

Anatomy for the Acupuncturist – Facts & Fiction

2: The Chest, Abdomen, and Back

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Summary

Anatomy knowledge, and the skill to apply it, is arguably the most important facet of safe and competent acupuncture practice. The authors believe that an acupuncturist should always know where the tip of their needle lies with respect to the relevant anatomy so that vital structures can be avoided and so that the intended target for stimulation can be reached. This article reviews clinically relevant anatomy for somatic needling of the chest and abdomen.

Keywords

Anatomy, acupuncture points.

Introduction

This is the second of a series of articles that highlight human anatomy issues of relevance to acupuncture practitioners. Whilst the framework of the articles is built around anatomical structures that should be avoided when needling, the aim is not to frighten practitioners, but rather to instil confidence in safe needling techniques.

Most textbooks of acupuncture use relative scales to determine the surface localisation of acupuncture points. However, the safest and probably the best way is the orientation on anatomical landmarks. Moreover, it is important to know what lies beneath the surface, i.e. which morphological structures could be the target of the needling, and, on the other hand, which structures should be avoided (e.g. vessels, nerves etc.).

Landmarks and important acupuncture points of the chest

The suprasternal (jugular) notch is a depression above the manubrium and between the sternoclavicular joints, which is clearly visible in most subjects, and can easily be palpated. CV22 (*Tian Tu*) is located in the middle of the suprasternal notch and is usually needled in a retrosternal direction. Due to interconnecting spaces in the connective tissue there is a risk of spreading infectious agents into the mediastinum if CV22 is needled too deeply.

The first rib usually cannot be palpated from the ventral side as it is covered by the clavicle – the best approach is from the supraclavicular region, between the posterior surface of the clavicle and the anterior border of the descending upper fibres of the trapezius muscle. The first palpable rib on the ventral surface is the second rib. It is located at the level of the sternal angle, which is formed by the junction of the manubrium and the body of the sternum. It serves as an orientation for the position of the second, and succeeding pairs of ribs and intercostal spaces. The upper seven pairs of ribs articulate directly with the sternum (true ribs), the next three pairs articulate with the cartilage of the seventh pair, and the lower two pairs usually have free floating ends.

In a coordinate system projected on the chest, the ribs represent the (almost) horizontal lines. However, there are some important vertical lines: the midline, in the middle of the sternum; the parasternal lines, on both lateral borders of the sternum; the midclavicular lines, which cut the clavicles approximately in two halves; and the anterior, middle and posterior axillary lines.

The sternum consists of three parts: the uppermost part is the manubrium; the main body of the sternum is also referred to as the corpus; and the xiphoid process is at the lower end. In 5% to 8% of the population a congenital abnormality occurs in the lower part of the corpus. This is

