National Essential Anaesthesia Drug List (NEADL) 2015

AAGBI POSITION STATEMENT

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The AAGBI is pleased to present the 2015 NEADL. An important purpose of NEADL is to advise suppliers and managers of a minimum set of drugs that must be available wherever anaesthesia is to be conducted safely. Efforts can then be focused to ensure sustainability of their supply. The list is in no way prescriptive and anaesthetists may well find they prefer other drugs in their own practice; this is to be encouraged because it takes pressure off the supply of the NEADL drugs, making shortage less likely. Moreover, it spreads familiarity with the use of alternatives when an essential drug is in shortage.

Shortages principally affect generic injectables. When a shortage occurs, we look first to find a direct alternative; lorazepam for midazolam, or vecuronium for rocuronium for example. NEADL is an obvious resource in that situation. Sometimes it will be necessary to look beyond injectables and to develop protocols that make use of non-injectable formulations. For example, if injectable opioids were in shortage, a protocol for anaesthesia for orthopaedic surgery might include premedication with oral simple analgesics and long-acting opioids.

Additional steps will help during shortages. They include;

- Reduce waste; only draw up what you will use, consider alternatives to patient-controlled analgesia.
- Reduce use by developing alternative techniques, such as regional analgesia during opioid shortage and vice-versa.
- Reduce supplies. Provide clinicians with the best alternatives, with advice on their safe use.
- Reduce activity. Triage to protect emergency and life-saving surgical procedures.

It may be a helpful exercise for teams to consider how reliant their service is on certain generic injectables, and to make contingency plans for the eventuality of shortage. AAGBI would be pleased to see such exercises reported as abstracts at the Winter Scientific Meeting and Annual Congress so that experiences can be shared.

In 2014 AAGBI joined the American Society of Anesthesiologists and other National Associations and Societies to consider global aspects of anaesthetic drug shortages. Under the Chairmanship of Adrian Gelb, the group hopes to develop an International Essential Anaesthetic Drug List similar to NEADL. Currently a professor in anesthesiology in San Francisco, Adrian has also worked in Canada and the United Kingdom; he is well placed to lead this international initiative.

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BNF chapter 15 classification of drugs for anaesthesia in brackets

Definition of essential, necessary and critical drug status:
- Essential medicines: Those that satisfy the priority healthcare needs of the population
  (as defined by the World Health Organization)
- Necessary drugs: Those used to treat or prevent a serious disease or medical condition for
  which there is no alternative medicine available in adequate supply
  (as defined by the US Food and Drugs Administration)
- Critical drugs: Those that are both necessary and vulnerable to shortage
  (as defined by the Drug Shortage Prevention Act 2012)
Medical gases

Drug name & formulation
- Air and oxygen are necessary for the safe administration of anaesthesia.

Clinical Indications (Priority indications marked P)
- (P) Carrier gases for anaesthetic agents.
- Air is used to drive various equipment including ventilators and surgical tools.

Alternative drugs or techniques
- Nitrous Oxide.
- A self inflating bag-valve-mask or draw-over system can be used to ventilate the lungs with air from the atmosphere.

General Comments
- Use of oxygen 100% during shortage of air risks oxygen toxicity and collapse of the lung (atelectasis).
- Nitrous oxide has been shown to be a safe carrier gas with weak anaesthetic and analgesic properties.
  Tendency to provoke nausea and vomiting can be offset with anti-emetic therapy.

Essential? Necessary? Critical?
E, N
Intravenous anaesthetic: propofol (1.1)

Drug name & formulation
- Propofol 10 mg/ ml (1%) in 20 ml ampoule or 50 ml bottle.

Clinical Indications (Priority indications marked P)
- (P) Induction of general anaesthesia.
- Maintenance of general anaesthesia, often in conjunction with neuraxial anaesthesia or with intravenous opioids.
- In sub hypnotic doses for short procedures such as reduction of dislocated joints.
- (P) Sedation for critically ill patients being mechanically ventilated on intensive care units.

