Surgical Learning

E-Bulletin for the Association of British University Surgical Societies (ABUSS), a committee of the Royal College of Surgeons of England

RCS ADVANCING SURGICAL STANDARDS

ISSUE 14 May 2015

This Issue

Google Drive

Can all societies ensure that you add useful contacts and events to the spreadsheet and keep your contact details up to date on the spreadsheet too. If you do not have permission to share a person's contact details then please add their name to the spreadsheet, what they were helpful for and then your society so that if need be anyone who would like to contact them can contact you and you can then liaise on their behalf. See previous newsletters and the handover document regarding google drive access. Contacts that are useful include reps, sponsors, websites, how to create websites, etc.

Links on Page 3

An introduction to Endoscopic Thoracic Sympathectomy and the SNS

History of Endoscopic Thoracic Sympathectomy

Endoscopic thoracic sympathectomy, ETS, is the latest advancement of a continually evolving surgical procedure; the sympathectomy, a procedure which aims to divide the sympathetic chain at varying levels and thus prevent the innervation of certain tissues[1]. The first open thoracic sympathectomy was performed in 1889 by Alexander in an attempt to cure epilepsy[1]. In its early years, sympathectomy was used to treat an extensive assortment of conditions ranging from exopthalmic goitre, spastic paralysis and glaucoma through to idiocy[1, 2]. These are no longer indications for sympathectomy, however in the 1920s the procedure began to be more widely used for hyperhidrosis, vasospastic conditions, and angina pectoris, which are still indicated today[3]. Despite its effectiveness, the sympathectomy was unpopular due to long post-operative recovery times and inevitable complications [4, 5]. This left a gap in the market for a less invasive technique that could achieve the same successful results.

The original thoracoscopic sympathectomy was pioneered in 1939 by Hughes, who described procedures being carried out for hypertension, neuropathic pain and Raynaud's phenomenon[6]. The technique was refined in the 1980s. With a reduced recovery time and fewer complications, sympathectomies began to regain popularity[3]. Now ETS is a routine procedure, carried out predominantly for hyperhidrosis, facial blushing, Raynaud's phenomenon, pain syndromes and angina, which have failed to respond to medical therapy[7-9]. The symptoms of these conditions can be so severe as to be disabling for the patients, making ETS a life changing operation[10, 11].

However modern day ETS is not without its complications. It is associated with considerable immediate and long-term undesirable effects[12]. The most frequently seen specific complications are Horner's Syndrome, compensatory sweating, gustatory sweating, rhinitis and intercostal neuralgia[11, 13], as well as the more general ones involved with any thoracic surgery such as pleural effusion, pneumothorax and wound infection [11]. Despite these common complications, ETS is considered extremely worthwhile owing to the debilitating nature of the conditions it is designed to alleviate.

Sympathetically Mediated Pathologies (Indications for ETS)

Historically ETS has been used to treat a great range of disorders, often with very little scientific basis. Now it is restricted to use in sympathetically mediated pathologies with current indications for ETS being focal hyperhidrosis, pain syndromes, peripheral vascular disorders such as Raynaud's phenomenon, and intractable angina[7, 11]. Another frequent indication is facial

Conferences

At the last meeting we discussed the number of conferences. Some people thought that attendance was reducing possibly due to the number of surgical societies and some smaller surgical societies felt that they were too small to set up a conference. We thought it would be a good idea for societies that are close to one another to link up and join together for conferences. This is just an idea but worth thinking about. The email addresses for all societies are in the spreadsheet on our google drive so please use these if you need to contact other societies.

Museums

The RCSEng museum holds regular events of relevance to students. Please see their website for details of this and how to contact them if you want to set up any educational events using the museum. We suggested at the meeting that the museum could hold some local events further north and we are liaising with the museums on this. The museums were keen to link up with your head of anatomy at your university so please can you send contact details of the head of your anatomy department to them.

blushing[8, 9]. These conditions share a common underlying pathophysiology based in over activity of the sympathetic nervous system, for example; over stimulation of the sudomotor glands (hyperhidrosis), acute vasoconstriction (Raynaud's phenomenon)[10] and too fast a heart rate for the oxygen supply available from narrowed coronary arteries (intractable angina)[10]. Other pathologies such as pain syndromes and facial blushing are less well understood but nonetheless seem to be sympathetic in origin. Due to the severity and disabling nature of these symptoms and potential inefficacy of medical treatment, ETS is an important procedure[11].

