CHAPTER 10

Brainstem Tracts

10.1 CORTICOPONTINE FIBERS

Corticopontine fibers are fibers which arise from all areas of the cerebral cortex, i.e. frontal, parietal, temporal and occipital lobes. However, the largest of these fibers arise from the frontal lobe. The purpose of the corticopontine fibers is a line of communication with the opposite cerebellum to allow for the coordination of planned motor functions, as it terminates in the deeper pontine nuclei.

The corticopontine fibers pass initially from the cerebral cortex (frontal lobe primarily) to terminate in the pontine nuclei. From here, they then project through the middle cerebellar peduncle to the opposite cerebellum via the pontocerebellar fibers. This pathway from cerebral cortex to pons to cerebellum is crucial in influencing the cerebellar function and integrity.

10.2 CLINICAL ASSESSMENT

Assessment of the function of the cerebellum is described as follows.

(1) Always introduce yourself to the patient (in any clinical examination or history taking) and state your position
(2) *Assess gait*. Ask the patient to walk from one side of the room (or examining area) to the other. If they normally use an aid to walking, they should be allowed to do so.
(3) *Heel to toe*. The patient should be asked to walk forward by placing one heel in front of the toes then switching to the opposite side and to keep walking in this fashion for a short distance
(4) *Romberg's test*. Further details are also found in Chapter 8.

    (a) Ask the patient to stand up with their feet together, arms by their side and eyes open.
    (b) Then, ask the patient to close their eyes for approximately 20–30 s.

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(c) The patient may exhibit mild swaying which is normal.
(d) It is possible to repeat the test two times to help assessment. If the patient loses their balance, it is said that they have a positive Romberg's test, or Romberg's sign.

(5) Check for a *resting tremor* by having the patient place their arms and hands out straight.
(6) *Assess muscle tone and power* as discussed in detail in Chapter 8.
(7) *Check for dysdiadochokinesis*. Ask the patient to touch one dorsal surface of the hand with the palmar surface of the opposite hand. The opposite hand should then rotate to the dorsal surface of the opposite hand. This alternating palmar/dorsal surface onto the opposite hand should be repeatedly as rapidly as possible for the patient. Dysdiadochokinesis is the inability to undertake this rapid movement.
(8) *Finger to nose*. The patient should touch their nose then the examiners finger which is held in space. The examiner should move their examining finger and the patient should repeat the movement of touching their nose and the moving examiners finger.
(9) *Heel to shin test*. The patient should be asked to place the heel of one foot at the knee of the opposite leg. Then roll the heel down the front of the shin and back up. This should be repeated several times. Repeat this on the opposite side several times too.

10.3 NUCLEI OF CRANIAL NERVES

The trigeminal, facial, vestibulocochlear, glossopharyngeal, vagus and accessory nerves all originate at the level of the brainstem. These nerves carry a variety of types of fibers within them and each will be discussed below.

10.3.1 Trigeminal Nerve

The trigeminal nerve arises from the lateral aspect of the pons comprised of a large sensory root and a smaller motor root. The trigeminal nerve has three components – ophthalmic, maxillary and mandibular. It contains two types of fibers in it – those for muscles of mastication (branchial motor) and sensory to the face (general sensory). The branchial motor component supplies the temporalis, masseter and the lateral and medial pterygoid muscles. The sensory supply from the face comes

Table 10.1. Details of the Nuclei of the Trigeminal Nerve Including Its Input, Output and Related Functions of Those Nuclei

Trigeminal Nerve			
Nucleus	**Input**	**Output**	**Function**
Motor	Ipsilateral and contralateral primary motor cortices Sensory nucleus of trigeminal nerve	Muscles of mastication Tensor tympani Tensor veli palatini Mylohyoid Anterior belly of digastric	Motor information
Chief sensory	Primary afferent fibers	Ventral posteromedial nucleus of thalamus	Pain, temperature and light touch from head
Spinal tract and nucleus	Aδ and C fibers	Ventral posteromedial nucleus of thalamus	Pain and temperature
Mesencephalic	Muscle spindles Periodontal ligaments Temporomandibular joint	Reticular formation Cerebellum Motor nucleus	Non-conscious proprioception of the face (lower jaw) Jaw jerk reflex

from its three major branches – the ophthalmic, maxillary and mandibular divisions. A summary of the functions of the trigeminal nerve has been previously described in Chapter 1.

