

Review

Anatomic Review of Ten Important Canine Acupuncture Points Located on the Head: Part I

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ABSTRACT

This paper reviews five commonly used acupuncture points located in and around the head and the relative anatomy associated with these points. Common anatomical structures are demonstrated with their relationship to needle placement in dogs and cats.

Key words: canine anatomy, acupuncture, traditional Chinese veterinary medicine

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ABBREVIATIONS

a	artery
m	muscle
mm	muscles
n	nerve
v	vein

Acupuncture points and their effect on the surrounding and distant environment in the dog and cat can seem mysterious. When the anatomy is examined, clues are revealed as to how acupuncture may elicit its effects. This article is designed to cover some very commonly used acupuncture points in and around the head and their anatomically-related structures beneath the skin. Some of the points are classical acupoints, while some are transpositional acupoints.

To begin a discussion of anatomy, it is important to understand acupoint nomenclature which is divided primarily into traditional and western nomenclature systems. In the traditional (classical) nomenclature, acupoints are named based on anatomic location (*Wei-jian*, “tail” “tip”), association with *Zang-fu* organs (“*Wei-shu*”, Stomach association point, “stomach-back”), therapeutic (“*Duan-xue*”, “stopping hemorrhage”) and symbolic (imaginative descriptive names to suggest location: “*Long-hui*”, “Dragon Meeting”). Western nomenclature

assigns a unique combination of letters and numbers that correspond to an acupoint location on 1 of the 14 meridians (example: LI-11, BL-23).

Acupoints are typically located in or near muscles, blood vessels, lymph vessels or nerves. Each acupoint has a unique location and physiological effect.¹ With this in mind, the anatomic location of five common canine acupuncture points located on the head will be presented with a discussion of the detailed anatomy associated with needle placement.

ACUPUNCTURE POINT CLINICAL ANATOMY

Governing Vessel 20

Governing Vessel 20 (GV-20, The Hundred Meetings), is the crossing point of the Governing Vessel and Bladder Channels. It is used as a sedation point, for *Shen* disturbances, epilepsy, sleep disorders and prolapse of the anus (Figures 1 and 2).¹

Anatomical Information^{2,3}

GV-20 is found in a depression on the dorsal midline of the head on a line drawn from the tips of the ears level with the center of the ear canals or a line drawn through the external auditory meatus when examining anatomic landmarks on the skull (Figure 3). This midline depression is where the interparietal bone connects the two parietal bones (Figure 4). The more rounded the head, the more difficult it is to feel this depression. The interparietal bone is part of the occipital complex of bones. It makes its appearance about the forty-fifth day of the canine gestation

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and can either fuse or remain a separate bone. It is from this interparietal bone that the external sagittal crest arises in mesocephalic and dolichocephalic breeds.

Sensory fibers surround this region of the dog's head as the muscles are more lateral. There is abundant connective tissue in this area. The sensory area is innervated by the greater occipital nerve [dorsal branch of cervical nerve 2 (C2)] (Figure 5). Mild mechanical or noxious stimuli at GV-20 travels from the local nerve (greater occipital and greater auricular) along the spinocervicothalamic pathway which is a four-neuron, fast conducting tract from spinal cord (C2) to sensory cortex. The first order neuron is

located in the spinal cord dorsal horn, then travels to the lateral horn of the cord (2nd neuron, lateral cervical nucleus). It continues to the medulla (3rd neuron, lateral cuneate nucleus) following the medial lemniscus to the midbrain and thalamic neurons (4th neuron, ventral caudal lateral nucleus) and then projects to the somesthetic area of the cerebral cortex (Figure 6).

The somesthetic area in the canine brain is described classically as being located in the parietal lobe of the cerebrum caudal to the cruciate sulcus (Figure 7). It overlaps with the motor cortex because it is localized in the caudal part of the postcruciate gyrus and the rostral



Figure 1: GV-20 is located midline on the dorsum of the skull on a line drawn from the tips of the ears level with the ear canals. It is used as a sedation point, for *Shen* disturbances, epilepsy and sleep disorders.

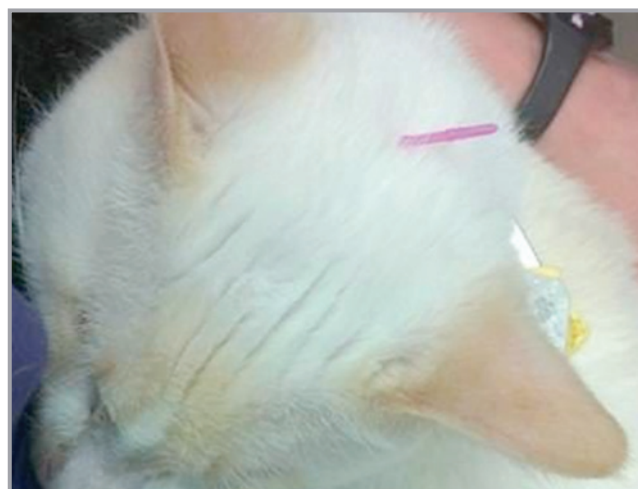


Figure 2: A feline patient demonstrating needle placement for GV-20.

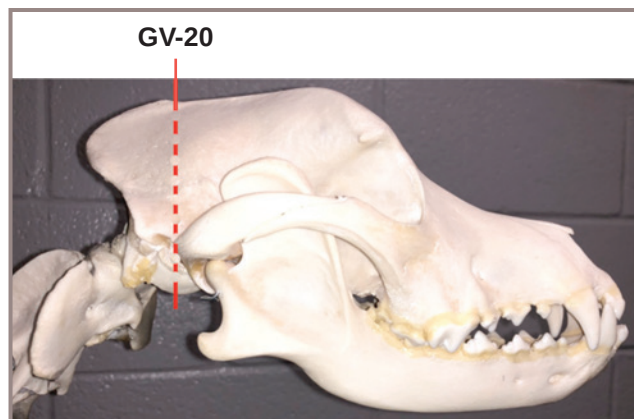


Figure 3: GV-20 anatomic landmark is a depression on the dorsal midline of the skull in line with the external auditory meatus.