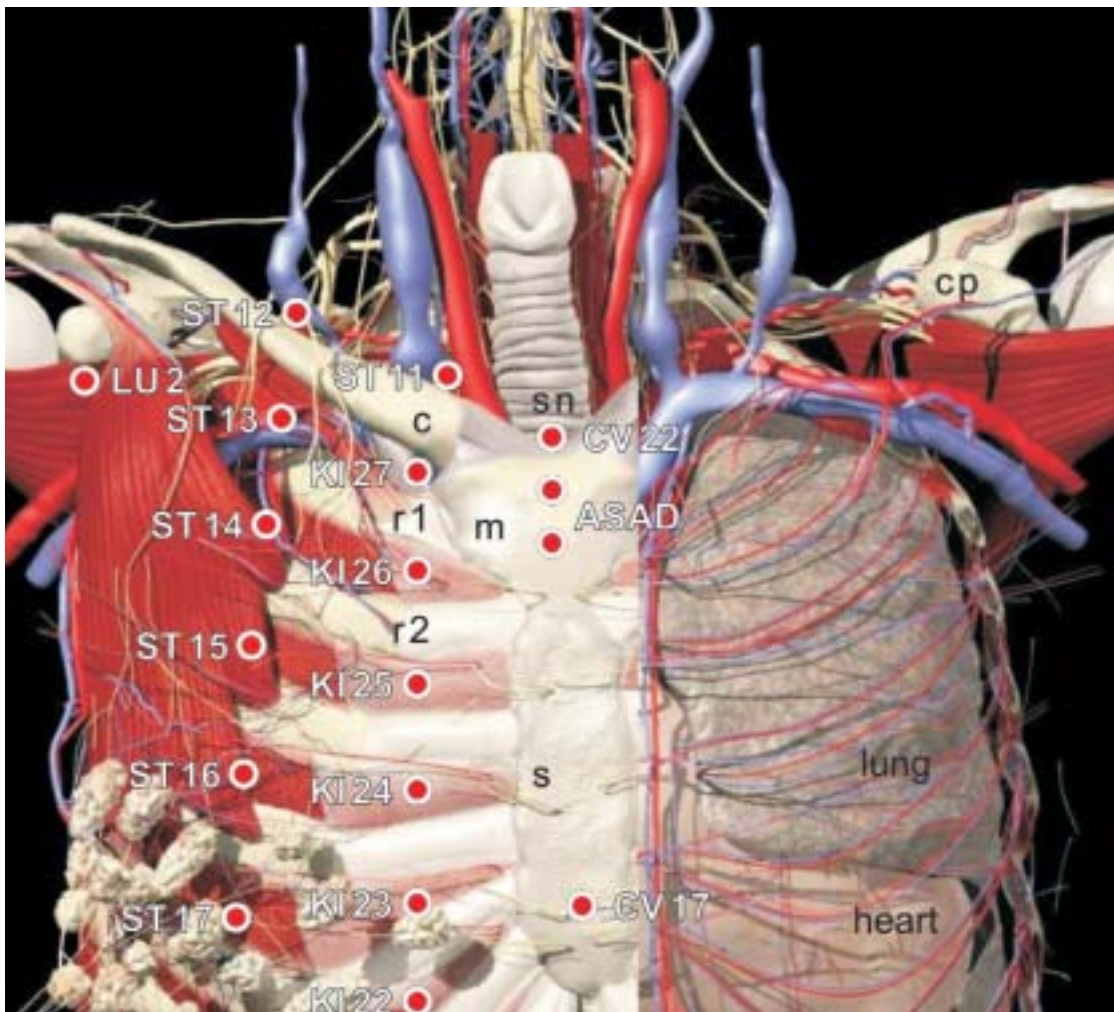


Figure 1 This is a split level view of the anterior aspect of the thorax showing a selection of acupuncture points. Key to labels: **cp**: coracoid process; **sn**: suprasternal notch; **c**: clavicle; **m**: manubrium; **r1**: first rib; **r2**: second rib; **s**: sternum; **zp**: ziphoid process. ASAD refers to two points over the manubrium that are safe to needle down to the periosteum. They were described by Jacqueline Filshie, and originally used to treat advanced cancer related dyspnoea. ASAD stands for anxiety, sickness and dyspnoea. Image courtesy of Primal Pictures Ltd. www.anatomy.tv

referred to as the sternal foramen, and results from incomplete fusion and ossification of the sternal plates. It is usually located at the level of the fourth intercostal space (i.e. precisely at the acupuncture point CV17, *Dan Zhong*). This common defect varies from incomplete formation of the sternal cortex to complete foramina, and very rarely to sternal clefts. It cannot be reliably detected by palpation because tendon fibers, thin connective tissue, or bone lamella, may conceal the foramen. In the scientific literature there are eight cases of injuries to the heart and the pericardium attributed to acupuncture.¹ Several of them were caused by lack of awareness of the sternal foramen. Needling of CV17 should be

performed obliquely at about 30 degrees to the sternum in a cephalic orientation.

The thoracic wall is built up by three layers of intercostal muscles: the external intercostal muscles; the internal intercostal muscles; and the innermost intercostal layer. The latter layer is made up of three parts: the transverse thoracis muscle in the anterior section; the intimal muscle layer in the lateral section; and the subcostalis muscles in the posterior region. The muscular layers of the thoracic wall are covered externally by a more or less distinct cutaneous and subcutaneous layer and internally by the parietal pleura. According to one of the author's (EP) own cadaveric studies, the thickness of the thoracic

wall varies between 2 and 4cm, depending on the individual's constitution.