The trigeminal nerve has four related nuclei which are described in Table 10.1.

10.4 CLINICAL ASSESSMENT

Two aspects of the trigeminal nerve should be assessed – the motor and sensory components. The motor component supplies the muscles of mastication and the sensory component supplies the majority of the face, apart from the angle of the mandible. The great auricular nerve, arising from the second and third cervical vertebrae, supplies the angle of the mandible.

(1) Always take a detailed history from the patient.
(2) ALWAYS tell the patient what you will be doing and what you expect them to do in helping elicit any signs and/or symptoms.
(3) Observe the skin over the area of temporalis and masseter first to identify if any atrophy or hypertrophy is obvious.
(4) Palpate the masseter muscles while you instruct the patient to bite down hard. Also note masseter wasting on observation. Repeat this with the temporalis muscle.

(5) Then, ask the patient to open their mouth with resistance applied by the examining clinician at the bottom of the patient's chin.
(6) To assess the stretch reflex (jaw jerk reflex), ask the patient to have their mouth half open and half closed. Place an index finger onto the tip of the mandible at the mental protuberance, and tap your finger briskly with a tendon hammer. Normally this reflex is absent or very light. However, for patients with an upper motor neuron lesion, the stretch reflex (jaw jerk reflex) will be more pronounced.
(7) Also ask the patient to move their jaw from side to side.
(8) Next, test gross sensation of the trigeminal nerve. Tell the patient to close their eyes and say "sharp" or "dull" when they feel an object touch their face. Allowing them to see the needle, brush or cotton wool ball before this examination may alleviate any fear. Using the needle, brush or cotton wool, randomly touch the patient's face with the object. Touch the patient above each temple, next to the nose and on each side of the chin, all bilaterally. You must test each of the territories of distribution of the ophthalmic, maxillary and mandibular nerves.
(9) Ask the patient to also compare the strength of the sensation of both sides. In other words ask them to state if they feel any differences between the left and right sides. If the patient has difficulty distinguishing pinprick and light touch, then proceed to check temperature and vibration sensation using the vibration fork. You can heat it up or cool it down in warm or cold water, respectively.
(10) Finally, test the corneal reflex (blink reflex). This is generally not done routinely, and should only be assessed if clinical suspicion indicates there may be a pathology involving the trigeminal nerve, as it can be a little uncomfortable for the patient. You can test it with a cotton wool ball rolled to a fine tip. Ask the patient to look at a distant object and then approaching laterally, touching the cornea (not the sclera) checking if the eyes blink. Repeat this on the opposite eye. If there is possible facial nerve pathology on the side that you are examining, it is imperative to observe the opposite side for the corneal reflex.

Some clinicians omit the corneal reflex unless there is sensory loss on the face elicited from the history or examination, or if cranial nerve palsies are present at the pontine level. It is best to ensure a complete clinical examination is undertaken, however, especially if there is a possible pathology of the trigeminal nerve.

10.4.1 Facial Nerve

The facial nerve has a short course within the cranial cavity after emerging from the junction between the pons and medulla just lateral to the root of the sixth nerve. The facial nerve (motor root and nervus intermedius), accompanied by the eighth cranial nerve (the vestibulocochlear nerve), enters the internal auditory meatus, traveling in a lateral direction through the petrous temporal bone. At the point it meets the cavity of the middle ear, it turns backward sharply forming a "knee-shaped bend". This is also where the sensory ganglion, the geniculate (genu, L. knee) ganglion, is found. On reaching the posterior wall of the middle ear it then passes inferiorly to exit the skull at the sylomastoid foramen. The facial nerve then enters the parotid gland, giving rise to its terminal branches for the facial muscles.

The facial nerve is composed of several different components that allow it to carry out its various functions. The divisions of the facial nerve functions are broken down into branchial (arising from the branchial/pharyngeal arches) motor, parasympathetic and sensory (general *and* special) fibers. A summary of the functions of the facial nerve has been previously described in Chapter 1.