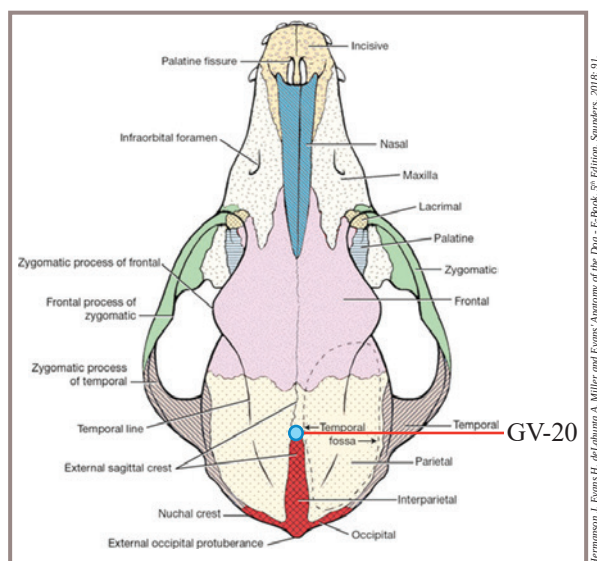
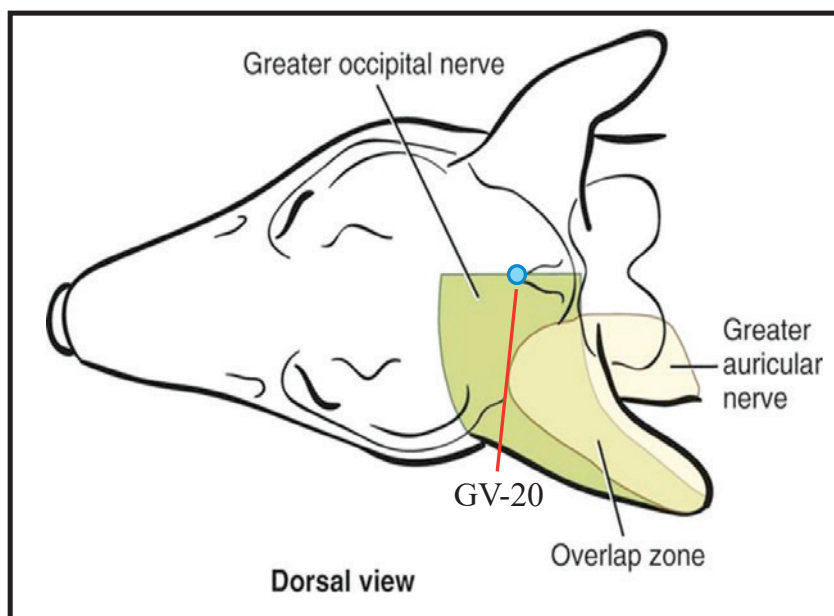
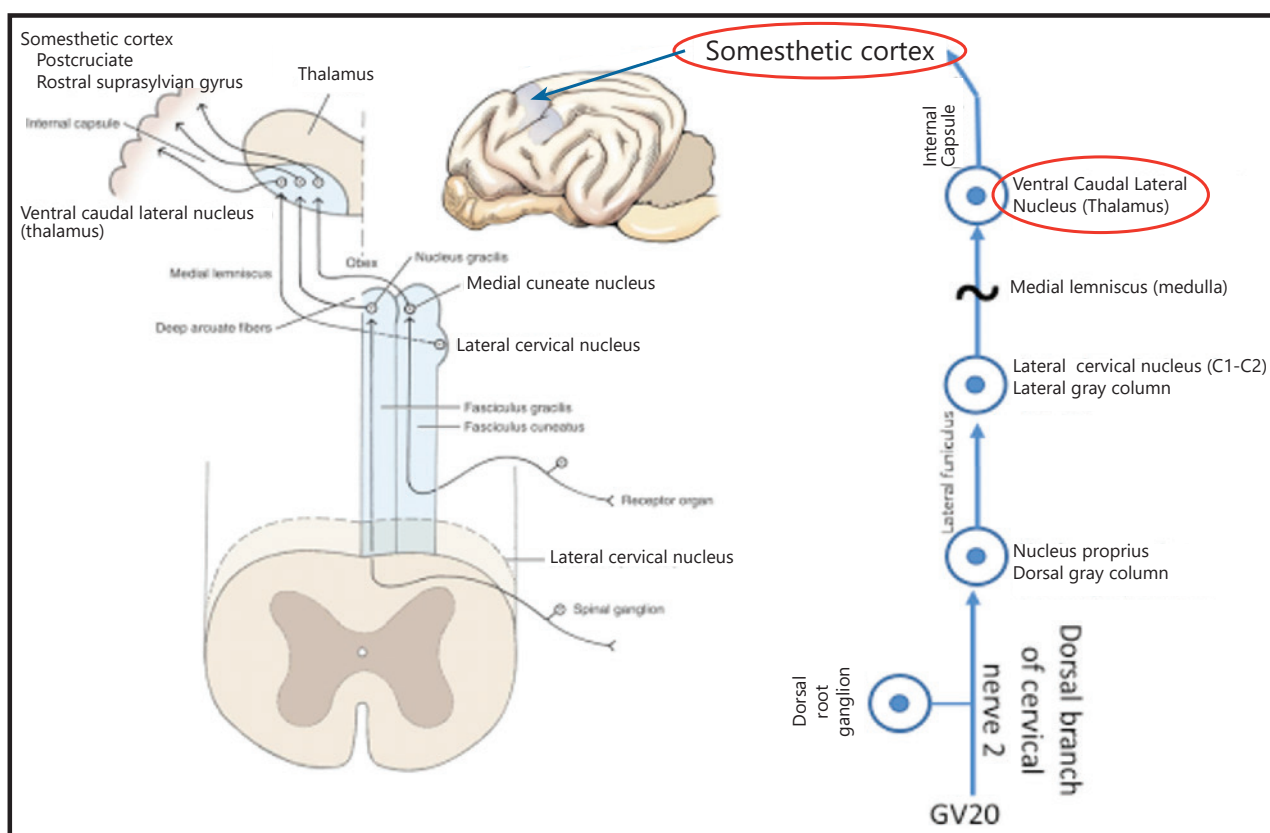


Figure 4: On the dorsal aspect of the skull, GV-20 is located where the interparietal bone meets the junction of the parietal bones.



Hermanson J, Evans H, deLahunta A. Miller and Evans' Anatomy of the Dog - E-Book, 5th Edition. Saunders, 2018: 91.

Figure 5: Schematic illustration of the cutaneous areas innervated by the dorsal (greater occipital) and ventral (greater auricular) cutaneous branches of cervical nerve 2. Note the extensive overlap zone of these nerves.



deLahunta Alexander, Eric Glass, Marc Kent, Veterinary Neuroanatomy and Clinical Neurology, 4th Edition. Saunders, 2014: 241

Figure 6: Spinocervicothalamic Pathway, (spinal nerve conscious pathway to the somesthetic cortex). GV-20 information from the second projection neuron decussates and travels through the medial lemniscus to the contralateral midbrain and thalamic neurons (the ventral caudal lateral nucleus) and then project to the somesthetic area of the cerebral cortex

suprasylvian gyrus and is somatotopically organized. In carnivores, the spinocervicothalamic pathway is an important pain pathway. The pathway is unusual because it has two spinal projection neurons (and four neurons involved instead of the typical three neurons for conscious pathways).