Alternative drugs or techniques
- Thiopental sodium
- Etomidate

General Comments
- Patients may be sensitive to the drug or its diluents, in which case an alternative must be used.
- Propofol infusion syndrome may arise in children or adults after prolonged infusion of larger doses in the ICU. Often fatal.
- Thiopental is not more widely used because supply is limited.
- CAUTIONS when used as an alternative to propofol:
  - Not an anti-emetic.
  - Does not suppress laryngeal and airway reflexes as effectively as propofol.
  - Causes severe tissue necrosis if extravasated. On intra-arterial injection crystals form causing distal ischaemia.
  - Longer elimination half time; unsuitable for rapid recovery after infusion or accumulated boluses.
  - CONTRA-INDICATED in patients with porphyria or barbiturate allergy.
- Etomidate is not more widely used because it inhibits 11-betahydroxylase in the synthesis of cortisol.
- CAUTIONS when used as an alternative to propofol:
  - A glucocorticoid should be given to cover adrenal suppression lasting up to 24 hours after a single dose.
  - Not an anti-emetic.
  - Involuntary movements, rigidity, coughing, hiccupping and laryngospasm much more common than with propofol (50% vs 10%).
  - Pain on injection, venous thrombosis and thrombophlebitis are particularly problematic.
  - Lethal as a sedative infusion for critically-ill patients.

Essential? Necessary? Critical?
- (E) Most widely used intravenous anaesthetic.
- Strong clinical familiarity and a long established safety record.
- (C) Shortages have occurred in North America.
Inhalational anaesthetic: sevoflurane (1.2)

Drug name & formulation
- Sevoflurane

Clinical Indications (Priority indications marked P)
- (P) For the maintenance of general anaesthesia.
- Induction of anaesthesia as alternative to intravenous induction.

Alternative drugs or techniques
- Isoflurane
- Desflurane

General Comments
- Sevoflurane is a polyfluorinated isopropyl methyl ether with a low blood:gas partition coefficient and a low minimum alveolar concentration (MAC) of 1.8. Regarded as non-irritant to the airways. As with all volatile agents it can be a trigger for malignant hyperthermia.
- Isoflurane is a halogenated methyl ether with a slightly lower blood:gas partition coefficient and slightly lower MAC. Not as rapid in onset or washout as the more modern agents.
- Desflurane is a fluorinated methylethyl ether (blood/gas partition coefficient of 0.45) that demonstrates a fast wash in/onset time and a fast wash out time. MAC is significantly higher than sevoflurane at around 6.

Essential? Necessary? Critical?
- (E) Sevoflurane is a widely used inhalation anaesthetic agent in the UK.
- Preferred for gaseous inductions in children.
- Excellent safety profile.
Anti-muscarinic drugs: atropine (1.3)

Drug name & formulation
- Atropine 0.6 mg in 1 ml ampoule or 1 mg in 10 ml prefilled syringe.

Clinical Indications (Priority indications marked P)
- (P) Cardiac Arrest Box.
- Treatment and prevention of intra-operative bradycardia.
- Antisialogogue.
- Control of muscarinic side effects of neostigmine.

Alternative drugs or techniques
- Glycopyrrolate

General Comments
- A competitive muscarinic receptor antagonist that increases heart rate by blockade of the vagus nerve.
- Glycopyrrolate has a similar onset and duration of action to neostigmine and is preferred to atropine for this indication.

Essential? Necessary? Critical?
- Essential for management of life threatening bradyarrhythmias.
- Long safety record.
Anti-muscarinic drugs: glycopyrrolate (1.3)

Drug name & formulation
- Glycopyrrolate (Glycopyronium bromide) 200 mcg in 1 ml or 600 mcg in 3 ml ampoule.
- Also in premix 0.5 mg with neostigmine 2.5 mg in 1 ml for reversal of non-depolarising neuromuscular block.

Clinical Indications (Priority indications marked P)
- Treatment or prevention of intra-operative bradycardia.
- Treatment of acute bradyarrhythmias.
- As a premedication to dry bronchial and salivary secretions.
- (P) For prevention of muscarinic side effects of neostigmine which is given to reverse neuromuscular blockade.

Alternative drugs or techniques
- Atropine sulphate
- Hyoscine hydrobromide

General Comments
- Glycopyrrolate does not cross the blood-brain barrier and has no effect on the sensorium.
- Atropine as an alternative has a faster speed of onset and a shorter duration of action (20 – 30 minutes) than glycopyrrolate and so a late unopposed bradycardia may occur when used with neostigmine.
- Hyoscine is an effective anti-sialogogue alternative but crosses the blood-brain barrier to cause sedation. An effective anti-emetic.