The nuclei related to the facial nerve are seen in Table 10.2.

Table 10.2. Details of the Nuclei of the Facial Nerve Including Its Input, Output and Related Functions of Those Nuclei

Facial Nerve			
Nucleus	**Input**	**Output**	**Function**
Facial motor	Corticonuclear fibers from both cerebral hemispheres for upper face Corticonuclear fibers from opposite cerebral hemispheres for lower face	Facial muscles	Muscles of facial expression
Nucleus of the solitary tract	Anterior two-thirds of the tongue	Ventral posteromedial nucleus of the thalamus	Taste from anterior two-thirds of the tongue
Superior salivatory nucleus	Hypothalamus	Submandibular salivary gland and lacrimal gland	Salivation and lacrimation

10.5 CLINICAL ASSESSMENT

The following presents a summary of the clinical testing of the facial nerve. It primarily focuses on the most important supply of the facial nerve from the clinical perspective i.e. its supply to the muscles of facial expression.

- The purpose of the facial nerve is to ensure functioning of the muscles of facial expression (Figure 1)
- Inspect the face at rest noting any asymmetry (e.g. drooping, sagging and even smoothing of the normal facial creases)
- Then:
  1. Ask the patient to raise their eyebrows, and
  2. Ask the patient to frown, and
  3. Ask the patient to show you their teeth

TIP!

Do not ask the patient to "smile" as they may be very worried about their signs and symptoms / clinical condition, and may feel uncomfortable being asked to smile! On the other hand, make sure they have their own teeth/substitutes in place to prevent embarrassment when undertaking this examination.

4. Ask the patient to close their mouth and to puff out their cheeks against tightly closed lips
5. Scrunch up their eyes, and the examining clinician should then try to open them on behalf of the patient

TIP!

Do tell them what you are about to do, as the patient will feel surprised that you are trying to prise their eyes open! This ensures the patient does not feel uncomfortable during the examination.

- The purpose of the examination is to note asymmetry of the face, but also, to assess the strength (or otherwise) of the power of the facial muscles

10.5.1 Vestibulocochlear Nerve

The eighth cranial nerve is the vestibulocochlear nerve. It arises from the brainstem between the pons and medulla, and has two nerves

Table 10.3. Details of the Nuclei of the Vestibulocochlear Nerve Including Its Input, Output and Related Functions of Those Nuclei

Vestibulocochlear Nerve			
Nucleus	**Input**	**Output**	**Function**
Vestibular related			
Superior vestibular	Vestibular nerve	Oculomotor nerve Trochlear nerve	
Medial vestibular	Vestibular nerve	Medial longitudinal fasciculus and cervical cord	Head and neck movements Eye movements
Inferior vestibular	Vestibular nerve	Ventral spinal cord Oculomotor nerve Trochlear nerve	Eye and head movements
Deiter's	Vestibular nerve	Ventral horn of spinal cord Motor nuclei of oculomotor, trochlear and abducens nerves	Equilibrium Movement of eyes in relation to head
Cochlear related			
Ventral cochlear	Auditory nerve fibers	Superior olive Inferior colliculus Lateral lemniscus	Processing of auditory information
Dorsal cochlear	Auditory nerve	Superior olive Inferior colliculus	Complex auditory information

responsible for different functions. The vestibular nerve deals with information related to equilibration, as it is distributed to the saccule and utricle, as well as to the ampullary crests of the semi-circular ducts. The cochlear nerve deals with hearing, and is distributed to the hair cells of the spiral organ. On exiting the brainstem, it then passes into the petrous temporal bone via the internal auditory meatus, very closely related to the facial nerve. A summary of the functions of the vestibulocochlear nerve has been previously described in Chapter 1 (which is also summarised in Table 10.3).

10.6 CLINICAL ASSESSMENT

Testing of the vestibulocochlear nerve can be complex and it may be indicated that the patient may need assessment by a neurologist or audiological specialist. However, testing can initially be undertaken at the bedside to provide a basic knowledge about the integrity of the vestibulocochlear nerve.

