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Safety In Acupuncture Pneumothorax Prevention #1

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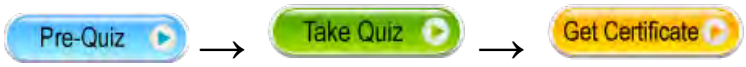

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Acupuncture & Pneumothorax

I Introduction

Acupuncture, when performed by a licensed acupuncturist, is safe and effective. Creating a pneumothorax (collapsed lung) through performing acupuncture is an avoidable risk. This can be avoided with a thorough understanding of lung anatomy in relationship to acupuncture points. This course will give an overview of underlying anatomy and give safe needling techniques so that the licensed acupuncture professional need never risk causing a pneumothorax.

II Definition and Mechanism of Pneumothorax

Pneumothorax is defined as **the presence of air or gas within the pleural space,** the "potential" space between the chest wall and the lung. A compete explanation of the how this causes pneumothorax is presented below.

Between the lungs and the chest wall are two layers of pleural lining, the *visceral* pleura and the *parietal* pleura, normally without any space between them. These two layers slide smoothly across each other due to serous fluid within the pleural space.

The function of the pleural space is to constantly maintain lower pressure outside the lungs and within the chest cavity compared to external atmospheric pressure. The difference in these pressures keeps the lungs inflated at all times whether inhaling or exhaling.

Air from outside the pleural space is under higher pressure than the pressure *within* the pleural space. When pressure within the pleural space increases to match external atmospheric pressure, it **causes a partial or complete collapse of the lung**.

A pneumothorax can be spontaneous, caused by an underlying disease process or caused by trauma.

There are three ways air can fill this "potential" space:

- Air can enter the pleural space from **outside the body**, as from a broken rib or other external puncture, including from medical procedures. The potential space between the two layers becomes exposed to external atmospheric air, causing the pressure in the pleural space to equalize with the external atmospheric pressure. The lung collapses due to the loss of normal lower pressure within the pleural cavity compared to external atmospheric pressure.

- Air can enter the pleural space from **inside the lung**, as from a bleb *(explained below)* or other underlying weakness in the lung. Even though the air entering the pleural space in this case comes from the lung itself, it originates from and is always connected to the outside atmosphere. Obviously, this air has the same pressure as the external atmosphere and a collapse of the lung results.

- More rarely, gas can accumulate from a bacterial infection **inside the pleural space** within the pleural fluid. This trapped gas slowly increases pressure within the pleural cavity eventually becoming equal to external atmospheric pressure. The lung collapses.

It is essential to realize that ***the lung itself does not have to be punctured to cause a pneumothorax***. The collapse of the lung is caused by an increase of pressure within the potential space between the visceral and parietal pleura of the lung, most commonly as a result of external air entering the interpleural space.

If only a small amount of external air enters the pleural space, the body can gradually reabsorb it. However, if there is too large an amount of air trapped within this space for the body to reabsorb, surgical intervention will be necessary by aspirating the trapped air

with a syringe or placing a chest tube into the pleural space to remove the trapped air.

Primary spontaneous pneumothorax

Spontaneous pneumothorax happens without trauma or intervention and most commonly happens in young people, particularly young men who are tall and thin. Small air blisters known as *blebs* can form on the surface of the lungs and when one of these blebs spontaneously ruptures, air from the lungs leaks into the pleural space and becomes trapped. While it's unknown why blebs form in some people, they can be compared to a weak spot on a bicycle tire inner tube that ruptures.

Certain preconditions such as smoking, scuba diving, and high altitudes can make an otherwise healthy person more prone to pneumothorax.

Secondary spontaneous pneumothorax

A secondary form of pneumothorax can be caused by underlying lung disease. Underlying chest disease such as lung cancer, COPD, asthma, cystic fibrosis or tuberculosis can make one more prone to pneumothorax and patients with these conditions should be treated with additional caution when needling points in the vicinity of the lungs. A person who has experienced a collapsed lung should also be treated with additional caution as they are more prone to a repeat pneumothorax.

