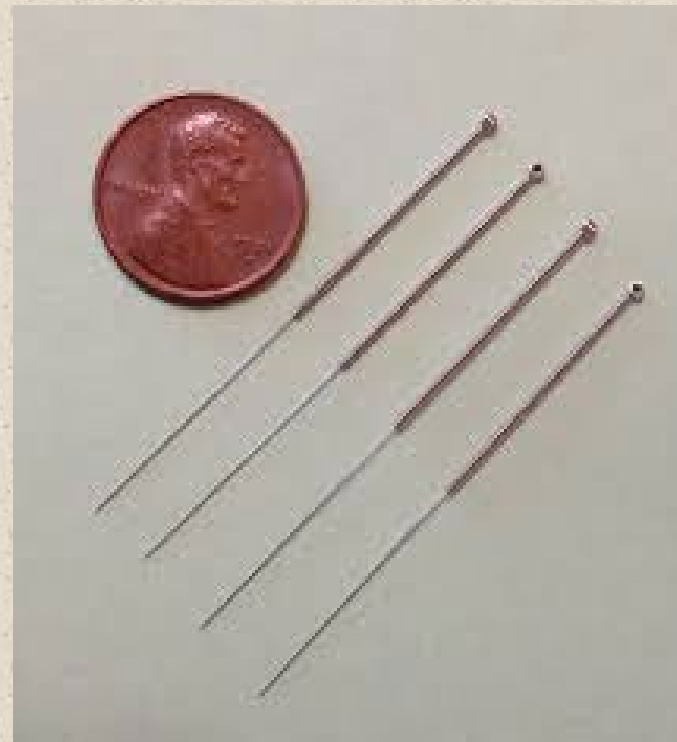
- o Miscarriage occurs in >10% of all pregnancy...80% will occur during the first trimester
- o Clarkson et al reviewed 17 acupuncture studies and found only one serious adverse event (woman at 15 weeks pregnancy developed premature contractions after LI 4 was needled.)
- o Concerns when treating pregnant patients:
 - o May avoid treating during first trimester
 - o Avoiding strong stimulation techniques
 - o Avoiding specific points
- o “Fear of Blame”

Serious Adverse Events

- o Pneumothorax/Haemothorax
- o Infections
- o Serious bleeds
- o Cardiac Tamponade
- o Nerve Injuries (CNS/PNS)
- o Miscellaneous:
 - o Pregnancy concerns
 - o Broken and lost needles

Broken Needles

- o A rare problem
- o May occur because of a crack or erosion of needle
- o Most common area to break is the root of the needle
- o Can be a life threatening problem if needle is left in the body



Needle Breakage

- o Leow Mable Qi He, Cao T, Won YR, Tay SC. *Needle breakage in acupuncture: a biomechanical study.* Acupunct Med 2017;35:78-79
- o What to do?
 - o Stay Calm and have patient not move
 - o If part of the needle is above the skin, gently remove it with forceps. If at level of skin, gently press tissue around the site until broke end is exposed, then remove with forceps
 - o If under skin, seek medical transport to hospital for surgical removal. Mark the place of needle entry

Case Studies:

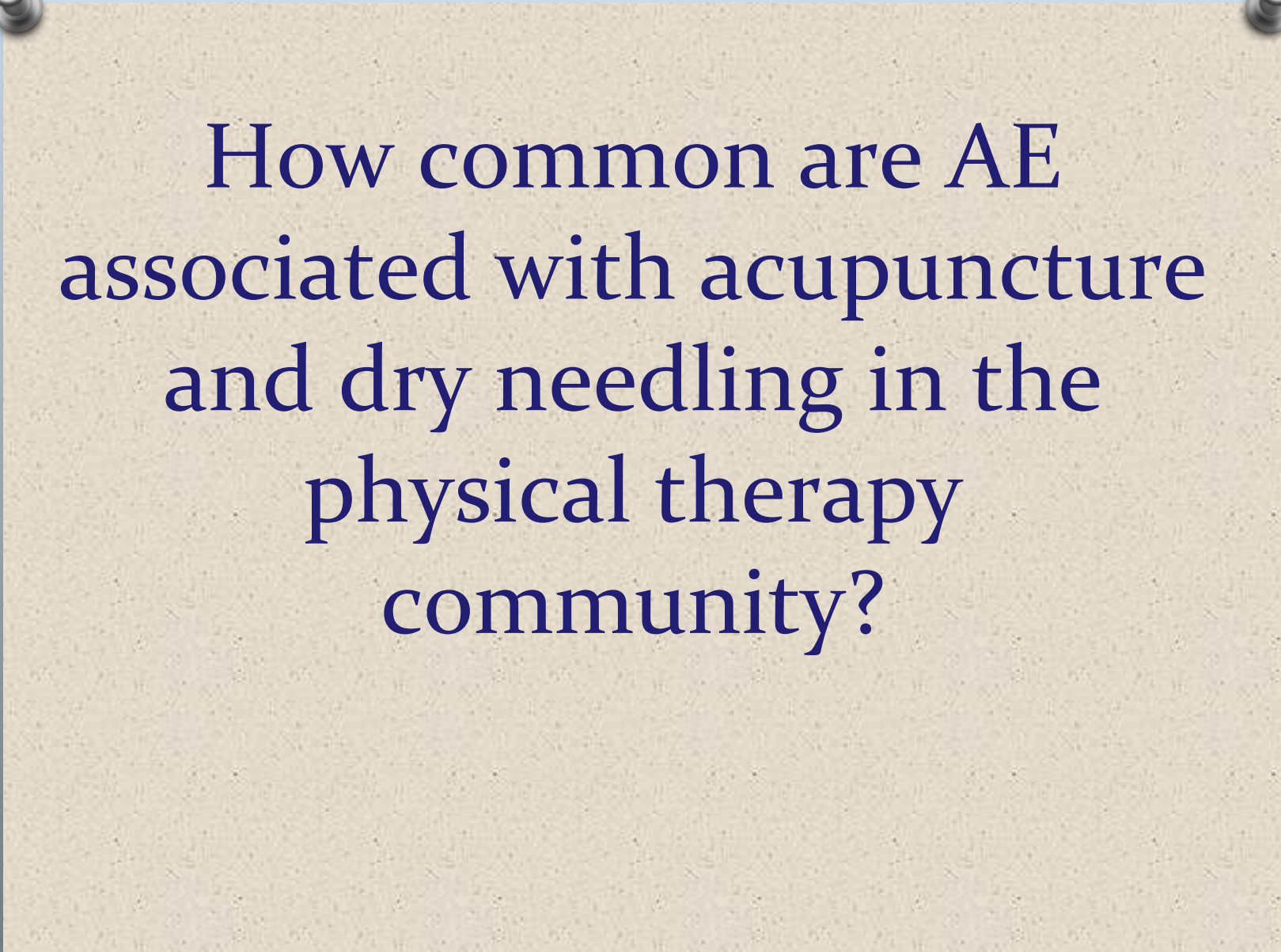
Chaput JM, Foster T. *Pain in the Neck: the Enigmatic Presentation of an Embedded Acupuncture Needle.*

West J Emerg Med 2010

May;11(2):144-145

Case Studies:

- o Snyder DD. Acupuncture gone awry: a case report of a patient who required surgical removal of two single-use filament needles following acupuncture intervention. *J Man Manip Ther* 2019;27(3):180-184.



How common are AE
associated with acupuncture
and dry needling in the
physical therapy
community?

Guidelines to minimize needle related liabilities

- o Complete and thorough patient history
- o Need for thorough and accurate informed consent form
- o Appropriate infection prevention techniques
- o Good documentation of needle insertion, treatment response
- o If patient required immediate medical care, document communication to referring practitioner
- o Good resource for appropriate patient selection:
<http://www.apta.org/StateIssues/DryNeedling>

CONCLUSIONS

- o Safe practice of needling must be an integral part of foundation and continued training
- o The cause of AE is sometimes difficult to determine
- o Frequency of AE are difficult to determine
- o How do we develop a culture of safety?
 - o Development of standardized collection of AE can help improve safe clinical practice
 - o Develop a critical event management plan
 - o Develop an informed consent form for patients

Questions?