10.6.1 Testing At the Bedside

10.6.1.1 Basic Testing

Assess hearing by instructing the patient to close their eyes and to say "left" or "right" when a sound is heard on the examined side. Vigorously rub your fingers together very near to, yet not touching, each ear and wait for the patient to respond each time they hear something. After this test, ask the patient if the sound was the same in both ears, or louder or duller in either one or the other ear. If there is lateralization or hearing abnormalities perform the Rinne and Weber tests using the 512 Hz tuning fork.

10.6.1.2 Weber Test

The Weber test is a test for lateralization. Tap the tuning fork strongly on your palm and then press the butt of the instrument on the top of the patient's head in the midline and ask the patient where they hear the sound. Normally, the sound is heard in the center of the head or equally in both ears. If there is a conductive hearing loss present, the vibration will be louder on the side with the conductive hearing loss. If the patient does not hear the vibration at all, attempt again, but press the butt harder on the patient's head.

10.6.1.3 Rinne Test

The Rinne test compares air conduction to bone conduction. Tap the tuning fork firmly on your palm and place the butt on the mastoid eminence firmly. Tell the patient to say "now" when they can no longer hear the vibration. When the patient says "now", remove the butt from the mastoid process and place the U of the tuning fork near the ear without touching it.

Tell the patient to say "now" when they can no longer hear anything. Normally, one will have greater air conduction than bone conduction and therefore hear the vibration longer with the fork in the air. If the bone conduction is the same or greater than the air conduction, there is a conductive hearing impairment on that side. If there is a sensorineural hearing loss, then the vibration is heard substantially longer than usual in the air.

Make sure that you perform both the Weber and Rinne tests on both ears. It would also be prudent to perform an otoscopic examination of both eardrums to rule out a severe otitis media, perforation of the tympanic membrane or even occlusion of the external auditory meatus, which all may confuse the results of these tests. If hearing loss is noted, an audiogram is indicated to provide a baseline of hearing for future reference.

10.6.1.4 Otoscopy

This will allow the external auditory meatus and the middle ear to be assessed by examination of the tympanic membrane.

Advanced testing of the vestibulocochlear nerve can be undertaken by referral to an audiological specialist, perhaps in consultation with the neurological team or the ear, nose and throat surgeons. Specifically, advanced testing can be undertaken using automated otoacoustic emission (AOAE), automated auditory brainstem response (AABR), pure tone audiometry (PTA) or bone conduction tests. These tests will assess the hearing element of the vestibulocochlear nerve.

Regarding the vestibular component of the vestibulocochlear nerve, rotation testing, electronystagmography, computerized dynamic posturography (CDP) or vestibular evoked myogenic potential (VEMP) recording may be indicated.

10.6.2 Glossopharyngeal Nerve

The glossopharyngeal nerve is the eighth cranial nerve. It arises as three or four rootlets at the level of the medulla oblongata. It passes out from between the inferior cerebellar peduncle and the olive, superior to the rootlets of the vagus nerve. It then sits on the jugular tubercle of the occipital bone. It then runs to the jugular foramen, passing through the middle part of it. At the point of entry to the jugular foramen, two ganglia are found – an inferior and superior ganglion. Both of these ganglia contain the cell bodies of the afferent fibers contained within the glossopharyngeal nerve. On passing through the jugular foramen, the glossopharyngeal nerve then passes between the internal carotid artery and the internal jugular vein, descending in front of the artery. It then passes deep to the styloid process and related muscles attaching on to this bony prominence. It then winds round the stylopharyngeus, passing deep to the hyoglossus and going between the superior and middle pharyngeal constrictors. A summary of the functions of the glossopharyngeal nerve has been previously described in Chapter 1 (which is also summarised in Table 10.4).

Table 10.4. Details of the Nuclei Related to the Glossopharyngeal Nerve Including its Input, Output and Related Functions of Those Nuclei

Glosspharyngeal Nerve			
Nucleus	**Input**	**Output**	**Function**
Spinal tract and nucleus	Aδ and C fibers	Ventral posteromedial nucleus of thalamus	Pain and temperature
Nucleus ambiguus	Corticobulbar tract	Motor fibers of the vagus nerve	Innervation of the soft palate, pharynx and larynx
Inferior salivatory nucleus	Parasympathetic input	Parotid gland	Salivation
Nucleus of solitary tract	Afferents for gag reflex	Nucleus ambiguus	Gag reflex

10.7 CLINICAL ASSESSMENT

The following can be undertaken when examining the integrity of the glossopharyngeal nerve in the clinical setting, and can be undertaken at the bedside, or examining room.