The intercostal nerves and vessels run at the lower border of the ribs, between internal and the innermost muscle layer. The pleural projection onto the thoracic wall is as follows: starting about 2cm above the sternoclavicular joints the right pleura reaches the midline at the height of the sternal angle. It runs down to the xiphoid process and then along the costal margin to the 10th rib in the mid axillary line. It crosses the 12th rib in the paravertebral line. The border of the left pleura is quite similar with one exception: at the height of the 4th intercostal space it deviates from the midline due to the position of the heart. The most forgotten detail about pleural projections is the fact that pleura (and lung) can be found above the rib cage and the clavicle. In this context the acupuncture points ST11 and 12 should be mentioned. Pneumothorax, which is definitely the most frequently reported serious injury caused by acupuncture, is a potential risk when needling these points. Pneumothorax has mostly occurred when needles are placed in parasternal or supraclavicular points (for example, when treating lung conditions). However, acupuncture to the paravertebral, infraclavicular, and lateral thoracic regions, widely used to treat muscle pain, may also cause injuries to pleurae and lungs. Descriptions of more than 100 such incidents can be found in scientific publications; in two cases, the incidents resulted in death. Pneumothorax is a preventable and potentially serious adverse event; avoiding it requires a clear understanding of the actual position and borders of the pleurae and lungs, and the thickness of the soft tissue covering them.

In the supraclavicular region, needling of ST11 and 12 has caused injuries of the lung; in the infraclavicular region, LU2, ST13, and KI27 are potentially risky. Furthermore, the parasternal points on the kidney meridian (i.e. KI22-27) and the points of the stomach meridian in the midclavicular line (ST12-18) require particular caution.

From postmortem examinations, we have found that a puncture depth of 10 to 20 mm, either parasternal or in the region of the midclavicular line, can reach the lungs. It should also be noted that, depending on the thickness of the needle and



Figure 2 This is a view from the back of the sternum showing a sternal foramen (sf). Image courtesy of Elmar Peuker

the amount of tissue resistance, a variable degree of compression of the soft tissue takes place, so that the effective puncturing depth may be considerably greater than the length of the needle. In the region of the outer line of the bladder meridian (BL41 to 54), located approximately in the medial scapular line, the surface of the lungs is about 15 to 20 mm beneath the skin.

The safest needling technique concerning all points in the thoracic region is to needle onto the respective ribs. If patients are covered with a blanket after insertion of the needles, therapists should take care that the needles are not displaced in deeper layers by the weight of the blanket.

Needling GB21 can injure the pleura, in principal. The needle tip will not reach the pleural dome, but can approach the 2nd intercostal space, if the needle is stuck in strictly perpendicular. A safe technique for needling GB21 is to use a slightly dorsal angulation at a tangent to the upper ribcage. LU1 and 2 are generally safe points regarding pneumothorax, at least if needled in the right way – in a dorsolateral direction.

Landmarks and important acupuncture points of the abdomen

As in the thoracic region, a coordinate system might serve for orientation on the abdominal

