Acupuncture-Related Pneumothorax

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ABSTRACT

Background: Acupuncture-related pneumothorax (PTX) is a poorly reported complication of thoracic needling. Recent Chinese literature reviews cited PTXs as the most common adverse outcome. Because of delayed presentation, this complication is thought to be underrecognized by acupuncturists and is largely addressed by hospital and emergency room personnel. The goal of this case study was to demonstrate common risk factors for a PTX, the mechanisms for its development, and protocols to use if one is suspected.

Case: A 43-year-old, athletic female with chronic neck pain that was poorly managed with oral medications sought an alternative intervention for pain control. Her treatment plan consisted of weekly acupuncture sessions in the prone and supine positions targeting points along the Bladder, Gall Bladder, and Small Intestine meridians, as well as the right scapular *Ah Shi* point. She also received infrared lamp therapy. The aim of this approach was to help the patient achieve subjective pain reduction and increased range of motion.

Results: One hour after her third treatment session, this patient experienced pleuritic chest pain and dyspnea. She was transported to a local Level-1 trauma center by emergency medical services and was diagnosed with a right-sided PTX.

Conclusions: The acupoints addressed, a practitioner's knowledge of variations in anatomy, and a patient's body habitus and medical history are risk factors for PTX development. A patient's initial presentation does not predict future outcome. A benign presentation can evolve into a potentially life-threatening cardiovascular collapse. When PTX is suspected, discussing it with the patient and facilitating appropriate evaluation and intervention by a tertiary-care facility is warranted.

Key Words: Acupuncture, Pneumothorax, Body Mass Index, Risk Factors

INTRODUCTION

A PNEUMOTHORAX (PTX) is a rare acupuncture-related complication. When it manifests, the potential need for an invasive procedure, continuous monitoring, and ancillary support is beyond the scope of most acupuncture clinics. The classic presentation, shortness of breath followed by hypoxia, may be insidious and, depending on severity, may devolve into a life-threatening condition, cardiovascular compromise. Immediately identifying a PTX and applying appropriate interventions are necessary to ensure an optimal

patient outcome. This article reports on a case of an otherwise healthy individual who developed PTX secondary to acupuncture therapy.

CASE

The patient, J.K., was a 43 year old female with a past medical history significant for cigarette smoking and an unnamed birth defect requiring a neck brace. Because of her chronic neck pain that unrelieved by oral analgesics, J.K.

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sought alternative therapies, including acupuncture. After her initial assessment, the recommendations for her case consisted of weekly acupuncture treatments in the prone and supine positions.

The acupuncturist obtained verbal and written consent from the patient treatment as described below. Subsequent to her presentation and radiographic findings, this case study was approved by the Oregon Health & Science University's institutional review board.

The Traditional Chinese Medicine (TCM) style (prone position) was used to open obstructed Qi and Blood channels presenting with pain. They included the Gall Bladder (bilateral GB 20 and 21), Bladder (bilateral BL 10 and 13–15), and Small Intestine (right SI 11). The patient's midline and right scapular pain were needled as *Ah Shi*. The *Tan* style (supine position) was utilized to treat channels corresponding to residual pain after the prone position treatments. Pain remaining in the foot *Tai Yang* channel was treated with hand *Tai Yang* channel points (right SI 4–6). Pain remaining in the hand *Tai Yang* channel points was treated with foot *Tai Yin* points (right Spleen [SP] 5, 5.2, 5.4, and 6). The patient also reported Triple Burner (TB) meridian pain while in the supine position, the right GB 40, a *Shao Yang* analogue to the TB meridian, was needled. Finally, her stress levels were addressed by targeting sedating ear points (bilateral *Shen Men* and ear Parasympathetic, and *Yin Tang*).

Twenty-nine, 0.25 mm × 30 mm and 0.25 mm × 40 mm, needles were utilized (Spring Ten Needles, Lhasa OMS, Inc., Weymouth, MA). The angles and depths of insertion were per standard practice specifications until the arrival of Qi. The prone TCM and supine *Tan* treatments involved counterclockwise and clockwise needle rotations respectively. The ear points and *Yin Tang* were not rotated.

Finally, while J.K. was in the prone position, infrared lamp therapy was applied over her upper back for 20 minutes. The length of each session was approximately 40 minutes.

RESULTS

The first two interventions resulted in significant reductions of this patient's pain. During her third treatment, a 0.25 mm × 40 mm needle was inserted obliquely into trigger point SI 11. This acupoint is located at T-4 approximately one-third the distance between the lower border of the scapular spine and the inferior angle of the scapula. The practitioner described the sensation of the needle's insertion as "unusual and unsettling," realized that he had incorrectly located SI 11 over the rhomboid muscle (Fig. 1), and considered the potential for a PTX. The needle was removed and the patient was verbally assessed for signs of respiratory distress. She was deemed asymptomatic, the needle was reinserted in the correct position (directly over the scapula), and the treatment was resumed without further incident. After completion of the session, she was discharged to go

FIG. 1. Posterior thorax. The shaded rectangle medial to the scapula represents the area instrumented.

home without any instructions related to the concern regarding a potential PTX. Within 1 hour of returning home, J.K. experienced right-sided pleuritic chest pain that varied in intensity with respiration. The acupuncturist was contacted and recommended emergency medical transport to a Level-1 trauma center.

