Sympathetic blocks

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The sympathetic nervous system (SNS) is a part of the autonomic nervous system that controls the body's involuntary activities. It has been implicated in neuropathic pain (NeP), vascular, and visceral pain. Sympathetic ganglia have been the target of local anaesthetic block to assess the role of the SNS in transmission of pain. Despite the frequent use of minimally invasive sympathetic blocks by pain practitioners, their efficacy for providing analgesia has been sparsely reported. Many case reports and series have been published, but few placebo-controlled, blinded studies exist.1, 2

Rationale for the use of sympathetic blocks

Vascular pain

The origins of vascular pain are complex, and pain can come from: arteries, for example, arterial occlusive disease; dysfunction of micro-circulation, for example, in diabetes; veins, for example, venous ulcers and NeP due to poor blood supply to local nerves. Sympathetic block using percutaneous techniques or by continuous infusion can improve circulation and can relieve pain.

Neuropathic pain

NeP is often multi-factorial with SNS as one of the several causes. Sympathetically mediated NeP may not be fully relieved by sympathetic blocks; however, some improvement may occur. Adjuvant therapy is often needed, for example, opioids, anticonvulsants, antidepressants, physiotherapy, neuromodulation, and psychological strategies.3

Indications4

(i) Peripheral vascular disease:
(a) Acute vascular disorders: post-traumatic vasospasm, acute, arterial or venous occlusion, cold injury; inadvertent intra-arterial injection of irritants, for example, thiopental or contaminated drugs of abuse.

(ii) Visceral pain:
(a) upper abdominal cancers;
(b) rectal tenesmus of cancer;
(c) chronic pancreatitis;
(d) chronic perineal cancer;
(e) some chronic non-cancer pelvic pain syndromes;
(f) cardiac pain, for example, acute myocardial infarction and refractory angina;
(g) perioperative pain: upper abdominal surgery can be performed using combined intercostal nerve and coeliac plexus blocks.

(iii) Hyperhidrosis

(iv) NeP:
(a) acute herpes zoster;
(b) carcinomatous neuropathy;
(c) complex regional pain syndrome (CRPS) types I and II.

Facilities and contraindications

The patient must be able to give appropriate consent after receiving a clear explanation of the nature of the procedure and the possible effects; common complications and rare but important adverse effects must be discussed and documented. Uncorrectable coagulopathy, for example, anticoagulant therapy, and hemorrhagic disorders are relative contraindications as large blood vessels often lie close to the sympathetic chain. Local infection or neoplasm can spread when needles are inserted through infected or cancerous tissues. Anatomical or vascular anomalies can make needle placement difficult. Hypovolaemia can be aggravated by coeliac plexus blocks (Fig. 1).
The blocks must be performed aseptically and with adequate facilities for resuscitation. Radiographic guidance for the procedures and the ability to save images must be available, especially with neurolytic blocks. Performance of the blocks can be uncomfortable, so sedation can be given in addition to infiltration with local anaesthetic. General anaesthesia is rarely necessary; nerve damage could go unrecognized in an anaesthetized patient who is unable to speak or respond. Patients must be carefully monitored during and after the procedure.

**Types of sympathetic block**

*Diagnostic blocks* are used to assess the sympathetic component of pain. To define the sympathetic contribution to any particular pain syndrome, the diagnostic block must be a pure sympathetic block without any accompanying somatic block. Hence, precise interruption of the sympathetic chain using an image intensifier to confirm the exact needle position and the spread of injected solution is needed. Objective signs of sympathetic block must be identified using changes in skin temperature or conductivity, or tests of sweat production. False-positive results can occur due to spread of solution to adjacent somatic nerves or into the epidural space, systemic effects of absorbed local anaesthetic, or a placebo response. False-negative results can occur after an incomplete or inappropriate block and inadequate assessment before or after the block. A complete sympathetic block is difficult to achieve. Many patients will have both sympathetic and somatic components to their pain. There is no clear correlation between the degree or duration of pain relief and the actual period of sympathetic block, and the same patient may show variable responses on different occasions. Therefore, the use of diagnostic blocks is difficult and often inaccurate. Increasing skin temperature, decreasing pain, and anhidrosis in the distal extremity may indicate a successful sympathectomy.

*Prognostic blocks* can be used to try to test the effect on pain, blood flow, or sweating, but there may be a poor correlation between the prognostic block and the outcome of any subsequent surgical or neuroablative procedure. If neuroablation is to be based on the results of prognostic blocks, more than one block should be performed and there must be a consistent response. Sometimes, the prognostic block can produce an increase in pain or an increase in limb temperature that the patient finds uncomfortable and unacceptable.