Traumatic Pneumothorax

A lung collapse can be precipitated by trauma such as a car accident, gunshot, knife wound, or air bag deployment. Broken ribs from trauma can cause pneumothorax by either piercing the chest wall and pleural space *or* by puncturing the lung itself.

Iatrogenic pneumothorax

Iatrogenic pneumothorax is caused by medical examination or procedures such as thoracentesis (biopsy), mechanical ventilation, and incorrect acupuncture technique.

Tension Pneumothorax

Tension pneumothorax is a medical emergency in which the collapsed lung causes severe difficulty in breathing, hypoxia and a severe drop in blood pressure.

Summary

A pneumothorax can occur *spontaneously* in an otherwise healthy person, most often someone young who is tall and thin. It can be the result of trauma such as a broken rib or may be caused by internal disease such as lung cancer or, more rarely, infection in the pleural space.

Most importantly from our perspective, it can be caused by a medical procedure that introduces air into the pleural space.

As we will see, pneumothorax as a result of acupuncture is rare, particularly in the United States as compared to other countries. It is even more rare when practitioners are adequately apprised of both the proximity of specific acupuncture points to the apices of the lungs and when proper needling techniques are used with these more vulnerable points.

III Symptoms and Diagnosis of Pneumothorax

CAUTION: If your patient reports any of the following symptoms during or shortly after acupuncture, do not attempt to diagnose pneumothorax on your own. Refer them to an immediate care center or emergency room for radiographic evaluation.

Symptoms of pneumothorax are generally rapid and unmistakable, presenting with sudden onset of sharp chest pain and shortness of breath that causes a dry unproductive cough and is made worse with coughing. Pain may also be felt in the upper back. With a more severe pneumothorax, the person will also feel fatigue, may experience a precipitous drop in blood pressure, and may even become blue from lack of oxygen. If any of these symptoms occur shortly after an acupuncture treatment, the patient must be immediately sent to the nearest emergency room.

Pneumothorax is diagnosed by Chest X-ray, CT Scan of the chest, or arterial blood gases. When listening with a stethoscope there will be reduction of absence of breath sounds over the affected area.

