

# Anaesthesia outside the theatre environment

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## Abstract

Remote anaesthesia is the provision of anaesthesia and sedation outside the theatre environment. The diverse range of locations, procedures and patient groups can provide a challenge to the anaesthesia team. Anaesthetists must maintain the same high standards as in the operating room, which requires appropriate facilities and staff, as well as suitable pre and post anaesthesia care.

**Keywords** Anaesthesia; remote; sedation

**Royal College of Anaesthetists CPD Matrix:** 2A08, 2A10, 2A11, 3A07, 3A15

Remote anaesthesia has dramatically increased in recent years. This increase is due to advances in the rapidly expanding field of diagnostic and minimally invasive procedures, as well as the increased awareness of the anaesthetist's ability to provide optimal conditions in a safe manner. Services are requested at many different locations, for a diverse range of procedures (Table 1). These can range from elective diagnostic procedures to lifesaving emergency interventions. They may last only seconds (e.g. cardioversion) through to all day affairs in the electrophysiology laboratory. The patient population is equally diverse, covering all age groups and comorbidities.

## Challenges

The many challenges in providing safe anaesthesia at a remote location include:

- limited space, lighting or patient access
- monitors and equipment which may be unfamiliar or old
- a lack of piped medical gases, scavenging, and appropriately protected power outlets
- a lack of trained anaesthetic assistance and immediate backup in the event of emergency
- limited or non-existent recovery facilities
- environmental hazards, such as ionizing radiation, magnetic fields, noise, and temperature
- productivity pressure that threatens safety culture.

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## Learning objectives

After reading this article, you should be able to:

- List the locations where remote anaesthesia is performed
- Summarize the various procedures requiring remote anaesthesia
- Identify the challenges associated with remote anaesthesia
- State the requirements for safe anaesthesia at any location

## Minimum standards

It is the responsibility of both the institution and the anaesthetist to ensure that all minimum standards for safe anaesthesia practice, as detailed by the various College and Society guidelines,<sup>1-4</sup> are met. Regardless of site, these standards must be guaranteed for location, personnel, monitoring, equipment, and for pre and post anaesthesia care.

### Location<sup>2</sup>

There are specific requirements for oxygen and power supply, scavenging and suction systems, space, illumination and room temperature. There should be a tilting procedure trolley, and a reliable means of calling for assistance, to ensure that help is readily available without delay.

### Personnel<sup>4,5</sup>

General anaesthesia (GA) requires a trained anaesthetist and a dedicated qualified assistant, both separate to the procedural staff. In some institutions, specially qualified anaesthetic nurses will provide sedation under (remote) supervision of an anaesthetist. It is important in the non-theatre environment that the whole team engages in a checklist or 'time-out' process as introduced by the World Health Organization.

### Monitoring<sup>1,2</sup>

The two basic requirements for all anaesthetics are:

- The continuous presence of an anaesthetist. Where hazards exist (e.g. CT), the anaesthetist may be outside the procedure room with remote observation and monitoring.
- The continuous monitoring of vital signs by the combination of clinical methods and monitoring devices as stipulated by the relevant governing association. For all GAs, pulse oximetry (SpO<sub>2</sub>), non-invasive blood pressure (NIBP), electrocardiography (ECG) and capnography (ETCO<sub>2</sub>) monitoring are the minimum requirements.

Sedation requires a minimum of monitoring of SpO<sub>2</sub>, and when appropriate ECG and NIBP. A recent closed claims analysis highlighted the risks of inadvertent over-sedation with propofol during monitored anaesthetic care at remote sites.<sup>5</sup> Death and permanent neurological injury have occurred despite the use of SpO<sub>2</sub>. Desaturation is usually a late sign of hypoventilation/apnoea, and adequate clinical assessment may be difficult in remote settings. The American Society of Anaesthesiologists recommend the use of capnography monitoring whenever propofol is used.<sup>6</sup> The Royal College of Anaesthetists recommends capnography for all procedures as you would in the operating