Essential? Necessary? Critical?
- (E) Glycopyrrolate is superior to atropine (in terms of both pharmacokinetics and pharmacodynamics) in combination with neostigmine for reversal of neuromuscular blockade. Established safety record and clinician familiarity.
Benzodiazepine (1.4.1)

Drug name & formulation
- Midazolam 1 mg/ml, 2 mg/ml and 5 mg/ml

Clinical Indications (Priority indications marked P)
- Premedication
- Intra-operative sedation
- (P) Sedation in intensive care
- Co-agent for induction of anaesthesia
- (P) Emergency treatment of status epilepticus

Alternative drugs or techniques
- Lorazepam 4 mg in 1 ml ampoule
- Diazepam 10 mg in 2 ml ampoule
- Diazemuls 10 mg in 2 ml ampoule

General Comments
- Benzodiazepines act via sites on the neuronal GABA receptor.
- Midazolam is available in a variety of concentrations and so has the potential for drug error. Overdose with high concentration midazolam during conscious sedation, out with the environment of Anaesthesia and Intensive Care, is one of the 2013/14 NHS England Patient Safety never events.
- The alternative drugs lorazepam and diazepam have longer onset time after administration and longer duration of action. Diazemuls is the preferred formulation of diazepam for intravenous injection. All can be antagonized with flumazenil.

Essential? Necessary? Critical?
- (E) Most commonly used benzodiazepine in anaesthesia and critical care.
Non-opioid analgesic; paracetamol (1.4.2)

Drug name & formulation
- Paracetamol 1 g in 100 ml for intravenous injection
- Enteral preparations (various)

Clinical Indications (Priority indications marked P)
- (P) Analgesia
- (P) Anti-pyrexia

Alternative drugs or techniques
- Ketorolac
- Diclofenac
- Parecoxib

General Comments
- In shortage of the injectable, plan to use other routes of administration.
- Intravenous Paracetamol was first licensed in the UK in 2000, since when it has formed an important part of the peri-operative analgesic regime. Following a Fatal Accident Inquiry in Scotland in 2011 the AAGBI Safe Anaesthesia Liaison Group (SALG) issued guidance around its administration. This includes careful prescribing of Paracetamol according to weight, age and co-morbidities. It is also recommended that for patients weighing less than 33 kg 50 ml vials should be used. Intravenous Paracetamol remains under close monitoring from the MHRA and yellow card reporting should follow any adverse events.
- Injectable cyclo-oxygenase inhibitors as an alternative simple analgesic are either cyclo-oxygenase (COX) 2 specific (parecoxib) or non-specific (Ketorolac, Diclofenac). The evidence for preferring one over another is slim.
- There is no good substitute for paracetamol as an anti-pyretic.

Essential? Necessary? Critical?
- (E) Paracetamol is the most commonly used simple analgesic and has an established place in a multimodal approach to analgesia.
Opioid analgesics: fentanyl (1.4.3)

Drug name & formulation
- Fentanyl 100 mcg in 2ml, 500 mcg in 10ml

Clinical Indications (Priority indications marked P)
- (P) Intra-operative analgesia as part of a balanced technique.
- Treatment of severe acute and chronic pain by various routes and under patient control.
- Analgesia/ sedation in intensive care.

Alternative drugs or techniques
- Alfentanil
- Remifentanil

General Comments
- Fentanyl is 100 times more potent than Morphine and produces respiratory depression in a dose dependent manner. Because of haemodynamic stability fentanyl can be used in very high doses while ventilation is controlled. Muscle rigidity (including chest wall) can occur but is prevented by muscle relaxants. When used in small doses (1-2 micrograms/ kg) fentanyl’s duration of action is 30-60 minutes and this short duration of action is due to redistribution. However when administered in higher doses or following prolonged administration as an infusion the effects last until the drug is eliminated from the body (terminal half life 3.5 hours).
- Alfentanil has a shorter duration of action than fentanyl. Not recommended for post-operative analgesia.
- Remifentanil is used as a continuous infusion for intraoperative analgesia. Not suitable for routine post-operative analgesia.

Essential? Necessary? Critical?
- (E) Widely used opioid to treat intra and post-operative pain and important role in providing analgesia for day case surgery.
- (C) Shortages have been reported.
Opioid analgesics: morphine (1.4.3)

Drug name & formulation
- Morphine 10 mg in 1 ml ampoule
- Enteral solutions

Clinical Indications (Priority indications marked P)
- (P) Analgesia for postoperative, acute and chronic pain by intravenous, subcutaneous or oral administration.
- (P) Sedation as an infusion in critical care, especially neonatal and paediatric units.