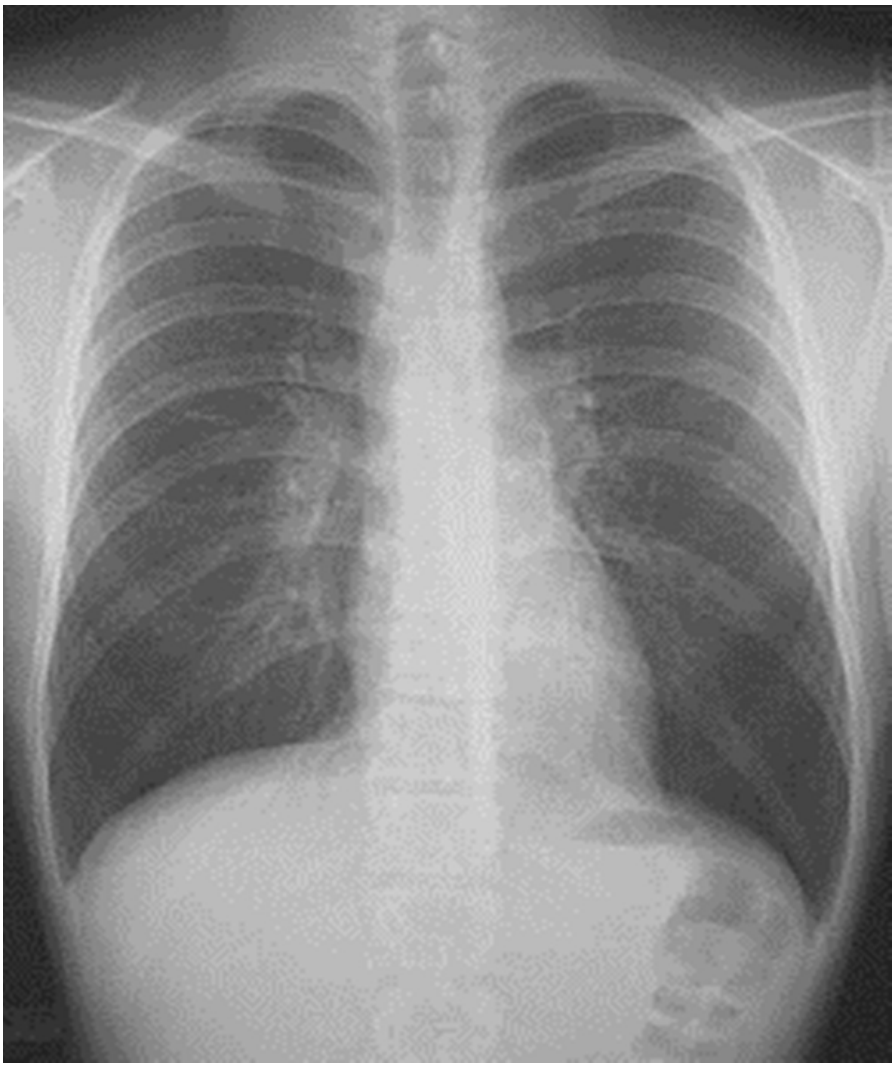
IV Treatment of Pneumothorax

A mild or partial pneumothorax may resolve on its own without treatment as small amounts of air trapped in the pleural space can gradually be reabsorbed and the small amount of lung collapse can re-inflate on its own. The patient will be directed to rest and supplemental oxygen may be used. It is not within the scope of practice of an acupuncturist to determine the severity and treatment of a pneumothorax.

In more severe cases, the trapped air may be aspirated with a syringe or a chest tube may be inserted between the ribs and into the space between the chest wall and the lung to help remove the trapped air and allow the lung to re-expand. The chest tube may be left in place for several days while the patient is hospitalized. In severe cases, chest surgery may be required.

V Lung Anatomy and X-Rays

First, let's look at a normal chest X-Ray:



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Normal Chest X-Ray taken from the back of an Adult Male

Orienting Yourself to the Image:

Personal Note from Colleen DeLaney, L.Ac., M.T.C.M.:

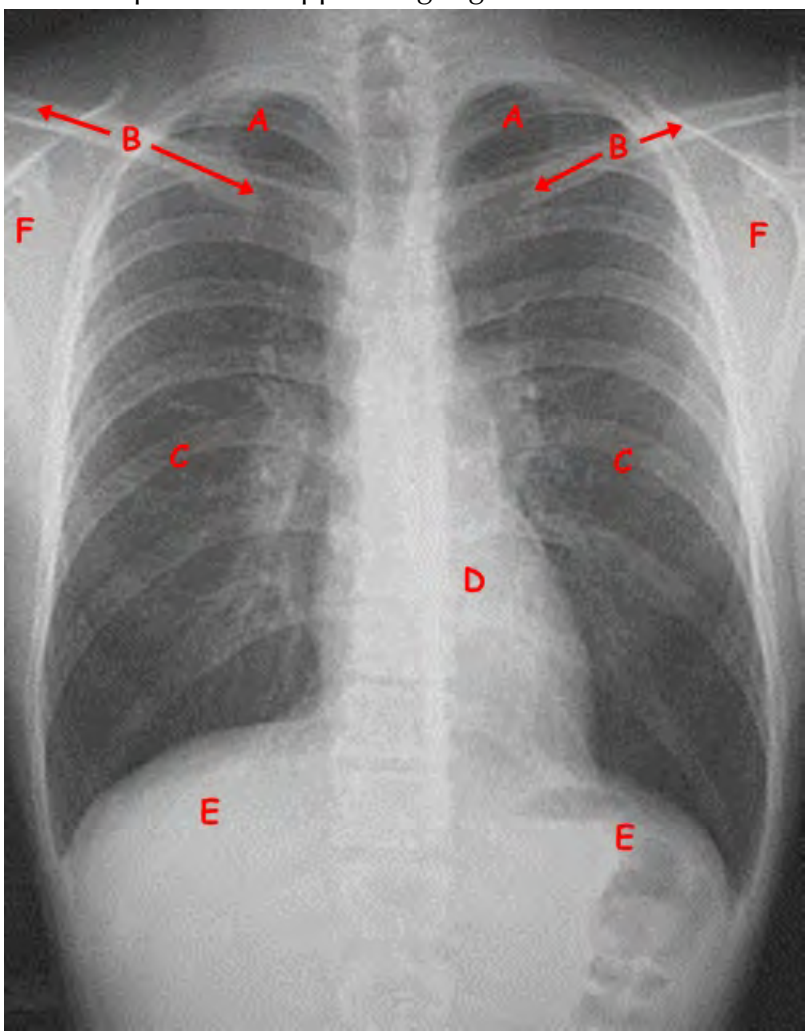
I worked as a Radiologic Technologist, primarily in hospital settings, from 1975 through 1990. During my radiology training I once X-rayed a 25 year old male Respiratory Therapist who experienced a spontaneous pneumothorax from a ruptured bleb as he was walking down the stairs towards the radiology department. He experienced sudden onset of sharp chest pain, non-productive cough and shortness of breath. This spontaneous pneumothorax was sufficiently severe to require placement of a chest tube for several days until the pneumothorax resolved. While generally not life-threatening, this is a serious and painful condition you do not want to cause in anyone, and it underscores the need for additional caution when treating a tall or thin young man who may be predisposed to a spontaneous pneumothorax.