Comments

While the acupuncture needle is directed either in a cranial or caudal direction by various acupuncturists, the needle often can be popped out with over-zealous petting during a treatment. Most owners can find GV-20 on their own and with steady pressure/constant rubbing, find that the animal calms down often to a level of sleep (Figure 8).

Governing Vessel 26

Governing Vessel 26 (GV-26, *Shui-gou* or *Ren-zhong*) is the crossing point of the Governing Vessel, Large Intestine and Stomach Channels. GV-26 is used in emergencies

for shock and collapse as well as resuscitation during respiratory difficulties. It is also used for coma, mania, facial paralysis, cervical and thoracolumbar intervertebral disk disease. Needle insertion is perpendicular with a dry needle (or a 20-22 g syringe needle) to a depth of 0.3 cun.

Anatomical Information^{2,3}

This very commonly used point is found in the philtrum at the level of the ventral limits of the nares (Figure 9). Anatomically, at this midline junction of hair and ventral philtrum, there are not many remarkable anatomical structures. The right and left maxillary division of the trigeminal nerve merge at this area (Figure 10). Sensory information travels along the infraorbital nerve and then the maxillary nerve (Figure 11). The information is then transported to the trigeminal ganglion (the sensory ganglion for all three divisions of the trigeminal nerve) (Figure 12).

The sensory axons enter the brain and synapse on

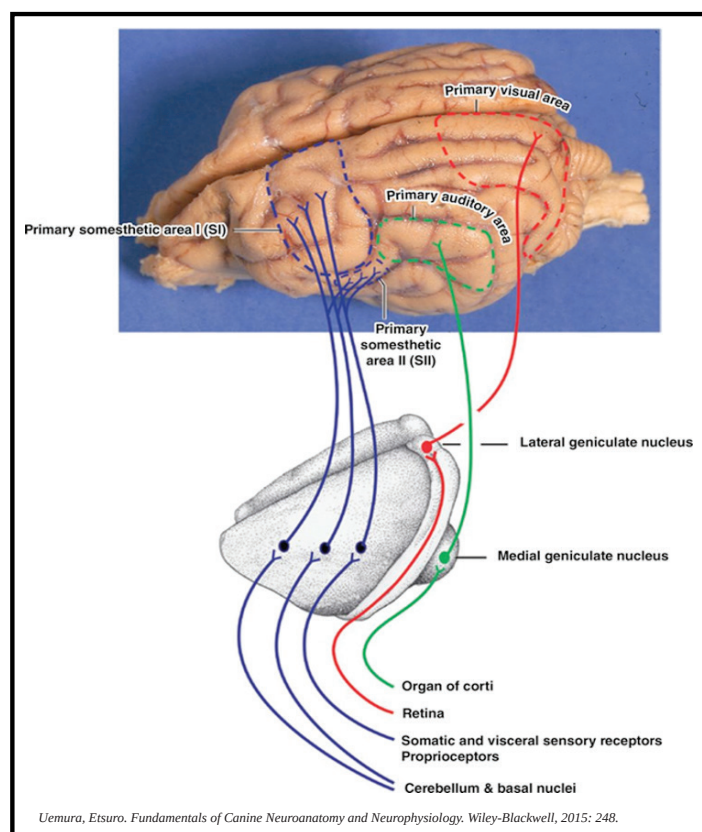


Figure 7: The somesthetic area in the canine brain is located in the parietal lobe of the cerebrum caudal to the cruciate sulcus. It overlaps with the motor cortex because it is localized in the caudal part of the postcruciate gyrus and the rostral suprasylvian gyrus. Thalamic nuclei project fibers to specific areas of the primary cerebral cortex. Each small part of the body has a point-to-point representation on the somatosensory area of the thalamus.



Figure 8: Finger manipulation at GV-20 has sedative effects in this cat after 30 seconds of rubbing.

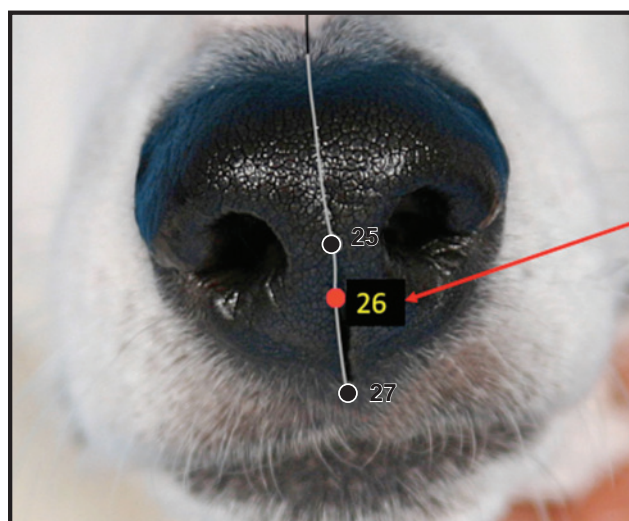


Figure 9: GV-26 is a very commonly used point found in the philtrum at the level of the ventral limits of the nares. It is used in emergencies for shock and collapse as well as resuscitation during respiratory difficulties.

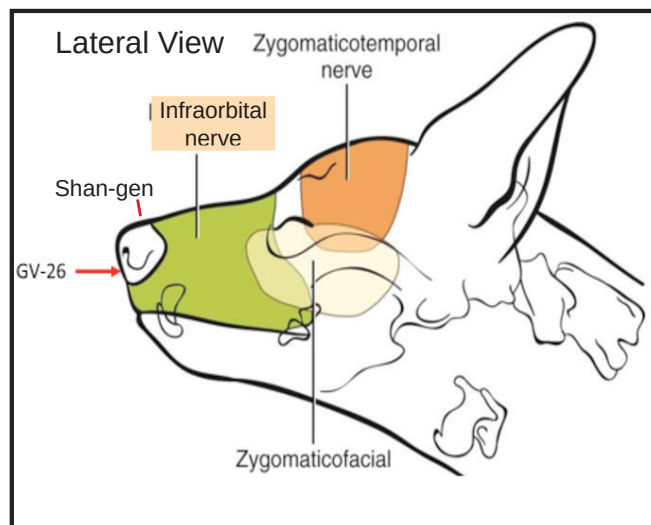


Figure 10: Cutaneous areas of the major sensory branches (infraorbital and zygomaticotemporal) of the maxillary division of the trigeminal nerve (cranial nerve V). The clear areas are zones of overlap between adjacent cutaneous areas.

