Anaesthetic Management of a Large Thoracic Mass Resection in a Setter

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Clementina graduated from the Camerino University in Italy in 2013. She subsequently completed a rotating internship in Naples followed by a year in Italy working in a referral practice. She joined the Anaesthesia team at Pride Veterinary Centre as an Anaesthesia Intern in 2017 and particularly enjoys critical care and clinical anaesthesia in small animals.
History

Maebh, an 8-year-old spayed female Red Setter was referred to the Internal Medicine Service of Pride Veterinary Centre with a history of hypothyroidism and distended abdomen. Pre-referral diagnostics revealed a possible thoracic mass and hypercalcemia.

Investigations and diagnosis

On admission Maebh had a moderate increase in respiratory effort. Cardiac auscultation was made difficult by the thoracic mass significantly displacing the heart from its normal position. A computed tomography (CT) scan under general anaesthesia showed a large, well margined mediastinal mass that exerted a severe mass effect over the intrathoracic organs (Figure 1). FNA and Tru-cut biopsies were carried out under ultrasound guidance. Results from these samples confirmed the mass as thymoma. Thymoma is an uncommon canine neoplasm of thyme epithelial cells and is classified as invasive or non invasive. The paraneoplastic hypercalcemia is rare and is reported in 5% of canine thymoma.

Surgical management

As Maebh’s condition was stable, surgical excision of the mass was scheduled one week after the initial referral. On the day of the surgery her blood type was checked in anticipation of intraoperative haemorrhage. A sternotomy was performed. The large, neovascularised mass was resected with harmonic scalpel and individual ligation.

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Sayaka graduated from The Royal Veterinary College in 2009 and subsequently undertook a rotating internship, followed by a 3 year residency in a referral centre in the UK. During her residency she visited some institutions in the UK as well as in Belgium, Switzerland and France. There were always something new to learn and take away from each place she visited!

Sayaka worked as a clinical anaesthetist for a year before joining the team at Pride Veterinary Centre in 2016. She gained the Diploma of the European College of Veterinary Anaesthesia and Analgesia later in 2016.

Figure 1 Transverse and saggital CT images of Maebh’s thorax showing a large thymoma compressing other organs.
Dorsally the mass was attached with the mediastinum and the adhesion was removed digitally. There was no adhesion with the pericardium or lungs. Significant haemorrhage occurred during the dissection which was successfully controlled. At the end of the surgery, a chest drain and an esophagostomy tube were placed.

Anaesthetic management

Maebh was pre-oxygenated before anaesthesia, premedicated with methadone and induced with propofol and ketamine. These are rapid onset anaesthetic drugs that allow quick intubation to achieve immediate control of the airways. During clipping and skin preparations Maebh was kept in sternal/lateral recumbency. This was to avoid postural hypotension and lung collapse caused by the mass compressing the cranial vena cava (CrVC). A second IV catheter was inserted.

TIVA (total intravenous anaesthesia) was used to achieve a stable anaesthetic plane, to provide better hemodynamic stability, and to avoid potential leakage of volatile agent into the thoracic cavity and subsequent environmental pollution. In addition, an opioid CRI (alfentanil) was used to provide analgesia.

Once the chest is opened the lungs collapse to a smaller volume. Positive pressure ventilation is essential in open chest surgeries. Maebh was ventilated from the beginning of the surgery with a positive end expiratory pressure (PEEP) of 5 cmH2O. The PEEP is used to mitigate end-expiratory alveolar collapse and thereby reducing the ventilation-perfusion mismatch.

Complications

Maebh maintained a good saturation of oxygen while she was in sternal recumbency and she breathed spontaneously during the preparation. As soon as she was placed in dorsal recumbency in theatre the SpO2 dropped rapidly to 77%. Mechanical ventilation was started which promptly improved the oxygenation. SpO2 remained >90% through the rest of the anesthesia.

The dorsal recumbency also caused a compression on the CrVC and resulted in a mild hypotension. This was treated with crystalloids fluid bolus administration with intent to increase the circulating volume. The surgical dissection around the tumor was associated with massive haemorrhage. In order to replace the intravascular volume loss, crystalloid and colloid boli were given followed by a packed RBC transfusion. Haemorrhage was controlled and haemodynamic stability was achieved.

Postoperative management and outcome

Maebh recovered in ICU where she was monitored closely overnight. Her chest was drained every 4 hours. Maebh’s pain

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**Figure 2** Green arrowheads highlighting the internal thoracic artery associated with the thymoma.
management consisted of methadone every 4 hours, intrapleural bupivacaine every 6 hours, paracetamol every 8 hours and a lidocaine patch was placed on the surgical site. She was also kept on dexmedetomidine CRI overnight for analgesia and mild sedation. Over the following week analgesic drugs were gradually tapered down. Maebh recovered well and we were pleased to send her home.

**Discussion**

Hypotension and acute hemorrhage were two of the major complications encountered during this procedure.

The treatment of hypotension should be aimed at the probable cause. In our case, physical compression on the CrVC by the thymoma severely impeded venous return and reduced the stroke volume (SV) when Maebh was turned onto her back. Based on the equations: Cardiac output (CO) = heart rate (HR) x SV, and Blood pressure (BP) = CO x systemic vascular resistance (SVR), we aimed to increase the circulating volume (and therefore SV) with the administration of a rapid fluid bolus.

The thoracic CT showed a marked neovascularization of the thymoma (Figure 2) and significant haemorrhage occurred intraoperatively (Figure 3). Blood loss during surgery could be insidious until approximately 15 – 20% of the circulating volume is lost when the cardiovascular reflexes kick in. Large volume haemorrhage leads to circulatory collapse and impaired tissue oxygenation due to poor perfusion. The priority in managing acute haemorrhage is to control the bleeding while simultaneously maintaining circulating volume. While crystalloids serve as a cornerstone of volume resuscitation, addition of colloid solutions provide advantage by remaining in the intravascular space longer and therefore maintaining the volume expansion. A recent study by Hammond et al. (2014) in dogs with spontaneous hemoperitoneum showed that a limited fluid volume resuscitation with hypertonic saline and colloid fluids result in a more rapid cardiovascular stabilization compared to the conventional resuscitation with large volume of crystalloid.

The surgical control of bleeding was not easy to achieve, and Maebh still showed sign of tachycardia, reduced arterial pressure and pale mucose membrane at the end of crystalloid and colloid bolus. Based on the volume of blood in the suction pot we estimated the blood lost to be over 15% of the circulating volume. At this point we made the decision to transfuse packed red blood cells, which was fortunately tolerated well by Maebh and significantly improved her cardiovascular stability. Additionally, the teamwork of the surgical team (the surgeon, anaesthetists and support staff) was essential in the smooth running of the operation. Effective communication increased efficiency and the speed of successful mass resection (Figure 4).

**Figure 3** Intraoperative image of the thymoma elevated from the thorax, associated with haemorrhage.

**Figure 4** Chest cavity after thymoma was resected.

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