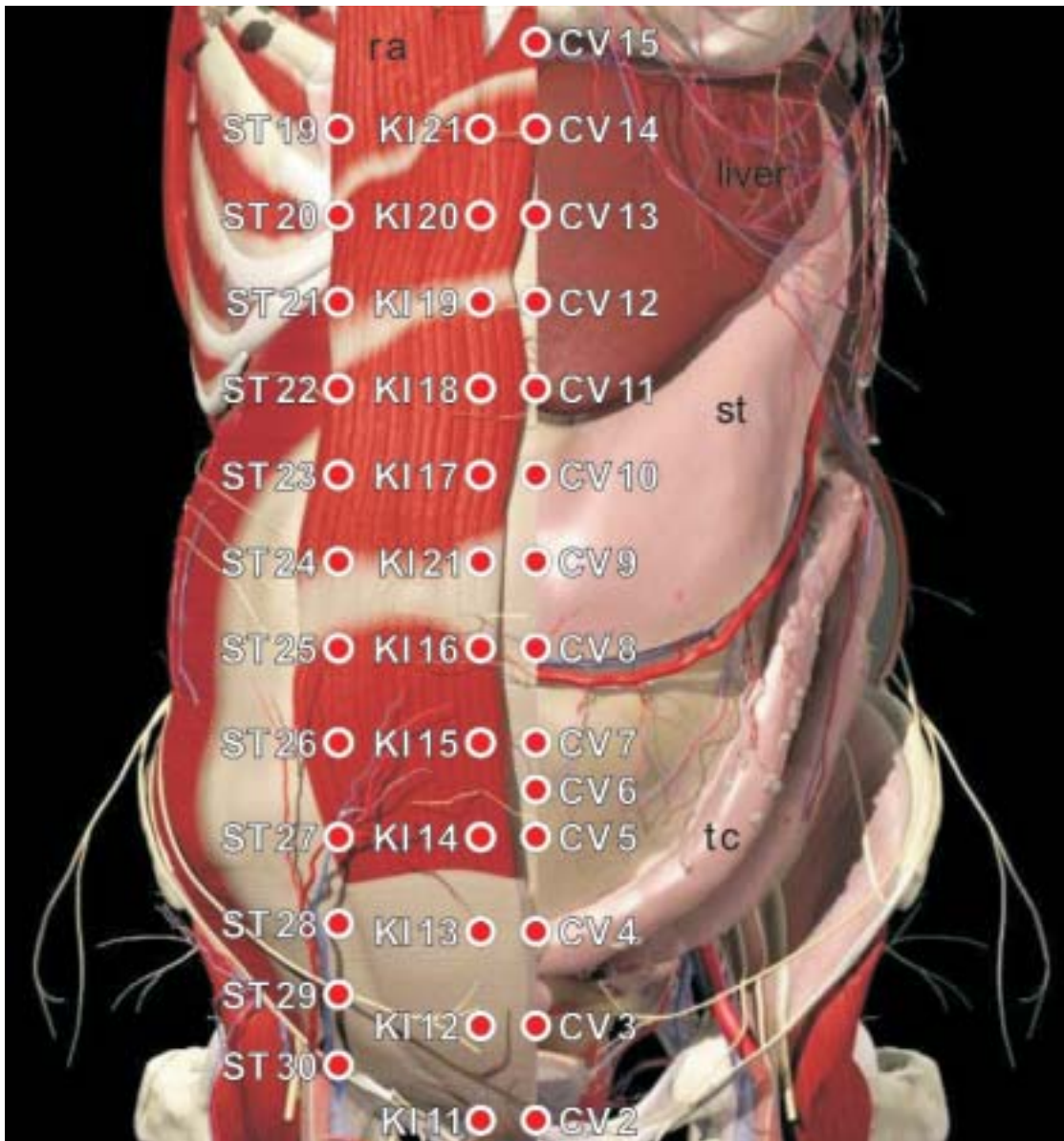


Figure 3 This is a split level view of the anterior aspect of the abdomen showing the relevant points on the stomach, kidney, and conception vessel meridians. Key to labels: *ra*: rectus abdominis; *st*: stomach; *tc*: transverse colon. Image courtesy of Primal Pictures Ltd. www.anatomy.tv

wall. A vertical and a horizontal line are drawn through the umbilicus. A subcostal plane connects the lowest points of the costal arches, a suprascostal plane is drawn parallel to the highest points of the iliac crest. The latter one represents the height of L4, the first one marks the level of the L2 vertebra.

Apart from cutaneous and subcutaneous tissues, the anterior abdominal wall consists of several muscular layers: the external oblique, the internal oblique and the transversus abdominis build the lateral part of the abdominal wall and enclose the rectus abdominis muscle with their

aponeurosis (rectus sheath).

The author's (EP) investigations showed that the thickness of the soft tissue in the anterolateral region of the abdominal wall in adults with normal weight lies between 2 and 4cm, depending on the individual constitution.

In the midline the conception vessel takes its course, with the points CV2-15 overlaying the abdominal region, over the linea alba. The kidney meridian runs almost parallel to the midline in its abdominal part. The points KI11-21 overlay the rectus abdominis muscle. The abdominal part of the stomach meridian lies a little bit more lateral