A person is positioned for a normal chest x-ray by standing him upright, placing his chest against the x-ray cassette holder, rotating his shoulders forward so that the scapula do not overshadow the lung fields, and by instructing him to take as deep a breath as possible and hold it to fully inflate the lungs. Upon full inspiration the lungs will optimally be visualized down to the 10th rib. In the healthy image above, all **of the darkened area is inflated lung tissue**. The heart and diaphragm, being of denser material, show as lighter "shadows" on the film. Inside the darkened areas you can also observe lighter shadows that consist of the *hilum*, or region of each lung where the bronchi, blood vessels, and nerves enter and leave the lungs, along with slightly grayish areas depicting the densities of the lungs.

NOTE: The central point of this course is to visually bring to your attention to the reality that the dome or apex of the lungs extend above the clavicles.

EXERCISE

Look at the image and place your fingers on your clavicles (marked by the letter B). Feel the soft triangle of tissue above the clavicles that slopes upwards to the base of the neck. The apices or domes of the lungs (marked by the letter A), are right below the trapezius muscle (directly below GB 21). In a thin person without developed trapezius muscles, the apices of the lungs will be even closer to the surface of the body. Because the scapulae (marked by the letter F) are rotated forward so as not to obscure the lung field they are not in their normal anatomical position where they would afford protection to part of the upper lung region.



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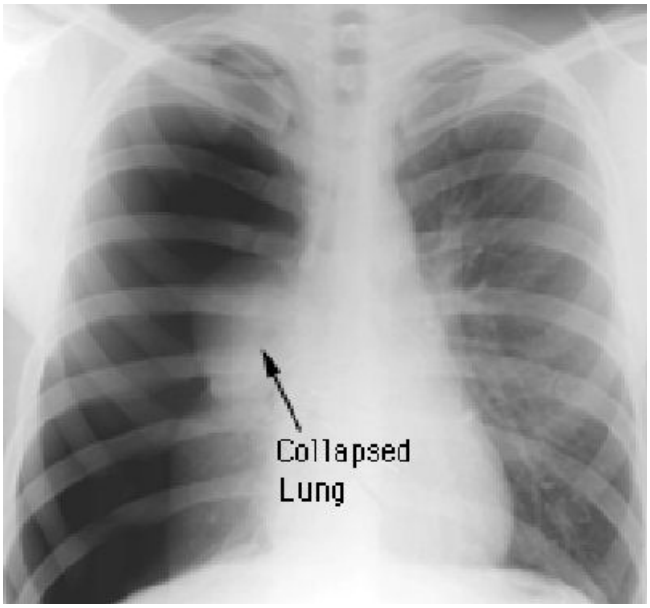
A: Apex of lungs B: Clavicles C: Lungs D: Heart E: Diaphragm

F: Scapula (rolled forward out of lung fields)

