Patient positioning in anaesthesia

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Abstract

Anaesthesia inhibits a variety of the protective mechanisms which are usually in place to protect us from harm and prevent damage to vulnerable tissues. In addition, anaesthesia may impose physiological stresses on these tissues. Patients are often required to assume positions for surgery which would be intolerable without anaesthesia; these positions may introduce hazards which can lead to injury. Positioning of patients under anaesthesia is an important subject for anaesthetists to consider, since patient positioning has implications upon the patient's physiological responses as well as potentially causing injury to the patient. We describe the considerations for the anaesthetist when positioning the surgical patient. We discuss the positions commonly used for surgical patients and relate the challenges associated with each of these positions; challenges which can be physical as well as physiological. Staffing and equipment provision levels must be commensurate with the degree of physical effort and the complexity predicted in positioning an individual patient. The anaesthetist also needs to consider the relatively restricted access to the patient for intervention when in the prone or lateral positions.

Keywords Positioning; perioperative nerve injury; lithotomy; prone

Royal College of Anaesthetists CPD Matrix: 2A07, 2A11

Learning objectives

After reading this article, you should be able to:

- describe the physiological changes associated with the commonly used surgical positions
- discuss the risk factors for and causes of injury to patients due to positioning
- describe how to reduce the risk of injury to patients due to surgical positioning

Relevance to anaesthetic practice

This topic is frequently visited in the anaesthetic literature since it is a core feature of patient care. Patient and procedural factors continue to result in recognized patterns of injury that are relevant during general anaesthesia and during sedation and regional techniques. Some specific positions are linked to particular mechanisms of injury and are therefore well known and well understood. Positioning considerations may still be relevant in the recovery area and before patients are mobile or self-caring. In addition to regular review of current practices, the adoption of new techniques and equipment should alert practitioners to the need to reassess the risks for patient harm. In positioning there may be conflicting needs between ideal surgical access (optimizing the surgical outcome) and safe positioning (minimizing the risk of injury). All team members involved in moving the patient must be clear on their actions required to achieve the new position. There is a conflict of tasks for the anaesthetist to manage, supervising the physical positioning according to the factors discussed here, while maintaining and monitoring patient physiology and delivering anaesthesia. While positioning takes place, the anaesthetist should be attentive to the vital signs, depth of anaesthesia, fluid administration and heat loss. The employment of an 'ABCDE' checklist after the patient has been repositioned such as that outlined in the NAP5 report may be useful. A plan should be in place for repositioning the patient in the event of a medical emergency where this may require surgery to be interrupted or abandoned.

Equipment, personnel and planning

Before any surgical procedure the World Health Organization checklist should be used to discuss the surgical position and equipment needed to safely position the patient. All equipment should be checked prior to use, the operating table should be checked to ensure that it suits positioning requirements and that in the case of for obese patients the maximum weight capacity of the table should be considered. Accessory equipment used to ensure optimal and safe patient position may include:

- head-ring or head support system
- arm supports and boards
- 'gelpads' and 'sandbags'
- leg supports or stirrups
- fixed supports attachable to operating table (e.g. hip post)
- foam mattress and foam facial support devices (e.g. ProneView™)
- table straps
- vacuum positioning systems
- ample soft material for padding.

It is vital that adequate personnel are available to position patients in order to prevent injury to staff or patient. A team leader (usually the anaesthetist controlling the airway) should be identified, and each team member should have a clearly allocated role. Communication is key; the team leader should give clear instructions prior to any patient reposition. Instructions given such as 'ready, steady, roll' are less ambiguous than 'one, two, three'.

Transfer of patient between trolley and theatre table also requires a co-ordinated approach with an appropriate team and specialized equipment. The Patslide™ is an example of a commonly used device used to reduce friction and transfer patient between beds. In obese patients an inflatable mattress (e.g.

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Hovermatt™) should be used. The inflatable mattress is used in conjunction with an air pump and allows relatively easy transfer of patients weighing 100 kg upwards. It is important to remember that even though an inflatable mattress facilitates transfer by reducing frictional forces; adequate numbers of personnel are required to assist in the transfer. It is possible that on initial inflation, the patient is displaced laterally by an uneven distribution of air. This may result in the patient rolling out of bed if staff numbers are insufficient to support the patient.