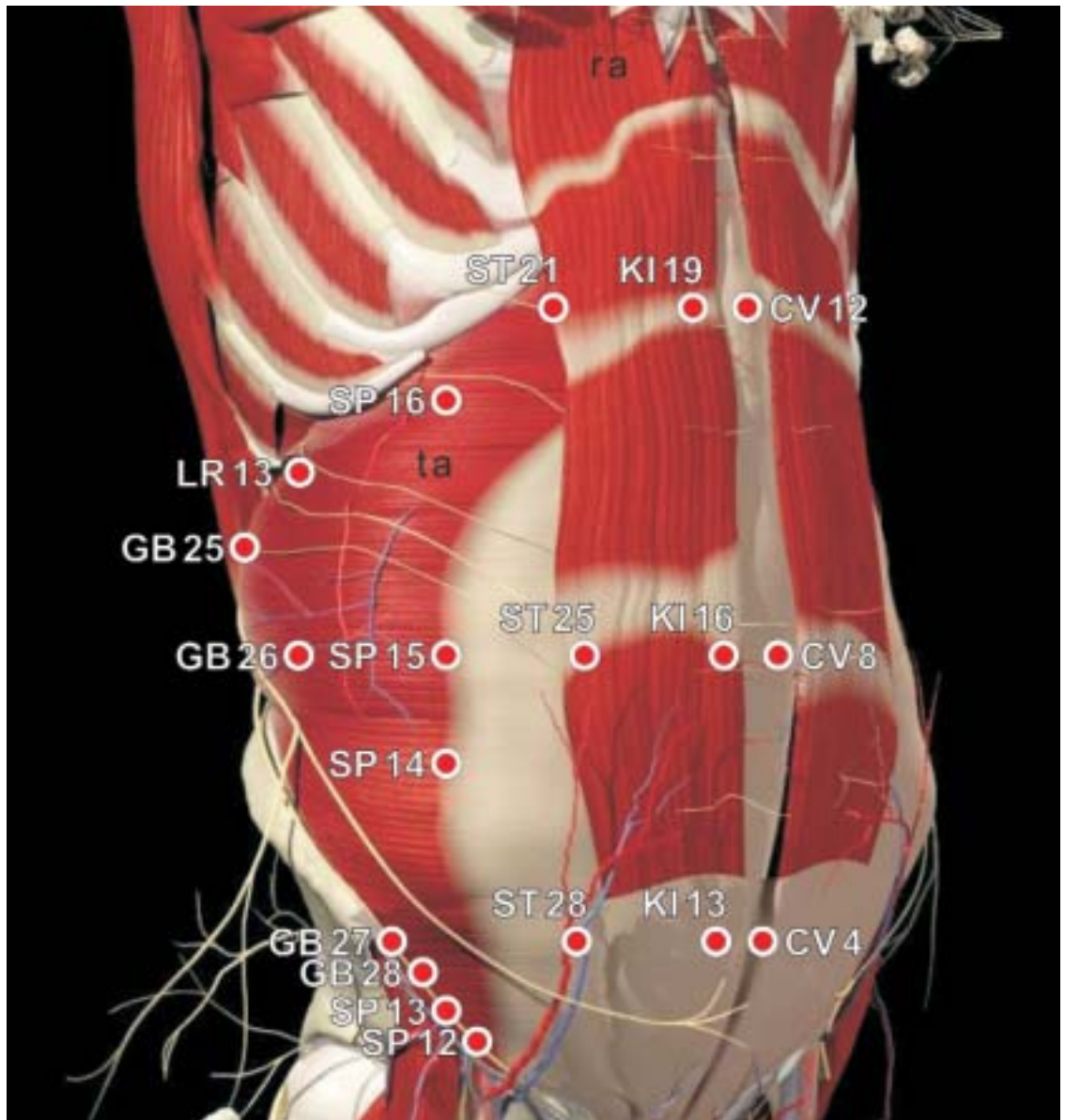


Figure 4 This is a right anteriolateral view of the abdomen showing the relevant points on the gallbladder, liver and spleen meridians. Some points from figure 3 are included for orientation. Key to labels: *ra*: rectus abdominis; *ta*: transversus abdominis. Image courtesy of Primal Pictures Ltd. www.anatomy.tv

than the kidney meridian. The points ST19-30 overlay the oblique and the transverse muscles of the abdomen (or the transition of their aponeurosis into the rectus sheath).

The gallbladder meridian is located at the lateral side. The points GB25-28 cover the abdominal region. The liver meridian only has one point on the abdominal wall (LV13 at the free end of the 11th rib), and there are five points of the spleen meridian (SP12-16).

In principle, the needling of points on the stomach, the spleen, the kidney, the liver, and the

conception meridians on the front and the bladder meridian on the back can lead to injuries of abdominal or retroperitoneal organs. However, lesions of abdominal viscera are rarely reported.

One paper reported the finding of a foreign body in the left kidney that turned out to be part of an acupuncture needle.² Occasional reports deal with lesions of the urinary bladder and the intestine. Perhaps therapists assume the abdominal regions are particularly vulnerable. Provided that a proper needling technique is performed there is little risk of reaching the abdominal cavity.