Anatomy of the Sympathetic Chain

A certain level of knowledge of the anatomy of the sympathetic nervous system is essential to understanding the principle behind the sympathectomy and can be instrumental in avoiding some of the ETS-specific complications during the procedure. The sympathetic nervous system is the division of the autonomic nervous system with the primary function of governing the body's 'fight or flight' response, along with homeostatic control[16]. Afferent fibres carry pain sensation from the internal viscera to higher centres in the brain whilst efferent fibres innervate both visceral and somatic structures [17]. Visceral structures in the head and neck receive ipsilateral fibres via plexuses surrounding the internal carotid and vertebral arteries. The abdominal and pelvic viscera receive fibres from central plexuses. Somatic fibres travel in spinal nerves to innervate segments of skin with vasoconstrictor, sudomotor and pilomotor actions[17].

First-order sympathetic neurons begin in the hypothalamus, descend into the spinal cord and synapse in the lateral horns of the grey matter[18]. Sympathetic outflow from the spinal cord originates at spinal cord levels T1 to L2. Shortly after exiting the spinal cord from the anterior rootlets, the second-order (preganglionic) sympathetic fibres join the spinal nerves, continuing into the anterior rami where they then travel through the white rami communicantes into the paravertebral sympathetic ganglia[17, 19].

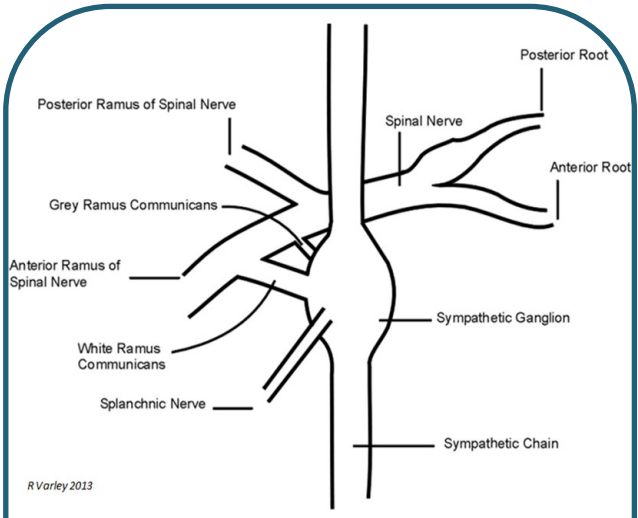

Fig.1: A schematic representation of a sympathetic chain ganglion and its connections, adapted from(19).

The preganglionic neurons begin in the lateral horns of the grey matter of the spinal cord and exit via the anterior rootlets which then join the anterior roots and eventually the spinal nerve(19). They enter the sympathetic ganglion through the white rami communicantes and synapse in one of the sympathetic chain ganglia. The majority of postganglionic neurons exit through the grey rami communicantes(17).

Some sympathetic fibres rejoin the spinal nerve that they originated in via the grey rami communicantes, many fibres either ascend or descend, connecting adjacent ganglia, thus forming the paired paravertebral sympathetic chains which stretch from the base of the skull to the coccyx[17]. Before exiting the ganglia the neurons synapse again with third-order (postganglionic) neurons[18]. Some fibres pass straight through the ganglia, forming the splanchnic nerves[17].

The region of sympathetic chain stretching between T1 and T12 is known as the thoracic sympathetic trunk and consists of 12 interconnected ganglia. Typically fibres arising from T1-T5 ascend, whereas ones below T5 descend. Generally, sympathetic efferents from T1-T2 supply the head and neck and those from

Important Links

Google Drive :
http://goo.gl/0vPQNc

All files available on google drive. Feel free to upload your own useful documents to share with others. Details of accessing the calendar are also located here

Calendar Event Submission Form: http://goo.gl forms/63xXijineq

This is the place to go if you have an event you would like publicized. It will be put onto our public calendar aswell as onto the next issue of the E-Bulletin.

ABUSS Email :
rcsabuss@gmail.com

Get in touch! Also email us with any news of your societies, novel events/ideas, and if you would like to submit something for publication in the next E-Bulletin.

E-Bulletin Archive:
http://goo.gl/OX6jcW

ASiT

The Association of Surgeons in Training (ASiT) has local representatives. At the meeting we discussed how they can help you. We agreed that it would be great if local representatives could contact the societies directly and come and speak to you. If you haven't heard from your local representative and would like to then please see the ASiT website for contact details of how to contact them.