(1) Examining the glossopharyngeal nerve is difficult. Assessing it on its own is not possible, and an isolated lesion of this nerve is almost unknown. When assessing the glossopharyngeal nerve, the fist thing to do is simply *listening to the patient talking*. Any abnormality of the voice, e.g. hoarse, whispering or a nasal voice may give a clue as to an abnormality. Also, ask the patient if they have any difficulty in swallowing. The result of a glossopharyngeal nerve (and related cranial nerves, e.g. vagus and accessory nerves due to their close proximity to each other) may be dysphagia (difficulty swallowing), aspiration pneumonia or dysarthria (difficulty in the motor control of speech).

(2) To assess the function of the glossopharyngeal nerve (and also the vagus nerve) ask the patient to say “ahhhh” (without protrusion of their tongue) for as long as they possibly can. Do not, however, prolong this examination beyond what is necessary. Normally, the palate should rise equally in the midline. The palate (uvula) will move *away* from the side of the lesion if there is a problem with the glossopharyngeal (and perhaps vagus) nerve, i.e. toward the “normal”, or unaffected side.

(3) Damage to the glossopharyngeal (and also the vagus) nerve, e.g. because of a stroke, may result in the loss of the gag reflex.

ALWAYS tell the patient what you will do before assessing the gag reflex, as it is not a pleasant examination, and may not always be necessary.

(4) A swab can be used to gently touch the palatal arch on the left then right hand sides. Try to assess the normal side first if you suspect a pathology.

10.7.1 Vagus Nerve

The vagus nerve arises from the medulla. It passes toward the jugular foramen between the glossopharyngeal and spinal accessory nerves. The vagus nerve has two ganglia associated with it – the superior and inferior ganglia. The vagus nerve then passes inferiorly in the carotid sheath between the internal jugular vein and the internal and external carotid arteries. As it descends, it is related to the internal jugular vein and the common carotid artery. Then, the right and left vagus nerves take different anatomical pathways.

On the right side, the vagus nerve passes anterior to the right subclavian artery and posterior to the superior vena cava. At the point where it is closely related to the subclavian artery, it gives off its recurrent laryngeal branch. This branch passes under the artery then posterior to it. It then ascends between the trachea and esophagus, both of which it supplies at that point. The right recurrent laryngeal nerve then passes closely related to the inferior thyroid artery. It enters the larynx behind the cricothyroid joint and deep to the inferior constrictor. The recurrent laryngeal nerve conveys sensory information from below the level of the vocal folds, and all of the muscles of the larynx on that side, except cricothyroid.

The left vagus nerve descends toward the thorax passing between the common carotid and subclavian arteries, passing posterior to the brachiocephalic vein. It gives off branches here to the esophagus, lungs and heart. It then passes to the left side of the arch of the aorta. From here, the recurrent laryngeal nerve is given off which descends underneath the arch of the aorta to ascend in the groove between the esophagus and trachea. As it does so, it gives off branches to the aorta, heart, esophagus and trachea. A summary of the functions of the vagus nerve has been previously described in Chapter 1 (which is also summarised in Table 10.5).

Table 10.5. Details of the Nuclei Related to the Vagus Nerve Including the Input, Output and Related Functions of Those Nuclei

Vagus Nerve			
Nucleus	**Input**	**Output**	**Function**
Nucleus ambiguus	Corticobulbar tract	Motor fibers of the vagus nerve	Innervation of the soft palate, pharynx and larynx
Dorsal nucleus of vagus nerve	Nucleus of solitary tract Hypothalamus	Parasympathetic to viscera	Parasympathetic innervation of viscera, e.g. gastrointestinal tract, lungs
Nucleus of solitary tract	Epiglottis Aortic body Viscera	Hypothalamus Amygdala	Processing of visceral afferent information
Chief sensory nucleus of trigeminal nerve	Primary afferent fibers	Ventral posteromedial nucleus of thalamus	Pain, temperature and light touch from head and laryngeal mucosa

10.8 CLINICAL ASSESSMENT

Testing of the vagus nerve is done in exactly the same way that the glossopharyngeal nerve is examined.