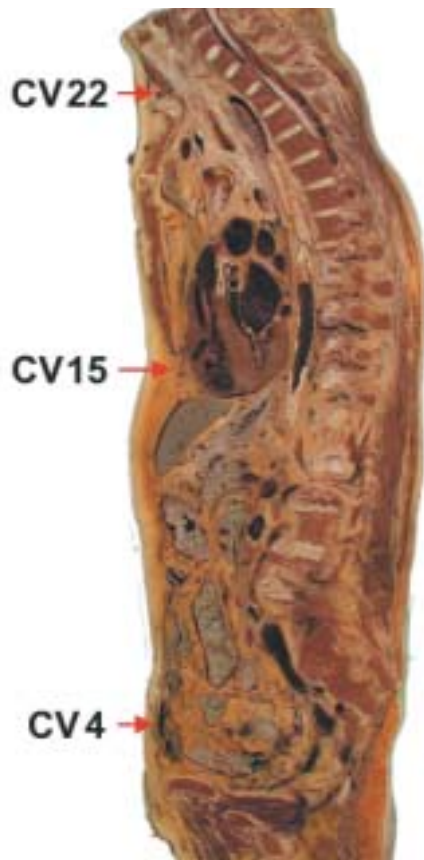


Figure 5 This is a median sagittal cadaveric section with the approximate positions of three midline acupuncture points marked on it. Image courtesy of Elmar Peuker

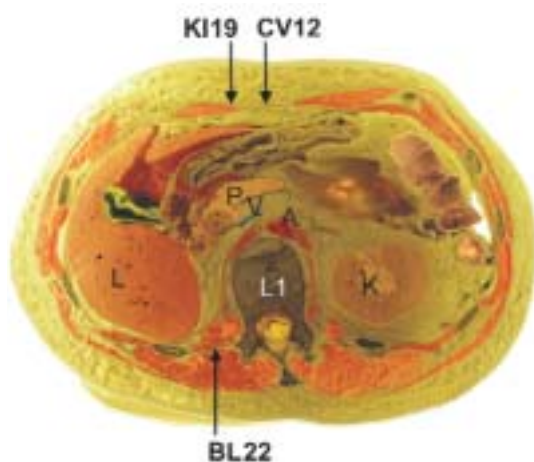


Figure 6 This is a transverse cadaveric section at the level of the body of L1 with the approximate positions of three acupuncture points marked on it. Key to labels: L: liver; P: pancreas; V: vena cava; A: aorta; K: kidney. Image courtesy of Elmar Peuker

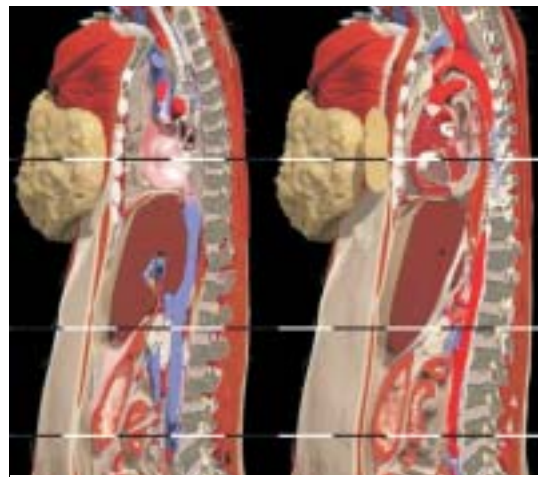


Figure 7 These are left anterolateral views of parasternal sagittal slices. The upper line illustrates the vertical level of CV17. The middle line illustrates the vertical level of CV12. The lower line illustrates the vertical level of CV8 (the level of the umbilicus). The bottom of the image is roughly the vertical level of CV4. Image courtesy of Primal Pictures Ltd. www.anatomy.tv

Landmarks and important acupuncture points of the back

In the midline of the back usually a median groove (median furrow) is visible which extends from the external occipital protuberance to the gluteal cleft. It is bordered by the erector spinae muscles. Moreover, the form of the back is determined by other muscles (although in some individuals the muscle relief is blurred by the subcutaneous tissue). The trapezius muscle originates from the external occipital protuberance and the spinous processes C2 to T12 and inserts lateral onto the scapula. The latissimus dorsi derives from the iliac crest and forms the lateral border of the back.