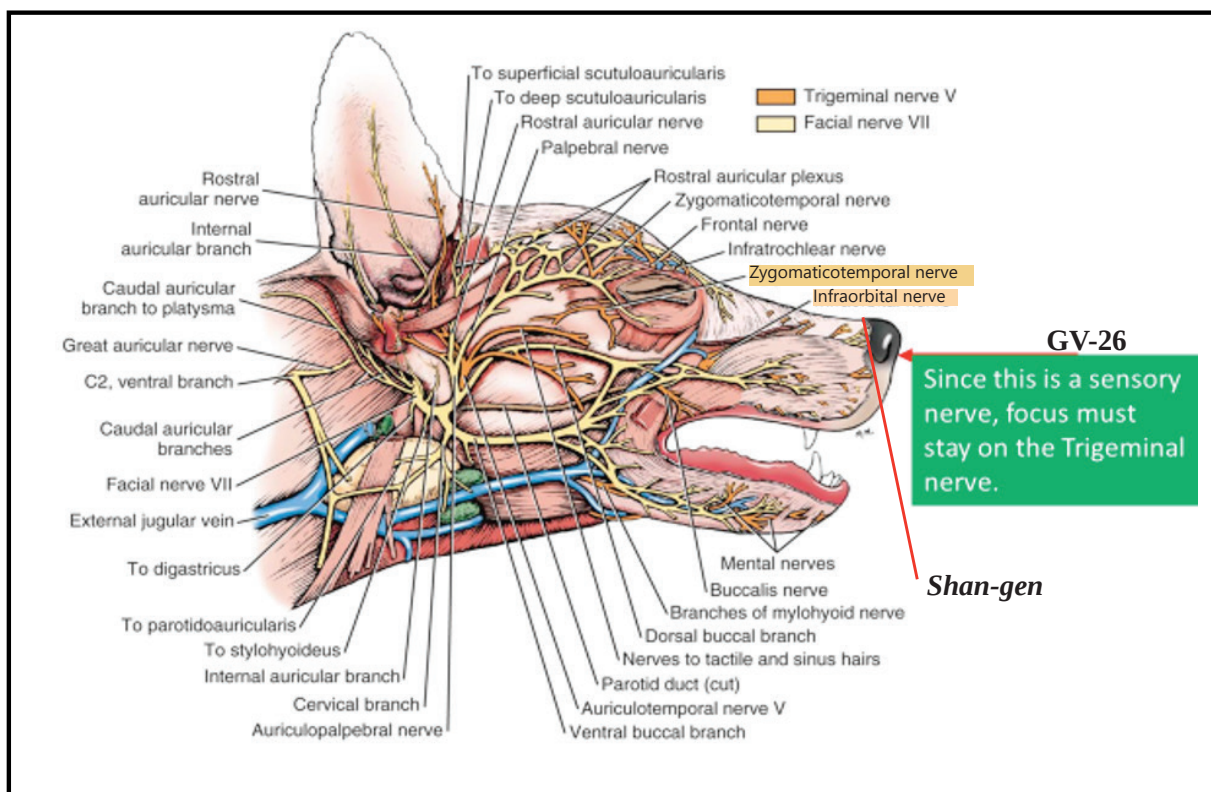


Figure 11: Anatomic location demonstrating trigeminal nerve innervation for GV-26 and Shan-gen acupoints.

the pontine sensory nucleus (located in pons). From this pontine nucleus, fibers travel in the trigeminal lemniscus (also known as the trigeminothalamic tract) to the thalamus (ventral caudal nuclei). From here it extends to the primary and secondary somesthetic areas of the cerebral cortex (Figures 13 and 14).

Some of the kinesthetic fibers have unipolar cell bodies in the midbrain (nucleus of the mesencephalic tract of V) instead of in the trigeminal ganglion. This is very unusual and allows rapid peripheral sensory input direct to the brainstem (instead of through a ganglion). If any of these fibers from the trigeminal lemniscus travel rostrally and connect into the mesencephalic reticular formation, axons are stimulated in the reticular alerting system in the ipsilateral cerebral cortex.

Axons also travel to intralaminar thalamic neurons via the central tegmental tract. The lateral hypothalamic nucleus which is located immediately medial and ventral to the thalamic nuclei has been implicated in cases of narcolepsy (Figure 15).

Comments

The role of the reticular formation is widespread with three diverse major zones of nuclei (lateral, medial and midline) and their interconnections play a key role

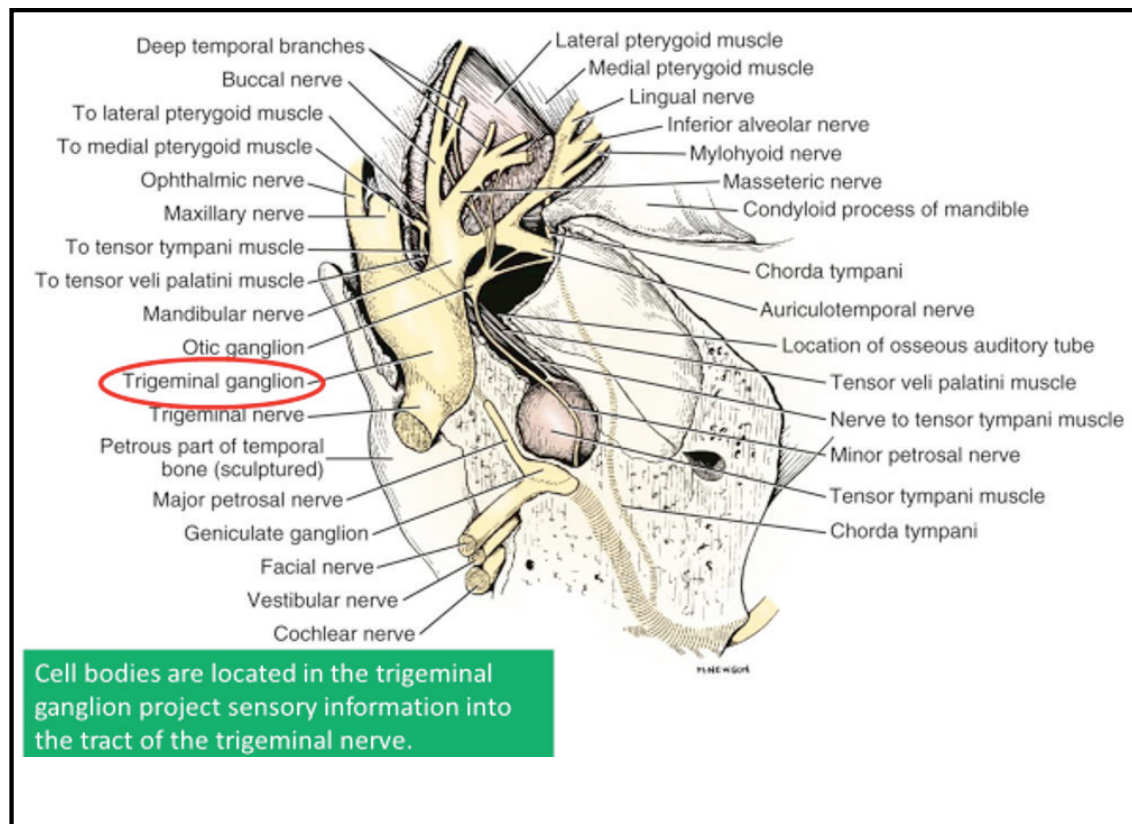
in consciousness, arousal. Midline nuclei can release serotonin to control mood and sensitivity to noxious stimuli. Lateral reticular nuclei are small and diverse. They project arousal signals to the forebrain while also projecting to the cerebellum.