*Therapeutic blocks* may be performed with local anaesthetics, neurolytic chemicals such as phenol or alcohol, neuroablative techniques such as radiofrequency lesioning, or with drugs such as guanethidine and bretylium in i.v. regional techniques. Neurolytic blocks are indicated primarily for cancer and peripheral vascular disease, and should be used with great caution in all other conditions.

**Drugs and techniques**

Local anaesthetics are used for diagnostic, prognostic, and therapeutic blocks. Lidocaine 1% is suitable for a diagnostic block, but bupivacaine 0.25–0.5% is often preferred for other blocks.
Neurolytic solutions are used for therapeutic blocks; the most common are phenol and alcohol. Phenol destroys both motor and sensory nerve fibres by protein denaturation; at a concentration of 2–3% in saline, phenol seems to spare motor function. As fibres can regenerate, these blocks are not permanent. Phenol is not as effective as alcohol in destroying the nerve cell body and its effect tends to be less profound and of shorter duration than alcohol. The strongest aqueous phenol solution is 6.6%, but higher concentrations can be obtained using an oily base. Care is needed as contact with somatic nerves may cause neuritis. Toxic reactions may occur with doses more than 600 mg in a 70 kg man. Alcohol has a similar non-selective destructive action on nerves, but it produces a very high incidence of neuritis. Although 50–100% alcohol is used as a neurolytic, the minimum concentration required for neurolysis has not been established. A local anaesthetic is commonly used as a diluent. I.V. regional block of the SNS may be performed with guanethidine, ketorolac, phenotolamine, and clonidine. Systemic use of drugs to block the SNS may involve phenotolamine, pamidronate, prazocin, phenoxybenzamine, nifedipine, and clonidine. Radiofrequency ablation of the SNS is also used.4

### Sympathetic blocks

<table>
<thead>
<tr>
<th>Area</th>
<th>Grade of evidence</th>
<th>Specific indications</th>
<th>Side-effects</th>
<th>Technique</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sphenopalatine ganglion</td>
<td>Mostly 1C</td>
<td>Sluders neuralgia, cluster headaches, migraine, atypical facial pain</td>
<td>Epistaxis, paraesthesiae of teeth and hard palate</td>
<td>Infra-temporal approach</td>
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<td></td>
<td>Position: head in moderate extension</td>
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<td>Needle inserted perpendicular to the skin below the midpoint of the zygoma until it hits the lateral plate of pterygoid and then redirected to lie inferior to foramen rotundum and anterior wall of sphenoid sinus</td>
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<td></td>
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<td></td>
<td>0.5–2 ml drug injected</td>
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<tr>
<td>Stellate ganglion7</td>
<td>Mostly 1C</td>
<td>Pain affecting upper limb and thorax, vascular insufficiency</td>
<td>Horner’s syndrome, nerve injury (brachial plexus, recurrent laryngeal nerve, phrenic nerve), perforation of trachea/oesophagus, inadvertent vascular or intrathecal injection, pneumothorax</td>
<td>Anterior paratracheal approach</td>
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<td>Position: supine, head extended</td>
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<td>A point is marked 2–3 cm above and 2 cm lateral to the suprasternal notch. The needle is inserted directly backwards to pass between the trachea and the carotid sheath until it strikes the transverse process of C6. The needle is then withdrawn 2–3 mm, so that the tip lies anterior to the prevertebral fascia.</td>
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<td>10–15 ml solution injected slowly with repeated aspiration</td>
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<td>Thoracic sympathetic chain</td>
<td>2C</td>
<td>Cancer and rarely non-cancer pain of the abdomen, thorax, head and neck</td>
<td>Pneumothorax, vascular trauma</td>
<td>Upper thoracic sympathetic block</td>
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<td>Position prone</td>
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<td>Appropriate vertebral level is identified and a spinal needle is inserted 4–5 cm lateral to the spinous process, midway between the transverse processes. The needle is directed cephalad and medially on to the more cephalad transverse process of that level. The needle is then withdrawn and redirected caudal to the transverse process and towards the side of the vertebral body. The lateral view is checked with the image intensifier to ensure that the needle tracks cephalad to the vertebral foramen to avoid the emerging somatic nerve. The needle is advanced until the tip is immediately beside the vertebral body, anterior to the vertebral foramen and next to the anterior aspect of the neck of the rib</td>
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<tr>
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<td></td>
<td>2–3 ml drug injected. Neurolytic solutions should be used with extreme caution for non-cancer conditions because some somatic block is highly likely</td>
</tr>
<tr>
<td>Coeliac plexus8</td>
<td>1B</td>
<td>Pain of upper abdominal cancers, rarely in chronic pancreatitis</td>
<td>Bleeding, retroperitoneal haematoma, intravascular injection, intrathoracic or epidural injection, perforation of nearby visceria, pneumothorax, chylothorax, infection, hypotension, diarrhoea, impotence, paraplegia, lower extremity warmth, thrombosis, or embolism</td>
<td>Posterior approach</td>
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<td>Position prone</td>
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<td>The needle entry point is just below the tip of the 12th rib, and using X-ray screening in two planes, the needle is advanced until it hits the side of the L1 vertebra. The needle is withdrawn slightly and then redirected forwards until it is in the area of the celiac plexus, avoiding the aorta and inferior vena cava. Radio-opaque dye is injected to confirm the correct placement of the needle, and then the appropriate mixture is injected</td>
</tr>
</tbody>
</table>