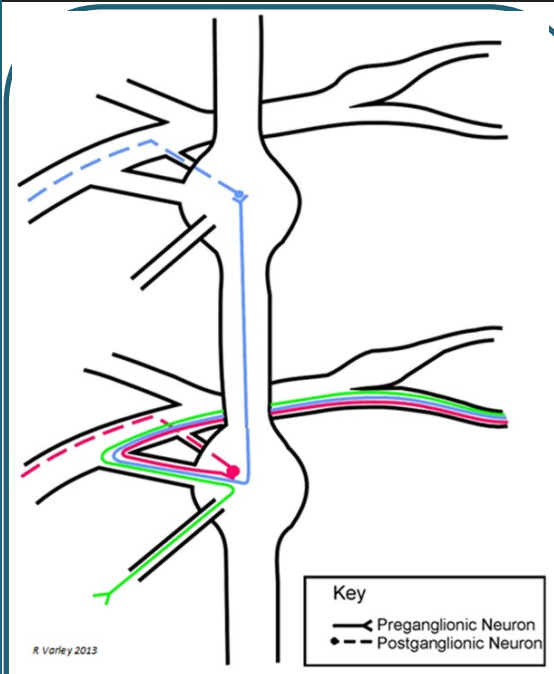

Fig.2: Schematic diagram of the different paths of preganglionic and postganglionic neurons, adapted from(19).

In this diagram the red lines show the path of neurons which synapse at the first sympathetic ganglion they pass through, re-entering the spinal nerve they originated in. The blue lines show the path of neurons which can either ascend or descend, synapsing in the ganglion at the level they exit the chain. The green line shows the path of splanchnic nerves which pass straight through the ganglion, synapsing in more peripheral prevertebral ganglia (supplying the abdominal and pelvic viscera), or with chromaffin cells in the adrenal medulla(17).

T2-T5 supply the upper limb[17, 20].

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The Cervical Sympathetic Trunk

As fibres from the thoracic sympathetic chain extend beyond T1 they become the cervical sympathetic chain, giving rise to a further three ganglia which supply the upper limbs, neck and head. These ganglia differ in that they have no white rami communicantes, meaning that all nerves passing into them originate from T1 or below[17]. The superior cervical ganglion is the most superior point of the sympathetic chain, found at the base of the skull at the level of the C4 vertebra [21]. It supplies: spinal nerves C1-C4; the pharynx via cranial nerves IX, X and XII; and the face via cranial nerve VII[18]. It also supplies the external carotid artery, with branches supplying the sudomotor and pilomotor activity of the face[18], and the internal carotid artery, branches of which supply the dilator pupillae muscle[17] and the superior tarsal muscle of the eyelid[22]. Additionally it gives off the superior cardiac nerves[19]. The middle cervical ganglion supplies spinal nerves C5-C6 and gives rise to the middle cardiac nerves. The inferior cervical ganglion supplies spinal nerves C7-C8 and the inferior cardiac nerves[19].

The inferior ganglion fuses with the uppermost thoracic ganglion to form the stellate ganglion (SG)[17, 19]. The SG is highly significant anatomically as it is the common point through which all sympathetic innervation reaches the head, neck and upper limbs. For this reason, knowledge of the exact location of the SG is of great importance during ETS so that it may be distinguished from neighbouring ganglia and thus avoided. Damage during surgery at the SG or above will result in Horner's Syndrome. The SG is found anterior to the transverse process of the seventh cervical vertebra at the neck of the first rib and posterior to the junction of the subclavian and vertebral arteries[19] embedded within a fat pad that surrounds these arteries[11].

Endoscopic Thoracic Sympathectomy Procedure

ETS is highly effective at treating the aforementioned conditions as it permanently interrupts the overactive sympathetic supply. There are many variations in the execution of ETS however there are some general steps that are common to all ETS procedures.

The majority of procedures are now carried out as bilateral day cases, performed under general anaesthesia. The patient is placed in the lateral position to allow easy insertion of axillary operating ports, through which the scope and instruments are introduced into the thoracic cavity[11, 23]. The number of ports used varies from 1-3. Once inside the thoracic cavity, any adhesions between the lung and parietal pleura are dissected and the lung is retracted. Retraction can be implemented by collapsing the lung on that side[15], raising the head of the operating table slightly or by manually retracting the lung[11, 23]. Next important landmarks are identified, such as the SG in its fat pad, the first four ribs and the sympathetic chain as it passes over these ribs [11, 24, 25]. The sympathetic chain is exposed by excising the parietal pleura and the chain is isolated. One of the main variations in practice lies in the method used to divide the chain however the most reported method is diathermy[12].