Shan-gen

Shan-gen (Mountain Base), is also present on the midline but proximal to GV-26 at the other end of the planum nasale at the junction of the hair and non-haired margin (Figure 16). The point has been very successfully used for pets that need assistance with poor appetite, shock, coma, Wind-Cold (pale tongue, respiratory infection), Wind-Heat (red tongue, respiratory infection) and sinusitis. This acupoint is very successful as an appetite stimulant.

Anatomical Information^{2,3}

This acupuncture point follows the anatomical pattern of GV-26 (Figures 10-14). The lateral hypothalamic nucleus is the center for appetite stimulation with a suggested hypocretin-orexin neuropeptide secretion (Figure 17). Meanwhile, the adjacent ventromedial hypothalamic nucleus is the satiety center. Input to the lateral hypothalamic nucleus comes from the hippocampus



Hermanson, John W, Howard Evans, Alexander Lohman, Miller and Evans' Anatomy of the Dog - 5th Edition, Saunders, 2018: 819.

Figure 12: Sensory information from GV-26 and *Shan-gen* continues from the round foramen to the trigeminal ganglion (sensory ganglion for all three divisions of the trigeminal nerve)

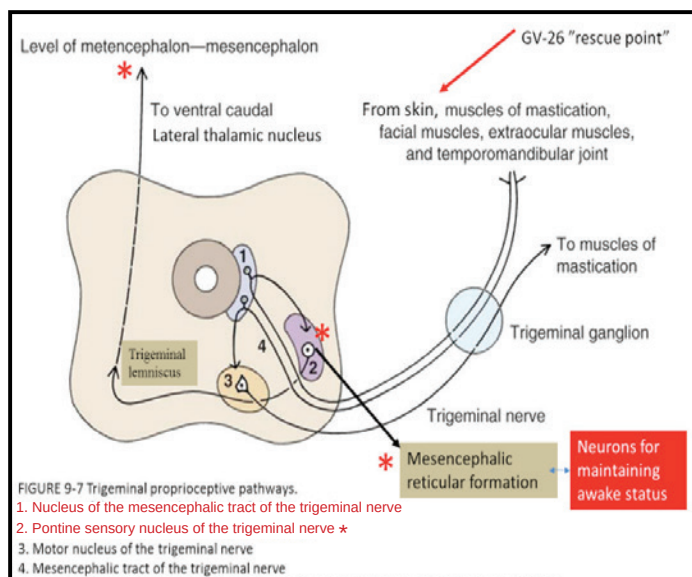


Figure 13: GV-26 and *Shan-gen* sensory pathway. The sensory axons synapse in the pons (pontine nucleus, trigeminal). Fibers then travel to the ventral caudal nucleus (thalamus) and finally to somesthetic cerebral cortex.

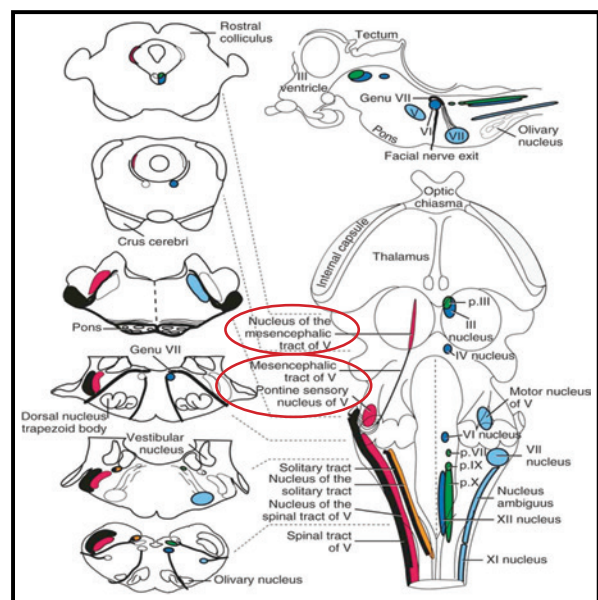


Figure 14: GV-26 and *Shan-gen*; mesencephalic nucleus of the trigeminal nerve (V). Notice that the nucleus is very rostral in the brain. This is significant with the interconnections that this sensory information can play with other areas more rostral, such as the hypothalamus or the reticular formation (consciousness/arousal/wakefulness).

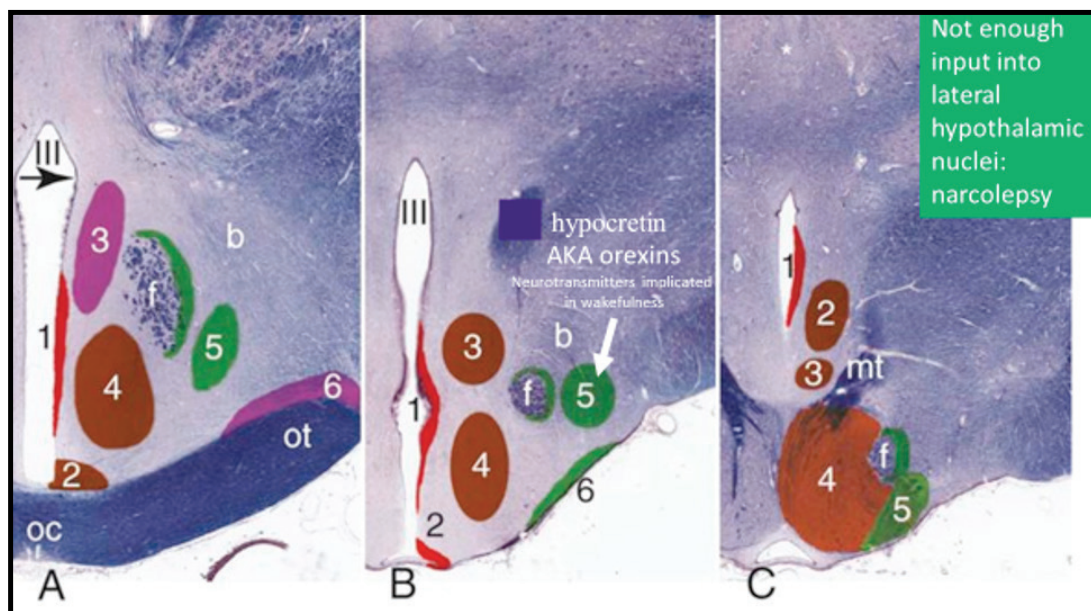


Figure 15: Approximate locations of the hypothalamic nuclei. The lateral hypothalamic nucleus (#5) which is located immediately medial and ventral to the thalamic nuclei has been implicated in cases of narcolepsy and lack of hypocretin (orexins), which is a hypothalamic neuropeptide measured in the CSF

and from the retina via the optic tract.