Continued
Careful aspiration tests should precede the injection, which should be very easy; resistance suggests that the needle tip lies in the wrong place. For non-malignant pain, 10 ml of local anaesthetic on each side, and for malignant pain, 5 ml 6% aqueous phenol with 5 ml local anaesthetic on each side is injected.

### Superior hypogastric plexus

<table>
<thead>
<tr>
<th>Grade</th>
<th>Specific indications</th>
<th>Side-effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>1C</td>
<td>Cancer and non-cancer pelvic pain</td>
<td>Visceral trauma, bleeding, bladder, rectal and erectile dysfunction</td>
</tr>
</tbody>
</table>

**Posterior approach**

- Position: prone
- The L4/5 interspace is identified and bilateral needle entry points are marked 5–7 cm lateral to the midline at that level. With image intensifier guidance, the two needles are inserted to lie anterolateral to the L5/S1 interspace. Contrast is injected and confirmed to lie anterior to the L5/S1 interspace.
- 8–10 ml local anaesthetic or neurolytic agent injected.
- Position: prone
- The injection is performed with a bent needle inserted just anterior to the tip of the coccyx and then directed to the front of the sacrococcygeal junction under X-ray guidance.
- After a test dose of 4 ml local anaesthetic, 4–10 ml phenol 6% or 10% concentration injected.

### Ganglion of impar

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<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>1C</td>
<td>Perineal pain, coccydynia</td>
<td>Visceral trauma, bleeding, bladder, rectal and erectile dysfunction</td>
</tr>
</tbody>
</table>

**Position: prone**

- The injection is performed with a bent needle inserted just anterior to the tip of the coccyx and then directed to the front of the sacrococcygeal junction under X-ray guidance.
- After a test dose of 4 ml local anaesthetic, 4–10 ml phenol 6% or 10% concentration injected.

### I.V. regional sympathetic blocks

I.V. regional sympathetic block is similar to i.v. regional anaesthesia. It involves the injection of a drug into an exsanguinated limb isolated from the circulation by a tourniquet. Guanethidine is the drug most frequently used in the UK. Guanethidine blocks the re-uptake of norepinephrine and depletes stores in the post-ganglionic nerve terminals. Other drugs that have been used include ketanserin, bretylium, labetalol, ketorolac, hydralazine, methyldopa, clonidine, and droperidol. There is wide variation in recommendations of technique from different centres. The technique is essentially the same as for i.v. regional anaesthesia for surgery. Sedation may be necessary before the tourniquet is inflated, and if the limb is particularly sensitive, exsanguination by elevation rather than compression is advised.

### Conclusions

When conservative therapies are only partially effective or ineffective for chronic pain, then interventional procedures may be considered. The question is: are the interventional procedures effective and is this supported by evidence. Although there may be evidence for the role of sympathetic blocks in management of vascular insufficiency and cancer pain, randomized control trials have cast doubt on the benefits of such blocks for conditions such as post-herpetic neuralgia, low back pain, and CRPS. Day has reviewed the literature on sympathetic blocks and summarized existing studies for each of the blocks. Studies were graded as providing high-quality evidence (randomized controlled trials, meta-analyses), medium-quality evidence (randomized controlled trials with limitations), and low-quality evidence (case reports, case series, observational studies). On the basis of these, recommendations for the individual blocks were graded from 1A (1A/strong recommendation, high-quality evidence) to 2C (2C/weak recommendation, low-quality, or very low-quality evidence). The only block that has multiple grade 1B evidence (strong recommendation, moderate-quality evidence) is the coeliac plexus block, with most other blocks only managing a grade 1C evidence (strong recommendation, low-quality, or very low-quality evidence).

However, even with their poor evidence base, these blocks are still commonly used clinically. Further studies are needed, and in the meantime, patients with little or no relief from conservative
management will probably continue to have sympathetic blocks to try to achieve symptom control. The balance of benefits and risks in each case is therefore crucial, if the use of these techniques is to be justified.

Conflict of interest
None declared.

References

Please see multiple choice questions 15–17