VI Appearance of a Pneumothorax:

A Pneumothorax can be small, only affecting a small degree of the lung, such as collapsing just one lobe of the lung in the area of the upper lung within the apex. Because the pleural space is self-enclosed on each side, and unless there is severe trauma to both sides of the chest wall, a pneumothorax will generally be limited to one lung. This type of limited pneumothorax may resolve with rest and close observation. However, as in the X-ray below, a pneumothorax can be severe. Enough air can enter the pleural cavity and become trapped there to cause collapse of the entire lung on one side, as depicted below:

Let's take a look at a right-sided pneumothorax:



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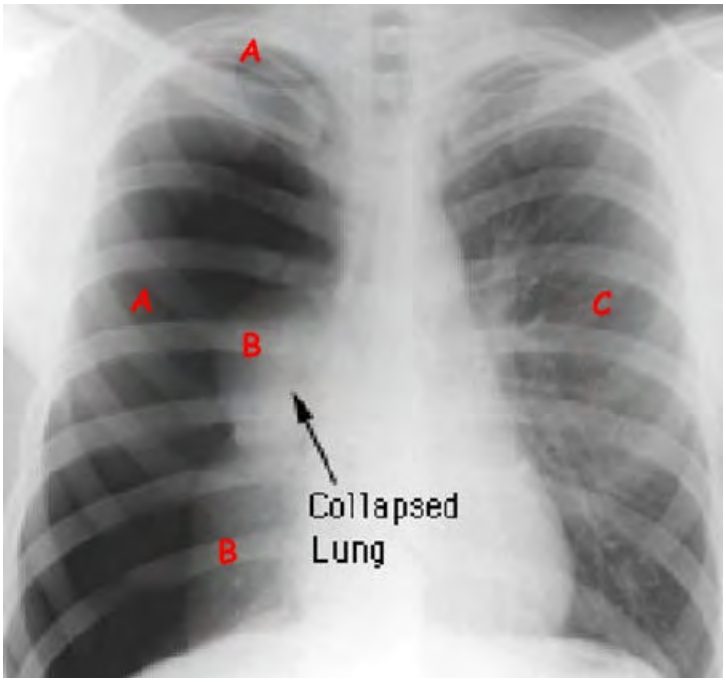
The right side of the chest shows a pneumothorax or collapsed lung, as indicated by the lack of pleural markings and vasculature seen on the left side. This “hyperlucency” or clear, dark area on the right is the hallmark of a collapsed lung.



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Additional red markings are those of the author.

A: Hyperlucent, air-filled pleural cavity: **Note this extends into the apex of the lung above the clavicle.**

B: Density showing collapsed lung tissue

C: Normal, inflated lung tissue with pleural markings

CT Scan of Collapsed Right Lung:

Right *Left*

image reproduced with permission by David Darling of http://www.daviddarling.info/encyclopedia/P/pneumothorax.html

Again, notice the hyperlucency (darkness) of the air-filled right pleural space, compared to the lung tissue and vasculature that fills the left side. The white ball of density towards the center of the right side is the collapsed lung tissue.

Acupuncture Points

Do not needle deeply over the lungs. Puncturing of the lungs causes pneumothorax, a collapsed or partially collapsed lung wherein there is air or gas in the pleural space. Accidental needling through the lung is iatrogenic pneumothorax, caused by a medical examination or procedure. This may be due to a biopsy or improper acupuncture needling technique.

Onset of pneumothorax is marked by sudden sharp chest pain, shortness of breath and an unproductive cough. Low blood pressure accompanied by more severe symptoms may also occur such as upper back pain, exhaustion and the patient may turn blue due to low oxygen levels. Mild pneumothorax may resolve without medical intervention. However, the only correct protocol if there is a pneumothorax is to make sure the patient is brought to an emergency medical facility immediately. Pneumothorax is a medical emergency. Severe cases may require surgery. Positive diagnosis is confirmed by X-Ray, CT scan or evaluation of arterial blood gases.