The ventral caudal thalamic nucleus receiving inputs from the trigeminothalamic tract are very close. Could neurons from this thalamic region project to the lateral hypothalamic nucleus? It certainly is within the realm of possibilities. Interestingly, outputs from the lateral hypothalamic nucleus are many, but the projections to the nucleus ambiguus and the dorsal vagal nucleus provide a more detailed completion of the activity of using *Shan-gen*. These projections contain cannabinoid receptor 1 and orexin receptor 1 (coded on chromosome 12) that are collocated to form the CB1-OR1 receptor heterodimer. The effect of this is stimulation of gastrointestinal motility and gastrointestinal function by increasing the activity of the vagus nerve (Figure 18).

Comments

It has been recommended by experienced veterinarians that the animal be approached from behind when placing a needle in this acupuncture point to allow optimal vertical placement of the needle.

Nao-shu

Nao-shu (Brain Association Point) is a classical point. This point is used for seizures and *Shen* disturbances. It is found over the temporalis muscle about a third of the way between the rostral and basal portion of the vertical ear canal to the lateral canthus of the eye (Figure 19). The needle is placed only 0.3 cun at a perpendicular angle to the skin.

Anatomical Information^{2,3}

The sensory supply to this region is supplied by

the zygomaticotemporal nerve (branch of maxillary n. from trigeminal) which has a wide distribution from the zygomatic arch to midline (Figure 20).

The pathway of the zygomaticotemporal nerve is a little different than the average sensory nerve. After collecting sensory input from the skin over the masseter muscle, the nerve travels medial to the zygomatic arch. Another branch has collected information near the zygomatic arch and curls rostrally and then medially over the arch to join with the other branch. These branches are deep within the periorbital and, after joining the zygomatic nerve, travels caudally to the rostral alar canal and then joins the maxillary nerve to finally meet the trigeminal (sensory) ganglion.

The temporalis muscle is the largest muscle of the head occupying the temporal fossa allowing the dog to raise the mandible and therefore close the mouth because of the connection of the temporalis m. to the coronoid process of the mandible (Figure 21). As the temporalis m. inserts on the coronoid process, fibers from other muscles of mastication blend into the insertion. Such blending gives the animal a very strong bite while only one muscle, the digastric, opens the mouth.

While the maxillary division of the trigeminal n. handles the sensory input from over the muscle, the motor input to this muscle of mastication is by the temporal nerve (mandibular division of trigeminal). It is also covered superficially by the caudal auricular muscles, scutiform cartilage and ear. There are connections to the orbital ligament and zygomatic arch, dorsal nuchal crest and external sagittal crest or temporal line medially. There is abundant fascia covering the muscle and extending deep into the muscular tissue.

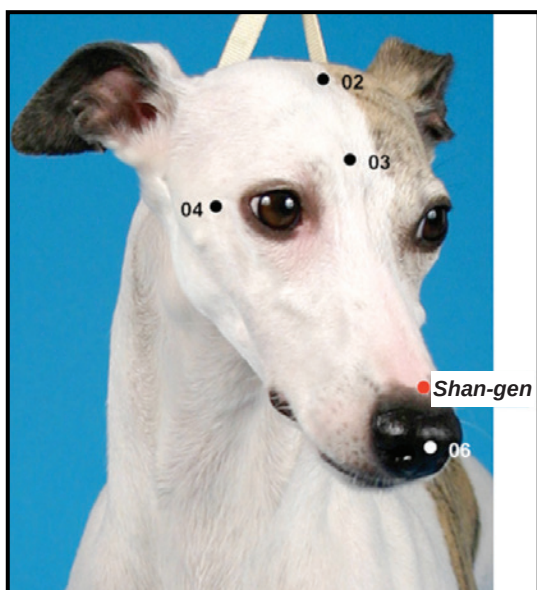


Figure 16: *Shan-gen* classical acupoint is present on the midline at the planum nasale at the junction of the hair and non-haired margin.

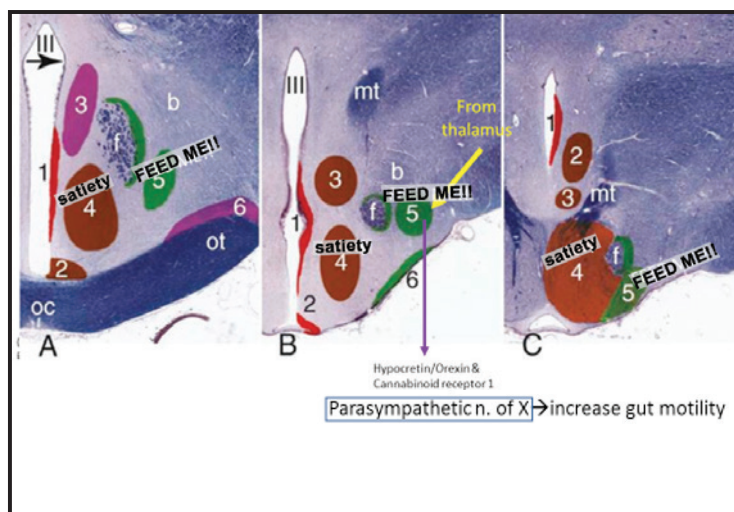


Figure 17: *Shan-gen* stimulation and approximate locations of hypothalamic nuclei; ventromedial nucleus (#4, satiety) and lateral hypothalamic nucleus (#5, hunger).

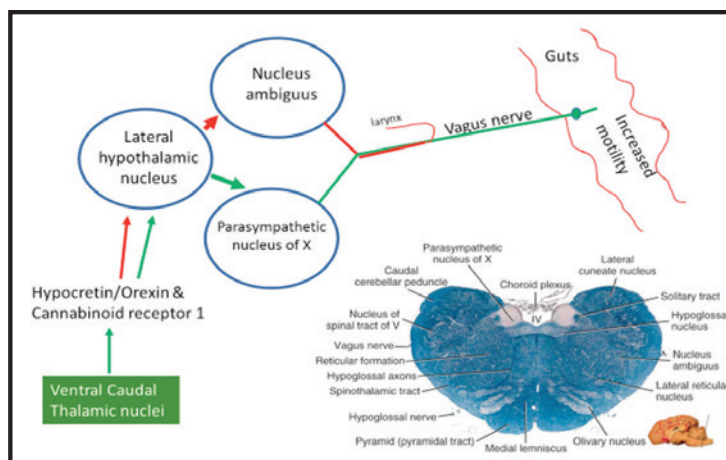


Figure 18: Shan-gen; outputs from the lateral hypothalamic nucleus are many, but the projections to the nucleus ambiguus and the dorsal vagal nucleus provide a more detailed explanation of the activity of using *Shan-gen*. The effect is stimulation of gastrointestinal motility and gastrointestinal function by increasing the activity of the vagus nerve.

