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Perioperative considerations for robotic-assisted thoracic surgery

Robotic-assisted thoracic surgery is being offered to more patients because it has a number of potential benefits. Awareness of the challenges that this type of surgery brings will allow teams to manage these patients safely in the perioperative period.

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Robotic-assisted thoracoscopic surgery is increasingly being used for lung resection and mediastinal lesions, as a result of improvements in surgical outcomes and postoperative recovery, and a focus on improving outcomes in lung cancer. Robotic surgery allows a minimally invasive approach to surgery, with avoidance of thoracotomy, while providing enhanced surgical precision. Patients with increasingly complex conditions are being offered robotic-assisted thoracoscopic surgery, which presents unique challenges in the perioperative period.

Preoperative assessment and suitability for robotic-assisted thoracic surgery

Patient selection for robotic-assisted thoracoscopic surgery considers the suitability of a lesion for minimally invasive surgery and the potential risks of surgery and anaesthesia to the patient. Robotic-assisted thoracoscopic surgery may reduce postoperative complications, pain, and length of stay compared to other techniques (Kent et al, 2023). However, longer surgical times, need for lung isolation, and the physiological insult of carbon dioxide insufflation into the chest cavity mean that some patients may be unsuitable for this procedure. Hypercapnia and acidosis can occur, risking complications in patients with pulmonary hypertension or those with intracranial lesions as a result of raised intracranial pressure. Cardiovascular changes can also occur with carbon dioxide insufflation, causing severe hypotension and reduction in cardiac output. Therefore, patients with severe valvular disease, unstable coronary artery disease or poor left ventricular function may not be suitable for robotic-assisted thoracoscopic surgery. Patients who have had previous chest radiotherapy, trauma or surgery may be unsuitable because of the presence of adhesions.

Patients should be carefully selected following appropriate investigations, including pulmonary function testing, electrocardiogram, assessment of functional capacity and echocardiography or angiography where indicated. Enhanced recovery pathways are recommended as they reduce hospital length of stay, postoperative complications and readmission rates (Khoury et al, 2021).

Intraoperative considerations

Robotic-assisted thoracoscopic surgery requires lung isolation to facilitate visualisation within the thoracic cavity. This is usually achieved with double lumen tube placement. Bronchial blockers with a standard endotracheal tube can be used where indicated, but these can be difficult to manage in robotic-assisted thoracoscopic surgery as they are prone to migration, and may not allow optimal lung isolation or suctioning. A flexible bronchoscope should be used to visually confirm the position of the device used. Gas insufflation to create positive pressure in the thorax can lead to hypercapnia, which is difficult to manage on one-lung ventilation as a result of reductions in minute ventilation. Significant respiratory acidosis can occur, which can cause potential rises in intracranial pressure and pulmonary vascular resistance.

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Care must be taken with patient positioning to minimise injury. The lateral decubitus position is usually used with flexion of the table, or a supine position with tilt may be used in mediastinal surgery. Supports such as padding and suction beanbags should be used to maintain positioning and protect pressure areas. The head and neck must also be positioned carefully to prevent migration of airway devices as this can interrupt oxygenation, ventilation and lung isolation, and interferes with surgical access which risks complications. Intraoperative warming can be difficult as patients lose heat quickly from the chest cavity. Forced air warming devices and fluid warmers should be used alongside temperature monitoring. Hypothermia may worsen acidosis and lead to an increased risk of bleeding and complications.

Use of robotic equipment severely restricts access to the patient, so care should be used to ensure tubing, lines and devices are secured before robot docking. Wide-bore venous and arterial lines should be sited, as robotic-assisted thoracoscopic surgery risks damage to great vessels and can lead to cardiac injury with potential for rapid haemorrhage. Positioning of any double lumen tube or bronchial blocker should be reconfirmed, and the device well secured to prevent displacement. Access to the airway should be maintained. Owing to the robotic arms, any patient movement can cause injury, so adequate neuromuscular blockade must be provided. The surgeons will be seated at a remote console, and the need to undock the robot can create a delay in emergency situations, so teams should have protocols for emergency undocking procedures with potential for conversion to thoracotomy if needed. These procedures should be rehearsed and ideally practiced as part of training.

Conclusions

The popularity of robotic-assisted thoracoscopic surgery is increasing, with advantages including improved surgical outcomes, reduced postoperative pain and earlier discharge. However, robotic-assisted thoracoscopic surgery creates physiological and logistical challenges that teams need to be aware of to manage patients safely in the perioperative period.

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