There are many points in common acupuncture practice that must be needled carefully to avoid pneumothorax. These points include the following:

- LU1, LU2
- ST11, ST13 , ST14, ST15, ST16, ST17, ST18
- UB11, UB12, UB13, UB14, UB15, UB41, UB42, UB43, UB44, UB45
- KI23, KI24, KI25, KI26, KI27
- GB21

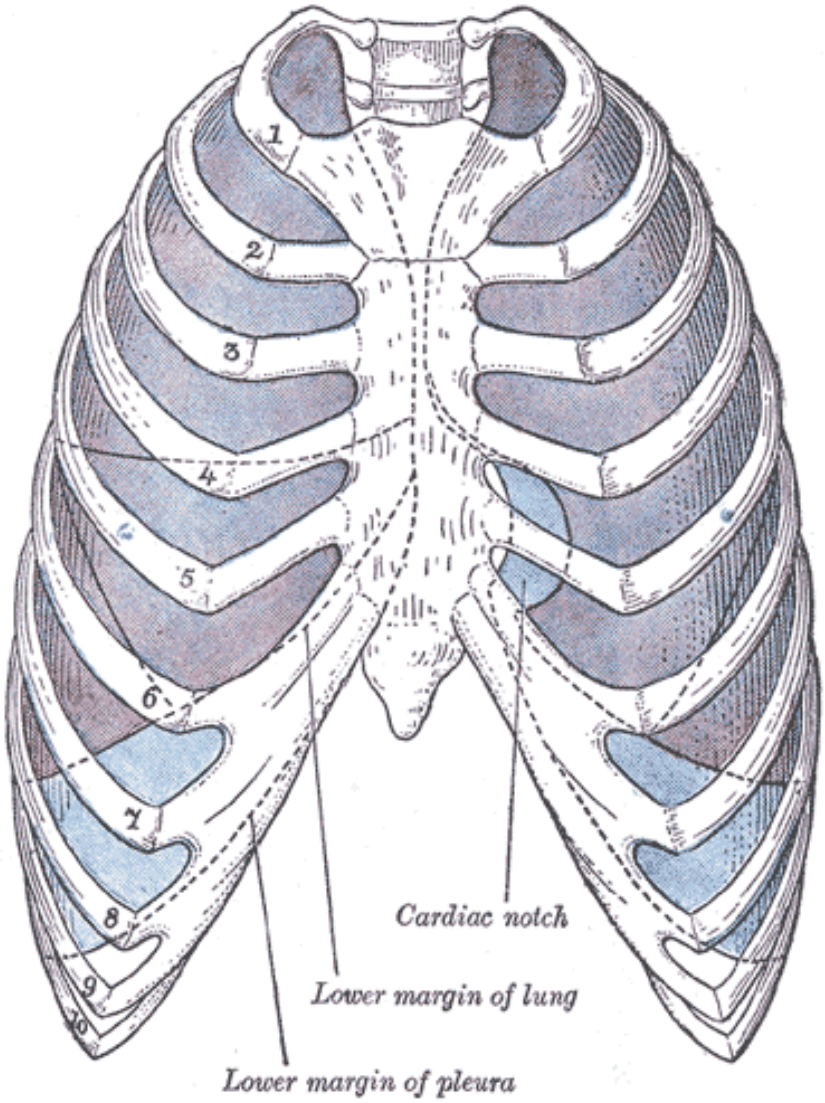
LU1, LU2

LU1 is located laterosuperior to the sternum at the lateral side of the 1st intercostal space, 6 cun lateral to the Conception Vessel. LU1 is 1 cun below LU2. LU1 is the front Mu point of the Lung and is an intersection point of the Spleen channel. LU1 is indicated for the treatment of respiratory conditions including coughing and asthma. LU1 is needled 0.5 to 0.8 inches obliquely and laterally. Avoid the

lungs by avoiding a medial or deep insertion.

LU1, LU2, ST11-16, KI24-27 and other lung area points

LU2 is located in a depression below the acromial extremity of the clavicle, 6 cun lateral to the Ren Meridian. The point is located in the center of the depression formed by the deltopectoral triangle. LU2 benefits the lungs and is indicated for conditions including cough, asthma, chest pain and shoulder pain. This point is needled 0.5 to 0.8 inches laterally. Deep needling and medial needling is contraindicated and may cause pneumothorax.