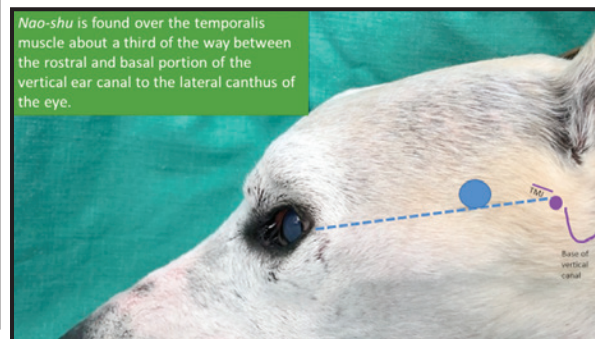


Figure 19: Nao-shu is a classical acupoint. It is used for seizures and *Shen* disturbances.

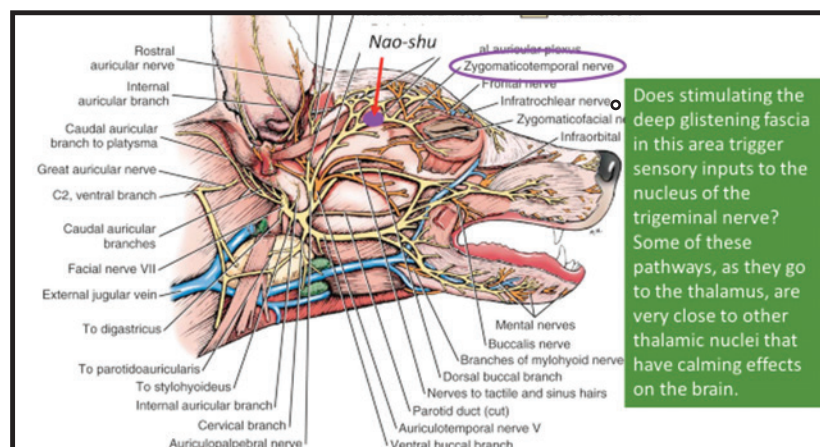


Figure 20: Nao-shu; the sensory supply to this region is supplied by the zygomaticotemporal nerve (branch of maxillary n. from trigeminal) which has a wide distribution from the zygomatic arch to midline.

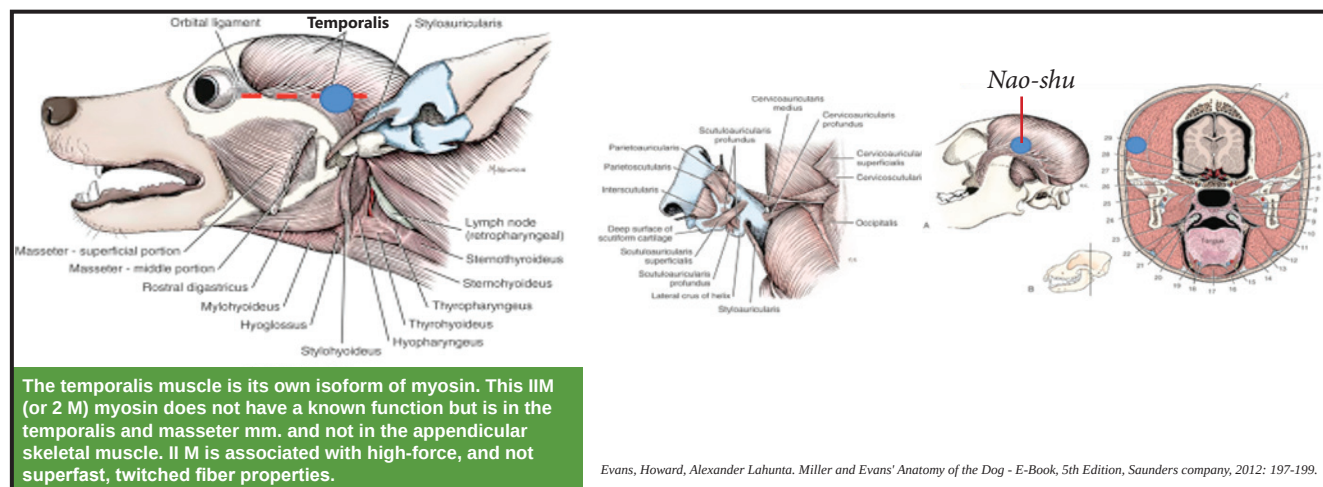


Figure 21: Location of Nao-shu in the temporalis muscle. The temporalis muscle is the largest muscle of the head occupying the temporal fossa.

Comments

Head shape plays an important role for amount of temporalism that is present at the mid-line. Dolichocephalic breeds have a temporalis that meets on midline and forms a mid-dorsal depression. Brachycephalic breeds usually have a temporalis that don't meet on mid-line. This area is often covered only with the auricular muscles. A unique feature of the temporalis muscle is its isoform of myosin. This II M myosin (or 2M) does not have a known function but is in the temporalis and masseter mm. and not in the appendicular skeletal muscle. This myosin is associated with high-force, and not superfast, twitch fiber properties. Does stimulating the deep glistening fascia in this area trigger sensory inputs to the nucleus of the trigeminal nerve? Some of these pathways as they go to the thalamus are very close to other thalamic nuclei that have calming effects on the brain (Figure 21). Obviously more research is needed.

An-shen

An-shen (Pacify *Shen*), is a commonly used classical acupuncture point. The acupoint is used to calm *Shen*, External Wind, and Internal Wind. It is useful for stiff necks, headaches, nose bleeds, nasal congestion, facial paralysis, otitis, and deafness. The point is located midway between the dorsal and ventral borders of the ear base in the large depression that is half-way between GB-20 (near occipital protuberance) and TH-17 (at the base of the ear cartilage) (Figure 22). Aqua-acupuncture of this point with deposition of 0.2-2 mL of vitamin B-12 is a common

method of providing sedation using this acupuncture point (Figure 23).

Anatomical Information^{2,3}

Anatomically, *An-shen* makes it easy to understand the “whys” to use this point. The first cervical nerve exits the lateral vertebral foramen of cervical vertebra 1 and quickly divides into dorsal and ventral branches. This nerve tends to stay “hidden” in the muscles. However, the second cervical nerve exits between cervical vertebrae 1 and 2, and the ventral branch receives sensory input from the concave and lateral surface of the ear to the apex of the ear. The motor divisions of this nerve are providing innervation to the epaxial and hypaxial muscles associated with this area. These muscles are connecting to a multitude of locations in and around the temporal and occipital bones.