Upon arrival to the emergency department of the center, she was in mild distress. Her heart rate was 80 beats per minute and her blood pressure was 108/58 mmHg. She was breathing at 18 respirations per minute and maintained an oxygen saturation of 99% without supplementation. On physical examination, J.K. was not noted to have labored breathing, her lung fields were clear to auscultation, and there was no evidence of tracheal deviation or jugular venous distension. An extended focused assessment with sonography for trauma produced results consistent with a right-sided pneumothorax. A chest radiograph verified the finding; it showed a 2.3-cm, right apical PTX without mediastinal shift (Fig. 2). J.K. was treated with high-flow oxygen and admitted to the emergency department's observation unit for 24-hour surveillance. Serial chest radiographs were obtained 6 and 18 hours (Fig. 3) after her admission, both showing minimal changes in the PTX. The following day, the supplemental oxygen was discontinued, this patient's pain was well-controlled with oral narcotic agents, and she was discharged to go home.

DISCUSSION

Acupuncture, a component of TCM, is based upon 12 body meridians. Each meridian corresponds to a specific

FIG. 2. Admission chest radiograph. The patient, J.K. was a 43-year-old female who presented with shortness of breath and diaphoresis 1 hour after receiving acupuncture near her right scapula. This chest radiograph shows a right apical pneumothorax, measuring 2.37 cm.

organ (Table 1) and acts as a pathway for Qi (life force), to flow. Qi is composed of complementary forces, Yin and Yang.¹ The insertion of small-gauge needles at acupoints, along each meridian manipulates these complementary forces and subsequently affects their courses of travel. Application of mechanical, electrical, and heat stimulation produces an additional therapeutic benefit. The U.S. Food and Drug Administration (FDA) estimates there are 9–12 million acupuncture sessions per year in the United States, resulting in \$500 million of annual revenue.²

Acupuncture is considered to be safe; however, numerous adverse events have been reported. A 30-year review (1980–2009)³ of 115 published articles from Chinese literature cited 296 traumatic injuries, 150 vasovagal episodes, 9 infectious complications, and 14 deaths. PTX ($n=201$) was one of the most frequent adverse events. Other traumatic events included: subarachnoid hemorrhage ($n=35$), abdominal organ injuries ($n=16$), and spinal epidural hematoma ($n=9$).

Similar findings were also noted in a separate 54-year review (1956–2010) of Chinese literature, which discussed 167 articles.⁴ Again PTX, 30% of the reported cases, was the most common traumatic adverse event. Over the last decade, Western literature has also reported numerous adverse events.^{5–18} A large-scale Western study involving 190,924 patients over a 6-month period found 0.024% ($n=45$) of these patients experienced death, an organ injury, or required hospitalization.¹⁹

A similar study followed 229,230 patients during a 44-month period. Approximately 2.2% ($n=4963$) of these experienced adverse events.²⁰ Two PTXs were reported.

FIG. 3. Discharge chest radiograph. Eighteen hours after the incident J.K.'s pneumothorax was still present but had slightly decreased in size.

While these large scale prospective studies demonstrate that acupuncture-related complications are rare, many of these events can lead to life-threatening conditions.

The current patient experienced a PTX, which is acupuncture's most commonly reported complication.^{14,18} A PTX is the presence of air within the thoracic cavity between the parietal (chest wall) and visceral (lung) pleura. As a consequence of air encroaching on the lungs, heart, and the compressible mediastinal vasculature (vena cava, arterial outflow tract), a life-threatening condition can result. A PTX can occur spontaneously or secondary to trauma, medical professional intervention, or a preexisting condition.^{21–23} Secondary spontaneous PTXs are the result of pulmonary diseases such as COPD. Smoking is the primary risk factor, increasing the risk by 20 times. Bulla, an inflammatory-mediated degradation of the lung's elastic tissue, resulting in a thin-walled air-filled cavity, is the suspected cause. When the bulla loses its integrity, air escapes into the pleural cavity, leading to compromise of the surrounding structures. Acupuncture-related PTXs are usually associated with paraventricular, infraclavicular, or thoracic needling. These thoracic acupoints have minimal subcutaneous tissue predisposing a patient to disruption of the bulla and migration of air through the bronchial tree to a potential space.