(1) When assessing the vagus nerve, as with the glossopharyngeal nerve, the fist thing to do is simply *listening to the patient talking*. Any abnormality of the voice, e.g. hoarse, whispering or a nasal voice may give a clue as to an abnormality. Also, ask the patient if they have any difficulty in swallowing.
(2) To assess the function of the vagus nerve (and the glossopharyngeal nerve) ask the patient to say "ahhhh" (without protruding their tongue) for as long as they can. Normally, the palate should rise equally in the midline. The palate (uvula) will move *away* from the side of the lesion if there is a problem with the vagus (and glossopharyngeal) nerve, i.e. pulling of the palate to the normal side. This is due to the pull of the musculature on the unaffected side.
(3) The gag reflex can also be assessed if relevant. You MUST tell the patient what you will do before doing this test, as it is unpleasant.
(4) Using a swab, GENTLY touch each palatal arch in turn, waiting each time for the patient to gag. Again, do not prolong this examination as it can be unpleasant for the patient.

TIP!

Vagus nerve pathology could present with the following, affecting one or all of its branches:

1. Palatal paralysis (absent gag reflex)
2. Pharyngeal/laryngeal paralysis
3. Abnormalities with the autonomic innervation of the organs it supplies (i.e. heart, stomach (gastric acid secretion/emptying), gut motility

Glossopharyngeal nerve pathology on the other hand will affect the following:

1. Dysphagia
2. Impaired taste and sensation on the posterior one-third of the tongue
3. Absent gag reflex
4. Abnormal secretions of the parotid gland, though difficult to assess from the patient accurately

10.8.1 Accessory Nerve

The accessory nerve has two roots – a cranial and spinal division. The cranial root arises from the inferior end of the nucleus ambiguus and perhaps also from the dorsal nucleus of the vagus nucleus. The fibers of the nucleus ambiguus are connected bilaterally with the corticobulbar tract (motor neurons of the cranial nerves connecting the cerebral cortex with the brainstem). The cranial part leave the medulla oblongata as four or five rootlets uniting together, and then to join with the spinal part of the accessory nerve just as it enters the jugular foramen (Figure 52). At that point, it can send occasional fibers to the spinal part. It is only united with the spinal part of the accessory nerve for a brief time before uniting with the inferior ganglion of the vagus nerve. These cranial fibers will then pass to the recurrent laryngeal and pharyngeal branches of the vagus nerve, ultimately destined for the muscles of the soft palate (not tensor veli palatini (supplied by the medial pterygoid nerve of the mandibular nerve).

The spinal root arises from the spinal nucleus found in the ventral gray column extending down to the fifth cervical vertebral level. These fibers then emerge from the spinal cord arising from between the ventral and dorsal roots. It then ascends between the dorsal roots of the spinal nerves entering the cranial cavity through the foramen magnum posterior to the vertebral arteries. It then passes to the jugular foramen, where it may receive some fibers from the cranial root. As it then exits the jugular foramen, it is closely related to the internal jugular vein. It then courses inferiorly passing medial to the styloid process and attached stylohyoid. It also is found medial to the posterior belly of digastric. The spinal root then supplies the sternocleidomastoid muscle on its medial aspect.

The cranial root then enters the posterior triangle on the neck lying on the surface of the levator scapulae at approximately mid-way down the sternocleidomastoid. As it passes inferiorly through the posterior triangle of the neck, and just above the clavicle, it then enters the trapezius muscle on its deep surface at its anterior border. The third and fourth cervical vertebral spinal nerves also supply the trapezius forming a plexus of nerves on its deeper surface.

The spinal accessory nucleus is formed from the lower motor neurons within the superior portion of the spinal cord in its dorsolateral aspect of the ventral gray horn. A summary of the functions of the accessory nerve has been previously described in Chapter 1.

10.9 CLINICAL ASSESSMENT

From the clinical perspective, the accessory nerve supplies the *sternocleidomastoid* and *trapezius* muscles, and as such, it is those that are tested when assessing the integrity of the nerve.