Alternative drugs or techniques
- Oxycodone
- Diamorphine

General Comments
- Morphine causes histamine release which may lead to hypotension, rash, itching and bronchospasm. Caution in renal failure due to the accumulation of metabolites morphine-3-glucuronide and morphine-6-glucuronide. Morphine can cause psychological and physical dependence, as well as tolerance, with long-term use. Some patients experiencing unwanted side effects benefit from switching, typically to fentanyl or oxycodone. Oliguric patients are sometimes switched to fentanyl to avoid accumulation of morphine glucuronides. Diamorphine is a suitable alternative when morphine is in shortage, but it is traditionally associated with palliative care.
- While injectables are in shortage, consider enteral administration of opioid analgesics.

Essential? Necessary? Critical?
- (E) Morphine is the most widely used opioid analgesic with long safety record.
- (C) Shortages have been reported.
Neuromuscular blocking drugs: suxamethonium (1.5)

Drug name & formulation
- Suxamethonium 100 mg in 2 ml ampoule

Clinical Indications (Priority indications marked P)
- (P) Used as part of the ‘traditional’ Rapid Sequence Induction [RSI] to produce a rapid-onset, short-acting neuromuscular blockade.
- At lower doses, to relieve laryngospasm and to modify the seizure activity associated electroconvulsive therapy.

Alternative drugs or techniques
- Rocuronium

General Comments
- Suxamethonium is the only depolarising neuromuscular blocking drug in clinical use in the UK. It is structurally related to acetylcholine, and causes a persisting membrane depolarisation by binding to nicotinic receptors at the neuromuscular junction. It is then rapidly hydrolysed by plasma cholinesterase to inactive compounds.
- Suxamethonium is associated with many significant side-effects:
  - Painful muscle fasciculations during the initial depolarisation
  - Post-operative myalgia
  - Bradycardia and ventricular arrhythmias
  - Transient hyperkalaemia which can provoke life-threatening arrhythmias in susceptible patients (renal failure, burns, spinal cord injuries or chronic neuropathies)
  - Raised intraocular pressure
  - Anaphylaxis
  - Prolonged paralysis in patients with congenital or acquired deficiencies of plasma cholinesterase
  - Malignant hyperthermia
- Rocuronium is also used for RSI. With sugammadex immediately available, short duration of action can also be achieved.

Essential? Necessary? Critical?
- (E) The only rapid-onset, short-acting neuromuscular blocking agent used in the UK. It provides superior intubating conditions in the fastest time.
- (C) Shortages have been reported.
Neuromuscular blocking drugs: rocuronium (1.5)

Drug name & formulation
- Rocuronium 50 mg 5 ml ampoule

Clinical Indications (Priority indications marked P)
- Non-depolarising neuromuscular blockade for anaesthesia and to assist controlled ventilation.
- (P) Used as part of the ‘modified’ Rapid Sequence Induction [RSI] to produce a rapid-onset neuromuscular blockade that is rapidly reversible in airway emergencies.

Alternative drugs or techniques
- Vecuronium
- Atracurium
- Cisatracurium

General Comments
- Rocuronium is an aminosteroid non-depolarising neuromuscular blocker which can provide good intubating conditions after 60 seconds. It is secreted unchanged mainly in the bile and the urine. Its elimination and duration of action are prolonged in hepatic dysfunction, but not by renal failure. Rocuronium is comparatively free from side-effects. It causes mild tachycardia at higher doses, but causes no significant histamine release or bronchospasm, and does not accumulate following repeated administration. It has the added benefit of being completely and rapidly reversed by sugammadex. Its major disadvantage is the highest incidence of IgE-mediated anaphylaxis amongst all the neuromuscular blockers.
- Vecuronium is considered a ‘clean’ neuromuscular blocker, with minimal cardiovascular side effects or histamine release and a lower incidence of anaphylaxis. It can be given as a continuous infusion and is not thought to accumulate. Onset not rapid, block reversible with sugammadex.
- Atracurium is a benzylisoquinolinium non-depolarising neuromuscular blocker. Onset is not rapid, and refrigeration is recommended. It can be used as a continuous infusion. It is metabolised by Hoffman degradation and ester hydrolysis via non-specific esterases. Its major side-effect is histamine release when higher doses are used, although atopic or asthmatic patients may be susceptible at lower doses. This can cause cutaneous flushing, bronchospasm and hypotension. Slow injection minimises these effects. Block not reversed by sugammadex.
- Cisatracurium’s principle benefit compared to atracurium is that the potential for histamine release is extremely low with good haemodynamic stability. Lowest incidence of anaphylaxis of all the neuromuscular blockers.