### Examples of procedures requiring anaesthesia outside of the operating room

Location	Procedure
Emergency Department (ED)	Assistance for resuscitation Difficult airway management Regional analgesia for short procedures
Radiology Department	Computed tomography (CT) Magnetic resonance imaging (MRI)
Interventional Radiology	
<i>Neurologic</i>	Cerebral aneurysm coiling Arteriovenous malformation embolization Localized thrombolysis and clot retrieval
<i>Vascular</i>	Elective – EVAR, carotid stents Emergency – EVAR, embolization of localized bleeding (e.g. pelvic, abdominal)
<i>Haematology and oncology</i>	CT guided radiofrequency tumour ablation Tumour embolization Bone marrow biopsy
Radiotherapy Department	Radiotherapy of any type
Interventional Cardiology	Percutaneous coronary intervention
Laboratory	Pacemaker or AICD insertion Electrophysiological studies Insertion of closure device for PFO/ ASD/VSD Alcohol septal ablation Transcatheter aortic valve replacement (TAVR) Transcatheter mitral valve replacement MitraClip®
Cardiac Unit/Coronary Care	Electrocardioversion Transoesophageal echocardiography (TOE)
Endoscopy Suite	Upper and lower gastrointestinal (GI) endoscopy, ERCP Bronchoscopy
Psychiatric Hospital	Electroconvulsive therapy (ECT)
Dental Surgery	Dental treatments
Burns Unit	Dressing changes
Urology Suite	Lithotripsy
Obstetric Unit	Labour analgesia

EVAR, endovascular aneurysm repair; AICD, automated implantable cardioverter defibrillator; PFO, patent foramen ovale; ASD, atrial septal defect; VSD, ventricular septal defect; ERCP, endoscopic retrograde cholangiopancreatography.

**Table 1**

theatre environment and this includes those patients under moderate or deep sedation.<sup>4</sup>

General anaesthesia and/or complex procedures require monitoring of a similar standard to that found in the operating

theatre. This includes gas analysis, circuit pressure, invasive haemodynamic, temperature, and neuromuscular monitoring.

#### Equipment, supplies, drugs

There must be adequate equipment, supplies and drugs for both the intended anaesthetic care and potential emergency scenarios. These are ideally standardized across an organization and must include procedures for the appropriate service, stock and expiry date checks. In addition to an emergency resuscitation trolley, the ability to obtain drugs or equipment for treatment of anaesthetic emergencies (e.g. malignant hyperthermia) or procedural complications (e.g. cardiac tamponade) should be in place and readily available. Safe work practices require universal precautions, safe disposal of sharps, and hazard protection.

#### Airway equipment

The possibility of an unanticipated difficult airway mandates there is always sufficient airway equipment to facilitate a multi-step approach for securing the airway. An appropriate range of airway equipment for emergency scenarios should also be readily available. Numerous portable devices for difficult intubation are now on the market, such as intubating LMAs and portable video laryngoscopes. Institutions with a large volume of remote anaesthesia procedures should consider investing in a portable difficult airway case or trolley. Whilst these devices increase the options for known difficult intubations, there will still be patients in whom first securing the airway and/or extubation in a controlled theatre environment is the safest option.

#### MRI equipment

Magnetic resonance imaging (MRI) is used for an increasing number of indications, in both adults and children. There are comprehensive guidelines on safety in MRI units and all staff working in this area must be aware of them.<sup>7,8</sup> MRI safety checklists should be completed prior to working in these environments and pregnant staff should follow the local occupational health policy.<sup>4</sup> Medical equipment is now classified as MRI safe, conditional, or unsafe. The increasing use of more powerful magnets will mandate the use of fully compatible (non-ferromagnetic and radiation shielded) anaesthetic equipment, to ensure normal function and to prevent interference with imaging.

In the event of an adverse event in the MRI room, the patient should be removed as swiftly as possible and managed accordingly.

#### Anaesthetic care

Anaesthetic care ranges from analgesia or light sedation through to GA (Table 2). Beyond the minimum standards, monitoring requirements vary widely, but may be sophisticated for some more complex procedures such as transcatheter aortic valve replacement (TAVR) and endovascular coilings. Regional anaesthesia techniques have an established role in labour suites, but are increasingly used in the setting of the emergency department and ICU. The anaesthetist must have a clear understanding of the patient, the procedure and the environment in order to provide appropriate care. This mandates pre-procedure assessment of the patient, adequate communication with the procedural team, and proper orientation to the site.

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