The spinous processes of C7 and T1 are visible in most individuals, at least when the head is flexed. The spinous process of T3 usually can be found at the same level as the root of the scapular spine. This structure is palpable in its whole extend and ends in the acromion. In most cases T4 is located at the extreme of the thoracic kyphosis and therefore its spinous process is the most prominent one below T1. The spinous process of T7 is usually located at the level of the inferior angle of the scapula (standing patient with his arms resting along the sides of the trunk). If the examination of the back is performed on the lying

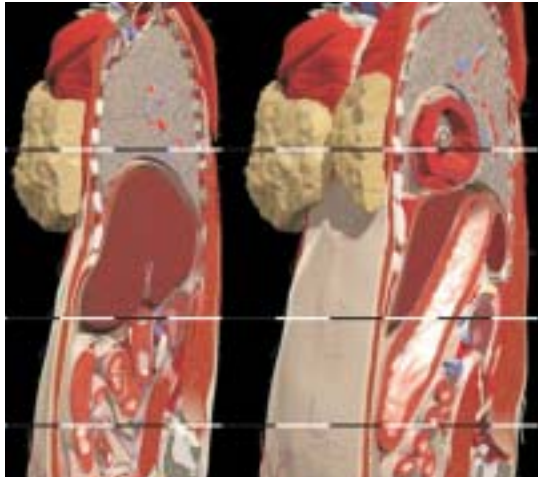


Figure 8 These are left anterolateral views of midclavicular sagittal slices. The upper line illustrates the vertical level of CV17. The middle line illustrates the vertical level of CV12. The lower line illustrates the vertical level of CV8 (the level of the umbilicus). The bottom of the image is roughly the vertical level of CV4. Image courtesy of Primal Pictures Ltd. www.anatomy.tv

patient (with his arms resting towards the floor), the rotation of the scapula causes a shift in the height of the inferior angle. In this position it is rather the spinous process of T6 which is located at the height of the angle. The spinous process of T12 usually lies approximately halfway between the inferior scapular angle and the height of the highest parts of the iliac crests (i.e. L4 in 80% of the population). In general, the vertebral bodies (and their transverse processes) are located variably superior to the tips of the respective spinous processes. The transverse processes of T1-4 and T10-12 are located about one spinous interspace superior to the tip of the spinous process of the same segment. In T5-9 the transverse processes are located about two spinous interspaces higher than the respective tips of the spinous processes.

The spinous processes of L4 and L5 are quite small and often difficult to palpate. Usually the tip of the spinous process of L4 is found at the level of the highest part of the iliac crests. However, in about 20% of subjects the spinous process of L5 is found in this level. Palpation of the iliac crest should be performed from a caudal direction. Palpation from a cranial direction might result in a

layer of soft tissue padding over the crests, and therefore lead to errors in finding the right level.

Six layers of back muscles cover the skeleton. The first layer consists of the trapezius and the latissimus dorsi muscles. The second layer includes the levator scapulae, the rhomboid major and minor muscles. Two small muscles form the third layer of back muscles: the serratus posterior superior and inferior. Most authors name these three layers as superficial back muscles. The deep muscles also form three layers. Layer 4, the first of the deep layers, is formed by the splenius capitis and cervicis muscles, which run from the spinous processes to the cervical transverse processes or the occiput. Layer 5: erector spinae or sacrospinalis muscle, consisting of the iliocostalis (lateral), the longissimus (intermediate), and the spinalis group of muscles (medial). Between the iliocostalis and the longissimus thoracis muscles the lateral branches of dorsal rami of the mixed spinal nerves exit.

TE15 is located at the superior angle of the scapula, where the levator scapula muscle inserts. It is an important trigger point of this muscle. Needling should be performed tangentially into the muscle and eventually down to the scapular bone.

The points of the inner branch of the bladder meridian BL11-28 are located 1.5cun from the midline, i.e. halfway between the midline and the medial border of the scapula. This location correlates to the exit of the lateral nerve branches of the dorsal rami. BL11-17 follow the numbering of the thoracic vertebrae, e.g. BL13 is 1.5cun lateral to the lower edge of the spinous process T3. Starting with BL18, one vertebra is added so that BL18 is level with the lower edge of the spinous process T9.

The bladder points are needled perpendicularly or in an oblique mediocaudal direction. The distance from the surface of the skin to the spinal cord or the roots of the spinal nerves ranges from 25 to 45mm, depending on the constitution of the patient.

The governing vessel is in the midline. The respective points GV3-14 are located below the spinous processes. Therefore, needling should be performed in an oblique caudal direction, because the spinous processes overlap like tiles on a roof. Deep needling upwards could cause lesions of the spinal cord.