Interestingly, four cranial nerves of interest are in this area. The facial nerve (VII) is exiting the stylomastoid foramen very near the injection or dry needle placement at this acupoint (Figure 24). The accessory nerve (XI) exits the jugular foramen splitting into dorsal and ventral branches and distributes to many extrinsic muscles of the thoracic limb (trapezius, rhomboideus, sternocleidomastoid mm. to name a few). The glossopharyngeal (IX) and vagus (X) nerves also exit at the area between the jugular foramen and tympanooccipital fissure and will join the vagosympathetic nerve trunk as it begins its long, wandering pathway to the muscles of the larynx, the heart, lungs and intestines up to the transverse colon.



Figure 22: *An-shen* is a classical acupuncture point used to calm *Shen*, External Wind, and Internal Wind. It is located midway between the dorsal and ventral borders of the ear base in a large depression that is half-way between GB-20 and TH-17. (Ear is being pulled out from body for better visualization of acupoint)



Figure 23: *An-shen*; aqua-acupuncture of this point with vitamin B-12 is a common method of providing sedation using this acupuncture point.

The afferent unipolar cell bodies (essentially the “dorsal root ganglion” of the vagus nerve) is the distal ganglion of X collecting afferent information from the viscera. It is just caudal to the cranial cervical ganglion. This ganglion is the most proximal sympathetic ganglion and is the site of synapses from axons projecting from the lateral horn within at least the first thoracic segments of the spinal cord. (Reports vary but include cell bodies from cervical segment 8 through thoracic segments 7.) Projections from the cranial cervical ganglion are numerous. There are interconnects with cranial nerves VII, IX, X, XI and XII. Many of the axons leaving the ganglion create plexi associated with the external and internal carotid arteries as well as other arteries and carry sympathetic information into the head.

Comments

The anatomical complexity at the point of *An-shen*, makes the use of *An-shen* clearer. The relief of muscle contraction with stiff necks is probably due to the association of cranial nerve XI, (accessory n) as it exits the jugular fissure and innervates most of the neck and shoulder muscles. Inputs from IX (glossopharyngeal n), X (vagus n), XI travel to the solitary tract and then to the nucleus of the solitary tract. If within this area, excitement of these nerves, in fact, do stimulate input into the brain,

other uses for *An-shen* may be determined.

In humans, for example, the solitary nucleus receives inputs that mediate the gag reflex, the carotid sinus reflex, the aortic reflex, chemoreceptor reflexes, several respiratory reflexes and reflexes within the gastrointestinal system (motility and secretion). Neurons from the gut wall, stretch of the lungs and dryness of the mucous membranes have their first stop within the solitary nucleus and participate in a simple reflex arc.

From the solitary nucleus, axons travel to the reticular formation, parasympathetic preganglionic neurons, hypothalamus, thalamus and amygdala to regulate pain, fear and defensive behaviors, blood pressure, heart rate, and stress hormone release. The solitary nucleus, therefore, coordinates a vast number of connections to smooth out an animal's response to a wide variety of behavioral responses.

SUMMARY

It is hoped that continued anatomical evaluation of the nerves and fascia and their role in the relief of pain and other clinical signs associated with acupuncture will help practitioners choose points with purpose and thought. More research is certainly needed to continue to make connections between the needle and the actual sites in the brain being stimulated.

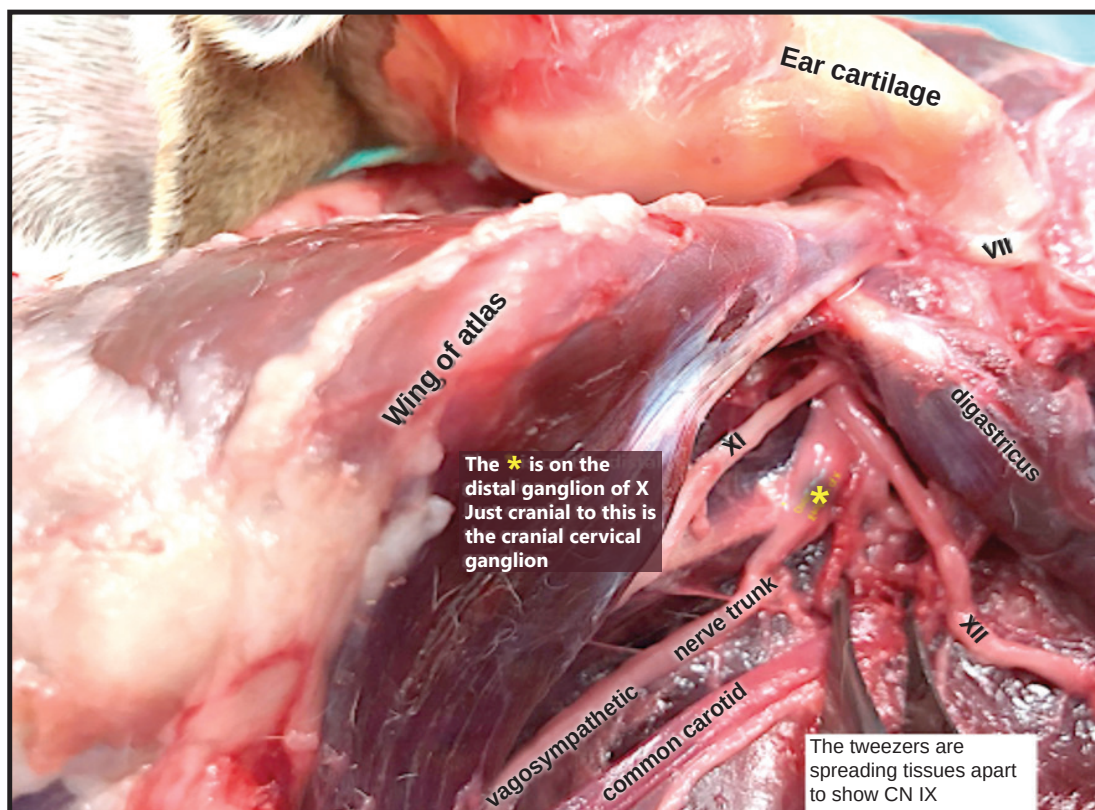


Figure 24: *An-shen* acupoint is located near cranial nerves VII, X, XI, XII and is a busy anatomic site. What does needle stimulation of this area mean? Vagus (X) to the gut; Sympathetic: to the head; Distal ganglion of X: sensory from gut; Glossopharyngeal (IX): carotid sinus/pressures.

Declaration of Interest

The author declares that there is no conflict of interest that could be perceived as prejudicing the impartiality of this paper.

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