Essential? Necessary? Critical?
- (E) Rapid onset, long acting neuromuscular blocker with minimal side effects; suitable for use as part of a modified RSI; rapidly reversible in the event of airway emergencies.
- (C) Shortages
Neuromuscular blocking drugs: atracurium (1.5)

Drug name & formulation
- Atracurium 50 mg 5 ml

Clinical Indications (Priority indications marked P)
- Medium duration non-depolarising neuromuscular blockade for anaesthesia, and to assist controlled ventilation when lower risk of anaphylaxis is important and Hoffman degradation is a perceived advantage.

Alternative drugs or techniques
- Cisatracurium
- Vecuronium

General Comments
- Atracurium is mixture of 10 stereoisomers owing to the presence of four chiral centres. It is stored at 4 °C to prevent hydrolysis. In high doses in animal models, the metabolic product laudanosine has been shown to cause seizures, but this is at levels far higher than encountered in normal clinical practice.
- Cisatracurium’s principle benefit compared to atracurium is that the potential for histamine release is extremely low with good haemodynamic stability. Lowest incidence of anaphylaxis of all the neuromuscular blockers.
- Vecuronium is considered a ‘clean’ neuromuscular blocker, with minimal cardiovascular side effects or histamine release and a lower incidence of anaphylaxis. It can be given as a continuous infusion and is not thought to accumulate. Onset not rapid, block reversible with sugammadex.

Essential? Necessary? Critical?
- (E) A medium duration blocking agent that is safe in renal and hepatic dysfunction with minimal cardiovascular instability; established clinician familiarity.
Drugs for reversal of neuromuscular blockade: neostigmine (1.6)

Drug name & formulation
- Neostigmine 2.5 mg in 1ml. Also in premix 2.5 mg with glycopyrrolate 0.5 mg in 1 ml for reversal of non-depolarising neuromuscular block.

Clinical Indications (Priority indications marked P)
- (P) Competitive reversal of non-depolarising neuromuscular blockade, primarily at the end of anaesthesia.

Alternative drugs or techniques
- Edrophonium chloride
- Sugammadex
- Extended respiratory support

General Comments
- Neostigmine forms a carbamylated enzyme complex with acetylcholinesterase so that breakdown of acetylcholine at the neuromuscular junction is inhibited. Unwanted muscarinic effects such as bradycardia, bronchospasm and salivation are countered by concurrent glycopyrrolate or atropine.
- Edrophonium is a shorter-acting anti-cholinesterase. When used as an alternative to neostigmine, risk of recurarisation. Sugammadex is only effective against rocuronium and vecuronium neuromuscular block.

Essential? Necessary? Critical?
- (E) Established safety record and clinician familiarity.
Drugs for reversal of neuromuscular blockade: sugammadex (1.6)

Drug name & formulation
- Sugammadex 100 mg/ ml solution for intravenous injection. 2 ml or 5 ml.

Clinical Indications (Priority indications marked P)
- (P) Sugammadex enables the use of rocuronium for high-risk induction of anaesthesia, particularly when suxamethonium is contraindicated.

Alternative drugs or techniques

General Comments
- Sugammadex is a modified gamma cyclodextrin for the reversal of rocuronium and, to a lesser extent, vecuronium. Sugammadex can be used at any point after administration of rocuronium, resulting in full reversal of neuromuscular blockade. It therefore provides the option of using rocuronium instead of suxamethonium in the high-risk patient (e.g.: obese, difficult airway).
- Caution in patients with severe renal impairment, due to uncertainty about excretion of the sugammadex-rocuronium complex. Hypersensitivity reactions, including anaphylaxis, have been reported with its use.

Essential? Necessary? Critical?
- (E) Sugammadex enables the safe use of rocuronium in high risk induction of anaesthesia in situations where suxamethonium is contraindicated.
Antagonists of central and respiratory depression: flumazenil (1.7)

Drug name & formulation
- Flumazenil 100 mcg/ ml 5 ml

Clinical Indications (Priority indications marked P)
- To reverse benzodiazepine-induced sedation

Alternative drugs or techniques
- None

General Comments
- Flumazenil is a GABAA receptor antagonist. The onset of action is rapid and usually effects are seen within one to two minutes. Patients show marked variation in their sensitivity to benzodiazepines and the ability to reverse enables safer use of the sedative.