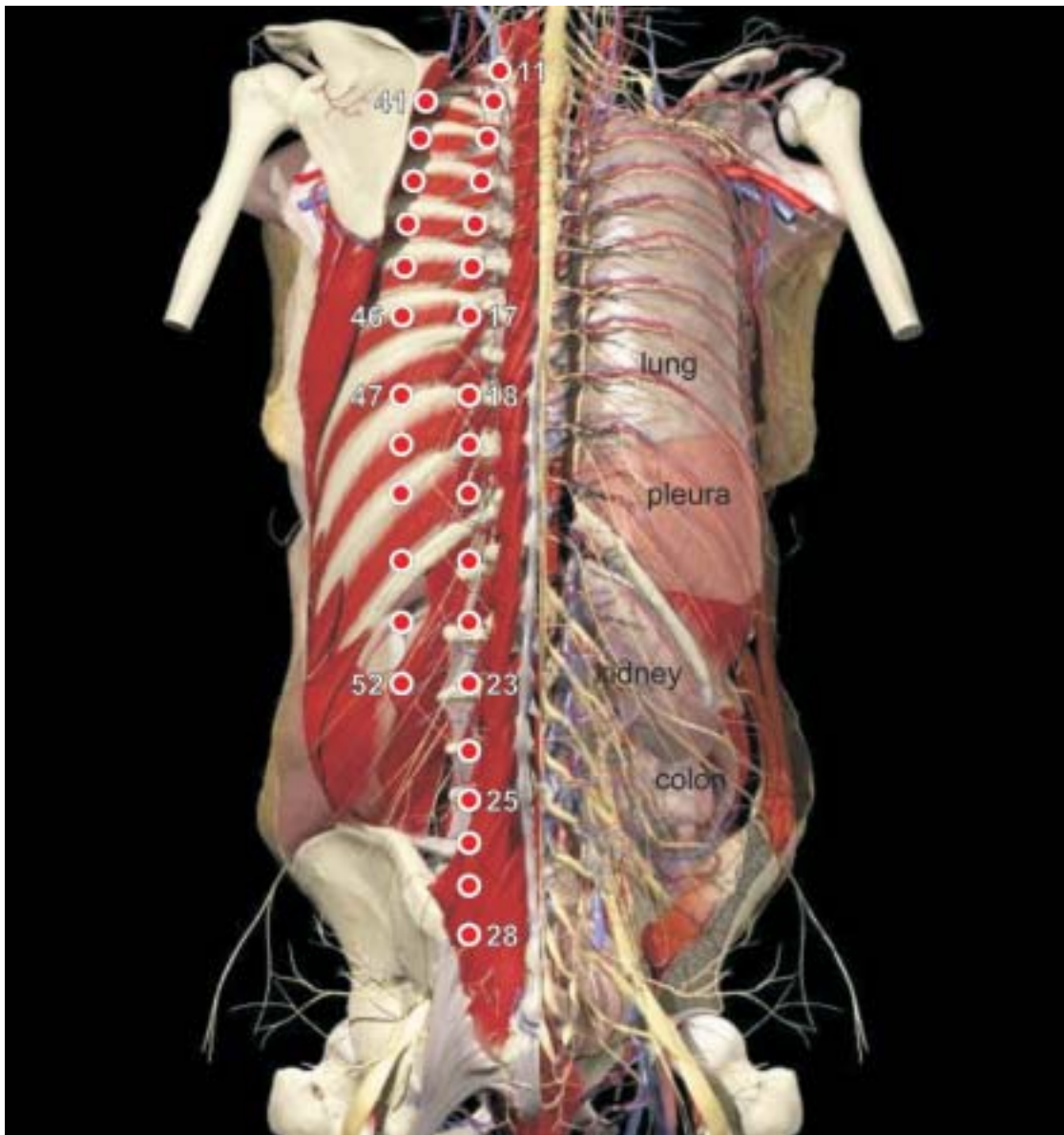


Figure 9 This is a split level view of the posterior aspect of the thorax and abdomen. The key visceral structures are labelled on the right, and the relevant bladder meridian points on the left. Image courtesy of Primal Pictures Ltd. www.anatomy.tv

Conclusion

The authors believe that an acupuncturist should always know where the tip of their needle lies with respect to the relevant anatomy so that vital structures can be avoided and so that the intended target for stimulation can be reached.

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