Anterior Points: ST11, ST13, ST14, ST15, ST16, ST17, ST18

Deep insertion at the following points may injure blood vessels and/or may cause pneumothorax. Use extreme caution and follow precise needling guidelines for licensed acupuncturists.

ST11 is located at the superior border of the sternal extremity of the clavicle between the sternal and clavicular heads of the sternocleidomastoideus muscle.

ST12 is located in the midpoint of the supraclavicular fossa, 4 cun lateral to the Ren Meridian.

ST13 is located at the lower border of the middle of the clavicle, 4 cun lateral to the Ren Meridian.

ST14 is located in the 1st intercostal space, 4 cun lateral to the Ren meridian.

ST15 is located in the 2nd the intercostal space, 4 cun lateral to the Ren meridian.

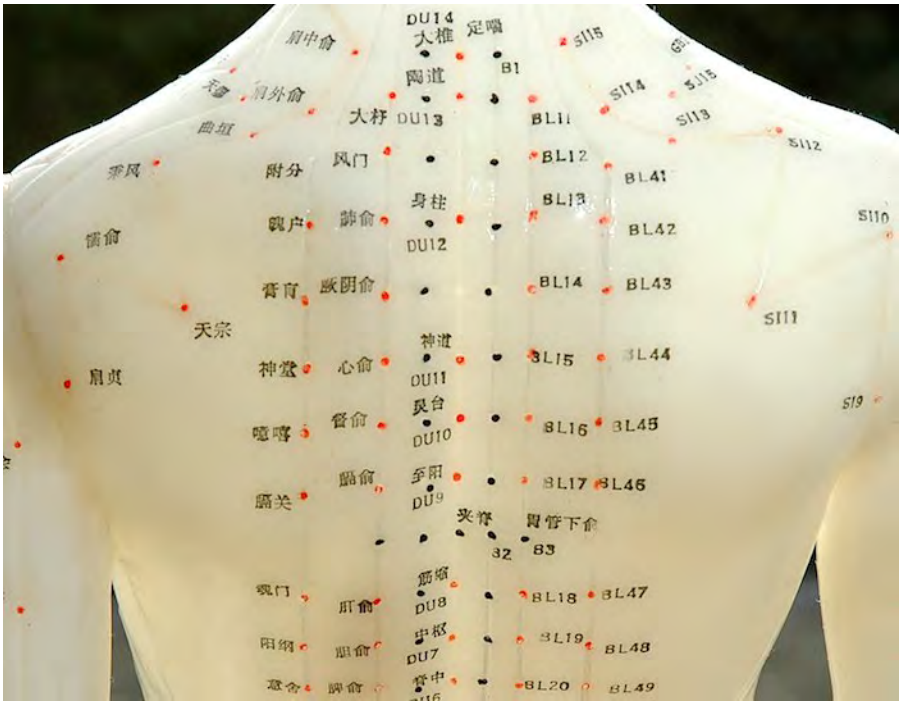
ST16 is located in the 3rd intercostal space, 4 cun lateral to the Ren meridian.

Not all acupuncture points are indicated for moxibustion and needling. ST17, located in the center of the nipple (mammilla) in the 4th intercostal space, is a forbidden point for both acupuncture and moxibustion. Piercing of this point for the application of jewelry is in common practice but may cause non-healing sores or cause permanent damage to the tissue.

ST18 is located below the nipple in the 5th intercostal space, 4 cun lateral to the Ren meridian.

Back Points: UB11 (BL11), UB12, UB13, UB14, UB15

Deep insertion at the following points may injure blood vessels and/or may cause pneumothorax. Use extreme caution and follow precise needling guidelines for licensed acupuncturists.



Common points of the back over the lungs and other organs

UB11 is located 1.5 cun lateral to T-1, at the level of the lower border of the spinous process of the 1st thoracic vertebra.

UB12 is located 1.5 cun lateral to T-2, at the level of the lower border of the spinous process of the 2nd thoracic vertebra.