Essential? Necessary? Critical?
- (E) Rapid reversal of benzodiazepine overdose
Antagonists of central and respiratory depression: naloxone (1.7)

Drug name & formulation
- Naloxone 0.4 mg in 1 ml

Clinical Indications (Priority indications marked P)
- Complete or partial reversal of opioid sedation, including respiratory depression.

Alternative drugs or techniques
- Naltrexone
- Buprenorphine

General Comments
- Naloxone has an extremely high affinity for μ-opioid receptors and can produce rapid onset of withdrawal symptoms if not carefully titrated to effect.
- Naltrexone is structurally similar but has a slightly increased affinity for κ-opioid receptors over naloxone, can only be administered enterally.
- Buprenorphine is a partial agonist and could be used to reduce but not reverse mu receptor stimulation.

Essential? Necessary? Critical?
- (E) It is on the World Health Organization's List of Essential Medicines for the complete or partial reversal of opioid overdose.
Drug for the treatment of malignant hyperthermia: dantrolene (1.8)

Drug name & formulation
- Dantrolene Sodium 20 mg to be reconstituted with water

Clinical Indications (Priority indications marked P)
- (P) Malignant Hyperthermia

Alternative drugs or techniques
- None

General Comments
- AAGBI Safety Guideline recommends 12 vials to be immediately available to provide initial dose of 2.5 mg/kg. Total maximum dose 10 mg/kg, so a treatment may require up to 48 vials. Treatment of acute MH will also require rapid access to ice-cold normal saline 2 l, calcium chloride 10%, sodium bicarbonate 8.4%, glucose 20%, amiodarone 300 mg and a beta-blocker.
- Each vial contains Mannitol 3 g.

Essential? Necessary? Critical?
(E) (N) (C)
Local anaesthetics: lidocaine (2)

Drug name & formulation
- Lidocaine 5 mg/ ml (0.5%) to 20 mg/ ml (2%) solution for injection

Clinical Indications (Priority indications marked P)
- Fast onset local anaesthetic agent
- Vaughan Williams Class Ib anti-arrhythmic
- Intravenous analgesic
- Depress the pressor response to laryngoscopy

Alternative drugs or techniques
- Prilocaine

General Comments
- Lidocaine is an amide local anaesthetic. Prilocaine is also an amide with shorter duration of action. One of the metabolites may precipitate methaemoglobinemia.

Essential? Necessary? Critical?
- The World Health Organization lists lidocaine as an Essential Medicine for basic health care needs.
- It boasts a good safety record, has multiple applications and is very familiar to a whole range of clinicians.
- Lidocaine is the most commonly-used local anaesthetic for infiltration.
- Awake fibreoptic intubation (as well as other similar procedures) relies heavily on this agent.
Local anaesthetics: levobupivacaine (2)

Drug name & formulation
- Levobupivacaine 10 ml ampoules containing 2.5 mg/ ml (0.25%), 5 mg/ ml (0.5%) and 7.5 mg/ ml (0.75%). Infusions in 100 ml or 200 ml bags 625 microg/ ml (0.0625%), 1.25 mg/ ml (0.125%).

Clinical Indications (Priority indications marked P.)
- Slower onset, long acting local anaesthetic agent

Alternative drugs or techniques
- Racemic bupivacaine
- Ropivacaine

General Comments
- Levobupivacaine is an amide local anaesthetic and the levorotatory enantiomer of bupivacaine, which is on the World Health Organization List of Essential Medicines. The levorotatory form binds less avidly to cardiac sodium channels and is less likely to cause cardiac toxicity.
- To dilute solutions add 0.9% Sodium chloride.
- Ropivacaine is a long acting agent with a shorter onset time than and arguably safer profile. It can be used like levobupivacaine for infiltration, peripheral nerve block and in epidural anaesthesia. Compared to levobupivacaine, ropivacaine is slightly less potent (6mg/ml ropivacaine equipotent to 5mg/ml bupivacaine) and has a somewhat shorter duration of action.

Essential? Necessary? Critical?
- (E) A popular agent for long acting peripheral nerve block and epidural analgesia.
- (N) Levobupivacaine is used commonly for epidural anaesthesia for emergency caesarean sections.
Local anaesthetics: hyperbaric bupivacaine (2)

Drug name & formulation
- Bupivacaine with glucose (heavy of hyperbaric bupavacaine) bupivacaine hydrochloride 5 mg/ ml (0.5%) with 80 mg/ ml glucose (specific gravity of 1.026).

Clinical Indications (Priority indications marked P)
- Intrathecal spinal anaesthesia in children and adults undergoing urological, abdominal and lower limb operations (P). It is especially useful for perineal surgery due to the dense saddle block it can offer.