In the case presented, the small-gauge needle hole probably did not create an open communication between the potential parietal–visceral space and the atmosphere. This direct pathway would have led to the immediate migration of air, expansion of the potential space, and cardiovascular and respiratory distress. Most likely, this patient's smoking history and possible bullae formation or another lung physiologic problem was the underlying culprit. Violation of the bulla leads to extravasation of air through the direct

TABLE 1. TWELVE STANDARD BODY MERIDIANS

Meridian		Organ	
English	Chinese	English	Chinese
Taiyin Lung Channel of the Hand	<i>Shǒu tàiyīn fèi jīng</i>	Lung	<i>Fèi</i>
Yangming Large Intestine Channel of the Hand	<i>Shǒu yáng míng dàcháng jīng</i>	Large Intestine	<i>Dàcháng</i>
Taiyang Small Intestine Channel of the Hand	<i>Shǒu tàiyáng xiǎocháng jīng</i>	Small Intestine	<i>Xiǎocháng</i>
Shaoyin Heart Channel of the Hand	<i>Shǒu shǎo yīn xīnjīng</i>	Heart	<i>Xīn</i>
Jueyin Pericardium Channel of the Hand	<i>Shǒu jué yīn xīnbāo jīng</i>	Pericardium/Circulation	<i>Xīnbāo</i>
Shaoyang Sanjiao Channel of the Hand	<i>Shǒu shǎo yáng sānjīao jīng</i>	Triple Warmer/Thyroid	<i>Sānjīao</i>
Taiyang Bladder Channel of the Foot	<i>Zú tàiyáng pángguāng jīng</i>	Urinary Bladder	<i>Pángguāng</i>
Shaoyin Kidney Channel of the Foot	<i>Zú shǎo yīn shèn jīng</i>	Kidney	<i>Shèn</i>
Yangming Stomach Channel of the Foot	<i>Zú yáng míng wèi jīng</i>	Stomach	<i>Wèi</i>
Taiyin Spleen Channel of the Foot	<i>Zú tàiyīn pí jīng</i>	Spleen	<i>Pí</i>
Shaoyang Gallbladder Channel of the Foot	<i>Zú shǎo yáng dǎn jīng</i>	Gall Bladder	<i>Dǎn</i>
Jueyin Liver Channel of Foot	<i>Zú jué yīn gān jīng</i>	Liver	<i>Gān</i>

communication of the bronchial pathways to this expanding space. It is unclear if the initial insertion of the needle versus the mechanical abrasion of the lung during respiration against the needle's tip was the exact mechanism—the end result would be the same.

There are numerous other acupoints over the thorax and within the area of concern. The routine use of these locations results in tonifying and strengthening organs. For example, thoracic trigger points are utilized for musculoskeletal problems involving the neck, shoulders, chest, and back. Alternative nonthoracic sites are available but are not routinely accessed because of acupuncturists' preferences or fears regarding an inadequate physiologic response.

In Western medicine, iatrogenic causes are usually related to subclavian or internal jugular-vein catheterizations. Because of this well-known association, a chest radiograph is usually obtained after the procedure, irrespective of the patient's presentation.

Aside from a practitioners' knowledge of the acupoints and their therapeutic benefits, an accurate understanding of anatomy, physiology, and the complications associated with a misplaced needle are essential to comprehensive care. In this case, the practitioner described misplacing a needle at SI 11; however, this practitioner had listed accessing BL 13–15 as part of the patient's treatment plan. When these points are needled perpendicularly and not obliquely toward the spine, they penetrate the thoracic cavity. BL 13 has also been associated with acupuncture-related PTX.¹⁴

When a complication arises or is suspected, executing the appropriate evaluation and interventions is warranted. Many PTXs are insidious and develop minutes to hours after the initial insult. This practitioner did, however, notice a change in tactile response which piqued his concerns. In this case, the patient was needled along the medial scapular edge. The lung is ~20 mm below this landmark. Given J.K.'s athletic body habitus with minimal subcutaneous fat, this distance was most likely decreased, predisposing her to an injury. Although J.K. was considered stable upon discharge from

the acupuncture clinic, she became symptomatic within 1 hour of departure. This occurrence illustrates that a patient's initial presentation is not an accurate barometer of future events.

As with any intervention, patient safety and understanding the mechanisms and techniques to avoid complications complements patient care. These techniques are introduced during initial training and are reinforced by experience and state licensure-maintenance requirements. Having received FDA approval, acupuncture protocols have a proven safety record. Deviations from these protocols can lead to complications.

If these complications occur, the event should be accompanied by a high level of communication between the patient and practitioner. The personal interaction between the patient and practitioner is part of the healing process. Full disclosure of the practitioner's concerns would have allowed the patient to understand the mechanism of the injury and need for radiographic evidence to rule out the concern or for expectant management with strict instructions if symptoms developed. This would have been the more-conscientious course of action and may have eliminated or assuaged the emotional insult in this case.