UB13 is located 1.5 cun lateral to T-3, at the level of the lower border of the spinous process of the 3rd thoracic vertebra.

UB14 is located 1.5 cun lateral to T-4, at the level of the lower border of the spinous process of the 4th thoracic vertebra.

UB15 is located 1.5 cun lateral to T-5, at the level of the lower border of the spinous process of the 5th thoracic vertebra.

Back Points: UB41 (BL41), UB42, UB43, UB44, UB45

Deep insertion at the following points may cause pneumothorax. Use extreme caution and follow precise needling guidelines for licensed acupuncturists.

UB41 is located 3 cun lateral to the DU (GV) channel at the level of the lower border of the spinous process of the 2nd thoracic vertebra on the spinal border of the scapula.

UB42 is located 3 cun lateral to T-3 on the spinal border of the scapula.

UB43 is located 3 cun lateral to T-4 on the spinal border of the scapula.

UB44 is located 3 cun lateral to T-5 on the spinal border of the scapula.

UB45 is located 3 cun lateral to T-6 on the spinal border of the scapula.

Chest Points: KI23, KI24, KI25, KI26, KI27

Like the UB channel points in this region, these Kidney channel points are located over the lungs. Deep needle insertion will cause pneumothorax is and contraindicated.

K23 is located 2 cun lateral to Ren 17 in the 4th intercostal space.

K24 is located 2 cun lateral to Ren 18 in the 3rd intercostal space.

K25 is located 2 cun lateral to Ren 19 in the 2nd intercostal space.

K26 is located 2 cun lateral to Ren 20 in the 1st intercostal space.

K27 is located 2 cun lateral to Ren 21 in the depression on the lower border of the clavicle.

GB21

GB21is located directly above the nipple midway between GV14 and the acromion at the highest point of the shoulder, at the crest of the trapezium muscle. GB21 is an intersection (meeting) point of the Triple Burner, Stomach and Yang Linking channels. GB21 is indicated for the treatment of apoplexy and hemiplegia due to stroke, mastitis, difficult labor, breast pain, scrofula, stiff neck and cervicalgia. This point is contraindicated for use during pregnancy.

Texts vary on needling depths and angles of insertion. The text Chinese Acupuncture and Moxibustion (Foreign Language Press, Beijing) notes that this point is needled perpendicularly 0.3 to 0.5 inches. Note the shallow insertion recommendation. The text does not mention the pinching-grabbing needle technique to the skin and muscle often taught in acupuncture schools as a precautionary measure. Needling techniques are beyond the scope of this course and are generally taught in live seminars or interactive environments. However, a discussion of needling methods from an academic perspective is important given that there is a high risk of pneumothorax if this acupuncture point is needled perpendicularly or deeply.

The text Acupuncture, A Comprehensive Text (Eastland Press) notes that the needling method for GB21 is “Straight insertion, 0.5-1 unit. Sensation: dissension and soreness extending to shoulder region. CAUTION: Care should be taken not to insert needle too deeply, to avoid puncturing the lung.” GB21 is at the apex of the lungs. In some individuals, the apex is less than 1 cun under GB21 and a perpendicular insertion of 1 inch, cun or unit would cause pneumothorax. Therefore, the needle depth limit set in Chinese Acupuncture and Moxibustion is significantly safer and notably prohibits needling deeper than 0.5 inches.

A final comparison is taken from another respected acupuncture text, A Manual of Acupuncture (Deadman, Al-Khafaji, Baker; Journal of Chinese Medicine Publications). The needling method is described by the following: “Posterior oblique insertion, 0.5-1 cun. Caution: i. perpendicular insertion, especially in thin patients, carries a substantial risk of inducing a pneumothorax; ii. contraindicated in pregnancy.” Here, the posterior oblique insertion angle is a more

cautious approach than the perpendicular needling method suggested in Chinese Acupuncture and Moxibustion but the needling length is longer. Given the varying methods mentioned in each text, it is important to note that no one should attempt needling this point without having been trained in a professional acupuncture school or approved tutorial program. This point is extraordinarily common in clinical practice and requires caution.

Endnotes

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