Future Plans

Going forward we are looking to continue to expand the number of surgical societies at our meetings. We are also going to continue to look at ways to improve communication i.e. wider use of our website and facebook pages etc.
The ABUSS part of the RCSEng website requires development and this is something that we are looking to concentrate on over the next 6 months.

I hope that this edition of the newsletter helps to keep you up to date with what is happening with ABUSS. If you have any ideas and suggestions regarding ABUSS and how we can continually keep improving then please email us. We look forward to hearing from you.

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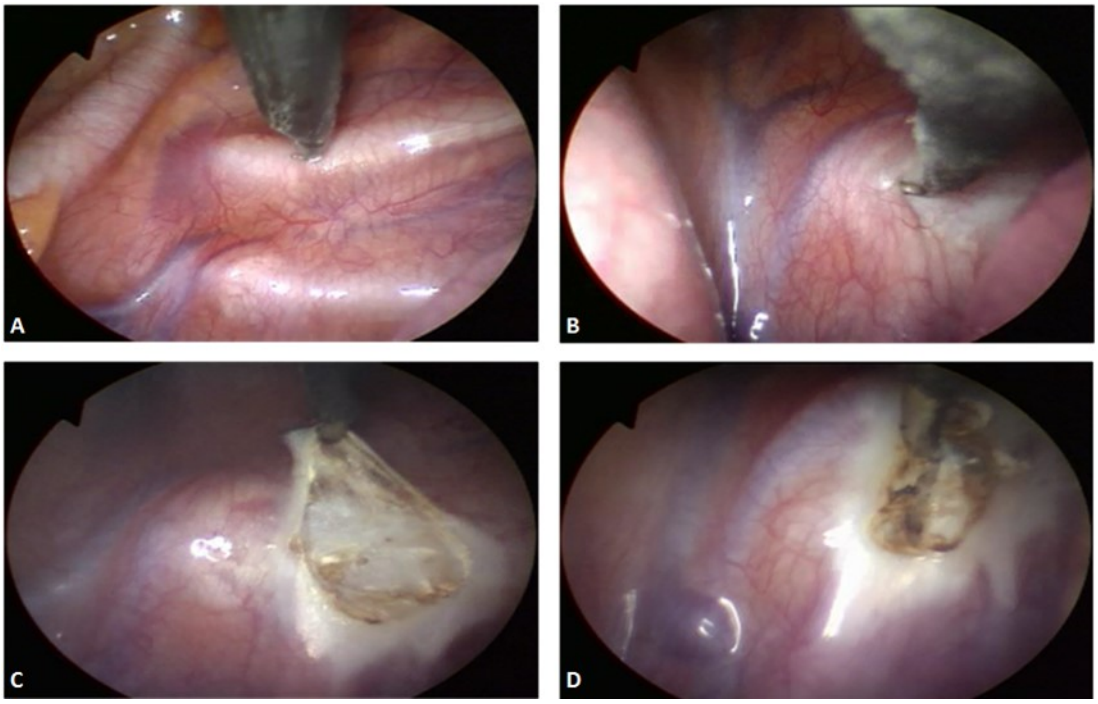

Fig.3: Typical operative technique using a diathermy hook

A) illustrates the process of identifying key anatomical landmarks by gently palpating ribs through the pleura and counting them. In B) the pleura is being pulled slightly away from structures beneath it so that it can be opened by coagulation, as in C), without damage to underlying structures. D) shows the sympathetic chain being isolated and lifted by the diathermy hook, ready to be divided by means of coagulation.

Summary

ETS is a common procedure, carried out for disorders of sympathetic over activity however it is not without problems. A detailed knowledge of the anatomy of the sympathetic nervous system can minimise the frequency of certain complications. Continuing refinement of the procedure itself is also necessary to reduce complications and ensure patients receive the best care available.

References Available on G Drive and : https://goo.gl/n7hcB2

Rebecca Varley

Rebecca is currently a 5th year medical student studying at Lancaster Medical School and interested in a career in surgery. She is particularly fascinated by the historical development of surgical techniques and how they will continue to develop in the future.