Alternative drugs or techniques
- Racemic bupivacaine
- Hyperbaric prilocaine

General Comments
- An amide local anaesthetic.
- The addition of glucose produces a hyperbaric solution relative to cerebrospinal fluid. Intrathecal spread can be influenced by patient positioning.

Essential? Necessary? Critical?
- (E) (N) One of the recommendations in the recent National Hip Fracture Database Sprint Audit was that hyperbaric bupivacaine should be used where spinal anaesthesia is performed for patients with a fractured neck of femur.
Drug for local anaesthetic overdose

Drug name & formulation
- Lipid emulsion (intralipid 20%)

Clinical Indications (Priority indications marked P)
- (P) Severe local anaesthetic toxicity with cardiovascular or neurological impairment. See AAGBI guidelines.

Alternative drugs or techniques
- 10% solution
- 30% solution

General Comments
- [http://www.aagbi.org/sites/default/files/la_toxicity_2010_0.pdf](http://www.aagbi.org/sites/default/files/la_toxicity_2010_0.pdf)

Essential? Necessary? Critical?
- (E) A unique agent for management of severe local anaesthetic toxicity, to be at hand whenever higher dose local anaesthetic is being administered.
- (N) Life-saving.
- (C) Shortages have been reported (Baxter Pharm).
Anti-emetics: dexamethasone

Drug name & formulation
- Dexamethasone sodium phosphate injection (4 mg/ml 1 ml and 3.3 mg/ml 1 ml or 2 ml)

Clinical Indications (Priority indications marked P)
- Prevention of post-operative nausea and vomiting (PONV).
- (P) Suppression of inflammatory and allergic disorders.
- (P) Treatment of cerebral oedema.

Alternative drugs or techniques
- There is a broad range of anti-emetics of the classes Serotonin antagonists, Dopamine antagonists. Histamine antagonists and Anticholinergics.

General Comments
- In shortage, dexamethasone should no longer be used as a perioperative anti-emetic.

Essential? Necessary? Critical?
- (E) Established safety record and efficacy in reducing risk of PONV by 25%. PONV is one of the most common causes of patient dissatisfaction post surgery and may delay day case patient discharge.
Anti-emetics: ondansetron

Drug name & formulation
- Ondansetron 2 mg/ml ondansetron hydrochloride dihydrate 2 ml or 4 ml.

Clinical Indications (Priority indications marked P)
- The prevention and treatment of post-operative nausea and vomiting (PONV).

Alternative drugs or techniques
- There is a broad range of anti-emetics of the classes Serotonin antagonists, Dopamine antagonists.
- Histamine antagonists and Anticholinergics.
- In shortage of injectables, plan to use enteral route of administration.

General Comments
- In shortage use another injectable serotonin antagonist or consider wide range of anti-emetic alternatives.

Essential? Necessary? Critical?
- (E) Established safety record and efficacy in reducing risk of PONV by 25%. PONV is one of the most common causes of patient dissatisfaction post surgery and may delay day case patient discharge.
Pressors by bolus: phenylephrine

Drug name & formulation
• Phenylephrine 10 mg/ml (1%) 1 ml.
• To be administered intravenously after dilution to at least 1 mg/ml 10 ml.

Clinical Indications (Priority indications marked P)
• (P) Anaesthesia-induced Hypotension

Alternative drugs or techniques
• Epinephrine / Adrenaline
• Norepinephrine / Noradrenaline

General Comments
• Phenylephrine is a synthetic sympathomimetic amine with alpha-agonist effects, causing a rapid rise in systemic vascular resistance via vasoconstriction, and a rise in blood pressure. It has no effect on beta adrenoreceptors. Slightly safer to use in presence of monoamine oxidase inhibitors than indirectly-acting sympathomimetics such as ephedrine and metaraminol, although caution should still be taken. Used primarily perioperatively for general or regional anaesthesia-induced hypotension. Most frequently used as bolus or infusion in obstetric theatre following spinal anaesthesia (P.) and to treat epidural-related post-operative hypotension (P.). Can be safely given as short-term peripheral intravenous infusion.

Essential? Necessary? Critical?
• (E) Established safety record and clinician familiarity.
Pressors by bolus: metaraminol

Drug name & formulation
- Metaraminol 10 mg/ ml (1%) 1 ml.
- To be administered intravenously after dilution to at least 1 mg/ ml 10 ml.