CONCLUSIONS

A PTX is a potentially life-threatening condition that can occur during acupuncture. Given the insidious nature of PTX in some cases, this finding may go largely unnoticed by the patient or acupuncturist until after the inciting event. In addition, evaluation at a local hospital or medical facility may never be disclosed to the original provider. Although this occurs infrequently, practitioners must be aware of this potential complication and the risk factors that predispose a patient to the development of an acupuncture-associated PTX, including a low body mass index, decreased subcutaneous fat over the needled areas, pulmonary disease, or history of smoking. Not all PTXs require invasive corrective

intervention; however, adherence to safety standards and open communication with a patient regarding the potential need to intervene is essential.

DISCLOSURE STATEMENT

No competing financial interests exist.

REFERENCES

1. NIH [National Institutes of Health] consensus conference: Acupuncture. *JAMA*. 1998;280(17):1518–1524.
2. Lytle CD. *An Overview of Acupuncture*. Washington, D.C.: United States Department of Health and Human Services, Health Sciences Branch, Division of Life Sciences, Office of Science and Technology, Center for Devices and Radiological Health, Food and Drug Administration; 1993.
3. Zhang J, Shang H, Gao X, Ernst E. Acupuncture-related adverse events: A systematic review of the Chinese literature. *Bull World Health Organ*. 2010;88(12):915C–921C.
4. 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*. 2012;18:892–901.
5. Carette MF, Mayaud C, Houacine S, Milleron B, Toty L, Akoun G. Treatment of an asthmatic crisis by acupuncture: Probable role in the onset of pneumothorax with development to status asthmaticus. *Rev Pneumol Clin*. 1984;40(1):69–70.
6. Gray R, Maharajh GS, Hyland R. Pneumothorax resulting from acupuncture. *Can Assoc Radiol J*. 1991;42(2):139–140.
7. Kao CL, Chang JP. Bilateral pneumothorax after acupuncture. *J Emerg Med*. 2002;22(1):101–102.
8. Iwadata K, Ito H, Katsumura S, et al. An autopsy case of bilateral tension pneumothorax after acupuncture. *Leg Med (Tokyo)*. 2003;5(3):170–174.
9. de Kuyper RD, van Hezik EJ. Bilateral pneumothorax in a young woman after acupuncture [in Dutch]. *Ned Tijdschr Geneesk*. 2002;146(24):1158.
10. Cantan R, Milesi-Defrance N, Hardenberg K, Vernet M, Messant I, Freysz M. Bilateral pneumothorax and tamponade after acupuncture. *Presse Med*. 2003;32(7):311–312.
11. Brettel HF. Acupuncture as a cause of death [in German; author's transl.]. *MMW Munch Med Wochenschr*. 1981;123(3):97–98.
12. Schneider LB, Salzberg MR. Bilateral pneumothorax following acupuncture. *Ann Emerg Med*. 1984;13(8):643.
13. Ritter HG, Tarala R. Pneumothorax after acupuncture. *BMJ*. 1978;2(6137):602–603.
14. Peuker E. Case report of tension pneumothorax related to acupuncture. *Acupunct Med*. 2004;22(1):40–43.
15. Wright RS, Kupperman JL, Liebhaber MI. Bilateral tension pneumothoraces after acupuncture. *West J Med*. 1991;154(1):102–103.
16. Vilke GM, Wulfert EA. Case reports of two patients with pneumothorax following acupuncture. *J Emerg Med*. 1997;15(2):155–157.
17. Su JW, Lim CH, Chua YL. Bilateral pneumothoraces as a complication of acupuncture. *Singapore Med J*. 2007;48(1):e32–e33.
18. Stenger M, Bauer N, Licht P. Is pneumothorax after acupuncture so uncommon? *J Thorac Dis*. 2013;5(4):E144–E146.
19. Endres H, Molsberger A, Lungenhausen M, Trampisch H. An internal standard for verifying the accuracy of serious adverse event reporting: The example of an acupuncture study of 190,924 patients. *Eur J Med Res*. 2004;9(12):545–551.
20. Witt C, Pach D, Brinkhaus B, Wruck K, Tag B, Mank S, Willich SN. Safety of acupuncture: Results of a prospective observational study with 229,230 patients and introduction of a medical information and consent form. *Forsch Komplementmed*. 2009;16(2):91–97.
21. Ahn SA, Heffner JE. Spontaneous pneumothorax. *N Engl J Med*. 2000;342(12):868–874.
22. Rousset-Jablonski C, Alifano M, Plu-Bureau G, et al. Catamenial pneumothorax and endometriosis-related pneumothorax: Clinical features and risk factors. *Hum Reprod*. 2011;26(9):2322–2329.
23. Alifano M. Catamenial pneumothorax. *Curr Opin Pulm Med*. 2010;16(4):381–386.

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