Risks of positioning

The risks to patients may be due to the predictable physiological changes attributable to some positions, or from mechanical forces that cause tissue injury. The potential for tissue damage from mishandling or ischaemia should be considered for all patients undergoing surgical procedures under anaesthesia or regional anaesthetic techniques. The factors contributing to injury can be considered as contributors to a final outcome of injury to nerves, musculoskeletal injuries, pressure sores, compartment syndrome or ocular injury.

These contributory factors can be classified as patient factors, mechanical factors or factors relating to anaesthesia (Table 1). It is important to note that injury to patients may occur even without the risk factors described below.

Perioperative nerve injury

The exact incidence of perioperative nerve injury is difficult to define but occurs in an estimated 0.03%–1.4% of patients undergoing surgery. Historical and more recent studies on the subject vary in respect to the population studied, anaesthetic technique, surgical procedures included, patient risk factors and definition of perioperative nerve injury. Some studies have included patients receiving a regional anaesthetic while others have excluded these patients. It is known that perioperative nerve injury occurs in patients irrespective of anaesthetic technique and may occur in patients who have not undergone anaesthesia at all. A regional block technique introduces the possibility of a nerve injury caused by direct trauma from a needle or injection of drugs. However a discussion of the risks of regional anaesthesia is beyond the scope of this article, and should be considered as a separate and additional risk factor for nerve injury.

Common contributing factors to mechanical injury

Patient risk factors	Mechanical factors	Anaesthetic factors
• Gender (M > F) • Obesity • Frailty • Diabetes • Neuropathy • Smoking • Steroids • Vascular disease	• Stretch • Shear • Compression • Sharp trauma • Entrapment • Surface contact – (temperature, electrical burns, skin adhesion)	• Hypoxia • Hypotension • Dehydration • Hypothermia • Electrolyte disturbance

Table 1

The risk of perioperative nerve injury to an individual patient is difficult to quantify since there are so many variables to be considered. It is known, however that some nerve injuries occur more frequently than others, and there are some nerve injuries that are recognized to be associated with specific patient positions. According to the American Society of Anaesthesiologists (ASA) Closed Claims Project Database, perioperative nerve injury is the second most common class of injury associated with anaesthesia accounting for 16% of all claims.

The most frequently reported injuries are:

- ulnar nerve 28%
- brachial plexus 20%
- lumbosacral nerve roots 16%
- spinal cord 13%.

The aetiology of perioperative nerve injury is not well understood and is multifactorial. It is interesting to note that no specific identifiable cause of nerve injury is found in the majority of cases. The symptoms of peripheral nerve injury may present immediately, or may arise slowly over several days. The phenomenon of a 'double crush syndrome' is important to note; a previous compressive lesion along a nerve renders the nerve less tolerant of compression at the same or a second locus.

Despite a poor understanding of the aetiology of nerve injury, it is recommended the anaesthetist pays careful attention patient position, ensures vulnerable areas are well protected and avoids intraoperative hypotension, hypothermia and dehydration. Whilst this approach is important for all patients, even more caution should be applied for patients with predisposing risk factors such as pre-existing peripheral neuropathy.

If nerve damage is suspected after surgery, early neurological assessment is recommended. Investigations including electromyography, nerve conduction studies and magnetic resonance imaging may be helpful in detecting and evaluating injuries.

Pressure sores

Pressure sores occur over bony prominences, especially when pressure has been applied for a long period of time. A reduction in tissue perfusion can lead to ischaemia and necrosis. The elderly and frail and those with poor nutritional status are especially at risk. Careful positioning, padding and regular assessment are important to prevent the development of pressure areas.

Eye injury

Eye injury may occur in any surgical position; the incidence of corneal abrasion under anaesthesia has been estimated as 0.034%–0.17%. It may occur as a result of injury to the cornea from drapes, facemasks and hard materials or chemical injury from surgical skin prep. Corneal abrasions have also been noted to occur in the unclosed and non-blinking eye; a reduction of tear flow which results in dry eyes being a contributory factor. Commonly tape is applied to the eyelids in order to close the eye and protect the patient from corneal abrasions (tape is more protective than applying ointment alone). The risk of injury to the eye in the prone position will be discussed later.