Clinical Indications (Priority indications marked P)
- (P) Anaesthesia-induced Hypotension

Alternative drugs or techniques
- Norepinephrine / Noradrenaline

General Comments
- Indirectly-acting sympathomimetic of longer duration of action. Less tachycardia than ephedrine.

Essential? Necessary? Critical?
- (E) Widely used in the UK with an established safety record and clinician familiarity.
Pressors by bolus: ephedrine

Drug name & formulation
- Ephedrine 3 mg/ ml 10 ml for intravenous injection, 30 mg/ ml 1 ml

Clinical Indications (Priority indications marked P)
- (P) Hypotension in obstetric anaesthesia
- Anaesthesia-induced Hypotension

Alternative drugs or techniques
- Epinephrine / Adrenaline

General Comments
- Ephedrine is a synthetic sympathomimetic with both alpha- and beta-agonist properties, increasing heart rate, force of contraction and blood pressure. Exhibits tachyphylaxis due to its indirect effects, as stores of noradrenaline at nerve endings are depleted.
- Used frequently for hypotension in obstetric anaesthesia as it may maintain uterine/placental blood flow more efficiently than some other sympathomimetics. In shortage, should be reserved for this indication.
- Can be given as an oral preparation in a dose of 30mg in case parenteral route is not available, resulting in a longer duration of action.

Essential? Necessary? Critical?
- Established safety record and clinician familiarity.
Pressors by infusion: noradrenaline

Drug name & formulation
- Noradrenaline (Norepinephrine) 1mg/ ml (as noradrenaline acid tartrate 2 mg/ ml). 2 ml, 4 ml, 20 ml
- Dilute before use

Clinical Indications (Priority indications marked P)
- (P) Antihypotensive agent, by infusion

Alternative drugs or techniques
- Dopamine
- Vasopressin
- Terlipressin

General Comments
- Dopamine causes more tachycardia than noradrenaline.
- Phenylephrine and metaraminol are longer-acting pressors that can be given by intermittent bolus.
- V1 agonists vasopressin and terlipressin are often effective in hypotensive states but safety is not fully assessed.

Essential? Necessary? Critical?
- (E) Hypotension is harmful and norepinephrine is the pressor of choice.
- (C) Shortages are reported.
Pressors by infusion: adrenaline

Drug name & formulation
- Adrenaline (epinephrine) 1:10000 10 ml. Ampoules & prefilled syringes. 1:1000 1 ml for intramuscular/subcutaneous administration, or for dilution before intravenous infusion.
- For patients at risk of Anaphylaxis – “Pen” devices.

Clinical Indications (Priority indications marked P)
- (P) Cardiac arrest situations as part of the Advanced Life Support algorithm.
- For inotropic support in the critically ill with circulatory failure (P) either by intravenous bolus or infusion.
- (P) anaphylaxis.
- Nebulised to reduce symptoms associated with acute upper airway obstruction, post-intubation swelling and infectious croup.
- Prolongs the action of local anaesthetics by decreasing local blood flow.
- Topical haemostatic agent e.g. peptic ulcers during endoscopy.

Alternative drugs or techniques
- Dopamine
- Dobutamine

General Comments
- Adrenaline (Epinephrine) is presented in different concentrations leading to errors of overdose when the stronger is used instead of the more dilute.
- Noradrenaline appears to be as effective as adrenaline in the treatment of cardiac arrest.
- In Critical care practice a combination of noradrenaline and dobutamine is often preferred to adrenaline alone, giving greater control over rate and pressure.
- Dopamine has a mixed alpha and beta profile comparable to adrenaline when infused to raise heart rate and pressure.

Essential? Necessary? Critical?
- (E)
- (N)Life saving
- (C) Shortages reported
Magnesium sulphate

Drug name & formulation
- Magnesium sulphate 2 mmol Mg/ml (50%) 10 ml, 2 ml, 4 ml, 5 ml, 10 ml.

Clinical Indications (Priority indications marked P)
- (P) Seizure prevention and control when caused by pre-eclampsia or eclampsia.
- (P) Severe Tetanus.
- Magnesium sulphate is valued as an adjunctive agent during anaesthesia. Felt to improve analgesia, relaxation and to protect against cardiac arrhythmia.

Alternative drugs or techniques

General Comments
- Hypomagnesaemia is common after surgery and usually corrects itself.

Essential? Necessary? Critical?
- (E) Established safety record and clinician familiarity in a wide variety of contexts.
- (N) Pre eclampsia.
- (N) Severe tetanus.