The sternocleidomastoid muscle has two functions depending on whether it is acting on its own, or with the opposite side. If the sternocleidomastoid is acting on its own, it tilts the head to that side it contracts and, due to its attachments and orientation, rotates the head so that the face moves in the direction of the opposite side. Therefore, if the left sternocleidomastoid muscle contracts, the face turns to the right hand side, and vice versa.

If, however, both sternocleidomastoid muscles contract, the neck flexes and the sternum is raised, as in forced inspiration.

The trapezius is an extremely large superficial muscle of the back. It is comprised of three united parts – superior, middle and inferior. It is involved in two main functions depending on if the scapula or the spine is stable. If the spinal part is stable, it helps move the scapula, and if the scapula is stable, it helps move the spine. Trapezius is involved in a variety of movements. The upper fibers raise the scapula, the middle fibers pull the scapula medially and the lower fibers move the medial side of the scapula down. Therefore, trapezius is involved in both elevation and depression of the scapula, depending on which part is contracting. As well as this, the trapezius also rotates and retracts the scapula.

Testing of the accessory nerve is done as follows.

(1) ALWAYS inform the patient of what you will be doing, after introducing yourself and taking a detailed clinical history.
(2) When examining a patient, ensure you just observe the patient in the resting position, and try to identify if there is any obvious deformity, or asymmetry of the shoulder and neck region. It may be that you will see an obvious weakness or asymmetrical position of the patient's neck and/or upper limbs
(3) First, you can assess the sternocleidomastoid muscle.
(4) You can ask the patient to rotate their head to look to the left and right hand sides to identify any obvious abnormality.
(5) Then, ask the patient to look to one side and test the muscle against resistance.
(6) For example, if the patient looks to the right side, place the ball of your hand on their left mandible.
(7) Ask the patient to press into your hand.
(8) Repeat this on the opposite side.
(9) Then, you need to assess the trapezius.
(10) First you can ask the patient to raise their shoulders, as in shrugging.
(11) Observe any gross abnormality
(12) Then while the patient is raising their shoulders, gently press down on them as they lift their shoulders.
(13) Assess any weakness that may be present, recording which side is affected.

TIP!

When assessing the function of the sternocleidomastoid and trapezius, it may help examining the unaffected side first, especially if the patient complains of pain or discomfort on one side. This helps build up trust with the patient, but also minimizes causing them any pain or discomfort.

10.10 INFERIOR OLIVARY COMPLEX

The inferior olivary complex, or inferior olive nucleus is found at the level of the rostral medulla. It is a swelling at the lateral aspect of the pyramids. As such, it is also closely related to the cerebellum. It is composed of gray folded layers opening medially by a hilum. At the point of the hilum, the olivocerebellar fibers pass through.

The purpose of the inferior olivary nucleus, due to its close relation to the cerebellum, is related to movement and the control and coordination of it. The inferior olivary nucleus is the only source of climbing fibers to the Purkinje cells in the cerebellum and it projects to both the cortex and the deeper nuclei of the cerebellum. It is also involved in processing of sensory information and tasks of cognition. It has also been implicated in the vestibule-ocular reflex and eye blinking (De Zeeuw et al., 1998).

10.11 OLIVOCEREBELLAR FIBERS

The cerebellum is involved in coordination and regulation of motor control, control of balance and posture, processing of vestibular information, cognitive functions (Goldman-Rakic, 1996; Schmahmann and Caplan, 2006) and has connections with the hypothalamus for autonomic and emotional functions (Schmahmann and Caplan, 2006).

The inferior olive provides all of the climbing fibers to the Purkinje cells, which are the only source of the output of the cerebellar cortex reaching central cerebellar and vestibular nuclei. The inferior olive receives sensory input following motor commands being executed, but also receives information from deep nuclei of the cerebellum and also the mesodiencephalic junction.

This pathway aids in learning and timing. The timing hypothesis as a function of the olivocerebellar function has been discussed by De Zeeuw et al. (1998) showing that the inferior olive functions as an oscillating clock, allowing for the correct timing of motor functions due to the nature of its neuronal electrophysiological characteristics.

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