Use of pleural access ports for treatment of recurrent pneumothorax in two dogs

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Case Description—An 8-year-old castrated male mixed-breed dog (dog 1) and a 13-year-old spayed female mixed-breed dog (dog 2) were evaluated because of spontaneous pneumothorax.

Clinical Findings—Both dogs had decreased bronchovesicular sounds with coughing, tachypnea, cyanosis, lethargy, or a combination of these clinical signs. Radiographic examination revealed pneumothorax in both dogs and consolidation of a lung lobe in dog 2. Pneumothorax was alleviated following thoracocentesis in both dogs but recurred.

Treatment and Outcome—Dog 1 was initially treated by placement of a thoracostomy tube but underwent thoracotomy when pneumothorax recurred after tube removal; left caudal lung lobectomy was performed because a ruptured bulla was suspected, and a pulmonary bulla was histologically confirmed. Dog 2 underwent thoracotomy with left caudal lung lobectomy and partial removal of the left cranial lung lobe; diffuse pulmonary emphysema was diagnosed. This dog underwent a second surgery for right caudal lung lobectomy because of torsion. When pneumothorax recurred and additional surgery was not considered feasible, pleural access ports were placed in both dogs for repeated removal of air from the thoracic cavity. Ports were used clinically for 17 days in dog 1 and 14 days in dog 2. Dog 1 successfully underwent another surgery when pneumothorax recurred 18 days after port placement but was euthanized 17 months later when dyspnea and tachypnea recurred. Pneumothorax had not recurred further in dog 2 twenty-three months after port placement.

Clinical Relevance—Findings suggested that pleural access ports may have a role in the management of spontaneous pneumothorax in dogs. (J Am Vet Med Assoc 2012;241:467–471)
was identified near the center of the ventral surface of the left caudal lung lobe. The pinpoint-sized lesion was surrounded by a focal area of erythema. A presumptive diagnosis of ruptured bulla was made. A complete left caudal lung lobectomy was performed. Silk suture was used for individual ligation of the associated artery, vein, and bronchus prior to transection with Metzenbaum scissors. Examination of the remainder of the thorax revealed no additional abnormalities. The median sternotomy was closed with 18-gauge orthopedic wire in a figure-of-8 pattern placed circumferentially around the sternum and skin were closed routinely. A thoracostomy tube was placed and managed as described.

Following removal of 120 mL (3.5 mL/kg [1.6 mL/lb]) of air 2 hours after surgery, aspiration was attempted every 4 hours, but no air or fluid was removed from the tube. Evaluation of thoracic radiographs 48 hours after surgery confirmed that pneumothorax had not recurred. After 4 days of hospitalization and removal of the thoracostomy tube as described, the dog was discharged to its home environment. Carprofen* (3.0 mg/kg [1.4 mg/lb], PO, q 24 h) and tramadol (3.0 mg/kg, PO, q 8 h) were prescribed for 10 days. Histologic evaluation of surgically excised tissues confirmed the presence of a ruptured pulmonary bulla.

Dog 1 was again returned to the referral hospital 5 days after discharge because of dyspnea, inappetence, and lethargy. Radiographic examination of the thorax revealed recurrence of pneumothorax. Exploratory thoracic surgery with or without advanced diagnostic imaging was recommended to the owner but was declined because of financial constraints. As a less expensive alternative, the dog was anesthetized as described, and a pleural access port was placed through a miniapproach to the left eighth intercostal space. Following aseptic preparation of the surgical site, a 5-cm skin incision was made over the dorsolateral aspect of the tenth rib. Mosquito hemostats were used to advance the fenestrated catheter tubing cranially through the subcutaneous tissue to introduce the catheter tubing through the eighth intercostal space. Approximately 15 cm of catheter tubing was advanced into the pleural space of the left thorax. The injection port was attached to the end of the catheter tubing and secured with the connecting device. Metzenbaum scissors were used create a subcutaneous pocket cranial to the incision over the tenth rib. The injection port was secured to the left dorsal thoracic muscle fascia within the subcutaneous pocket by use of nonabsorbable, 2-0 monofilament suture material. The subcutaneous tissue was closed with absorbable, 3-0 monofilament suture material in a simple interrupted pattern, and the dermis was closed with nonabsorbable, 3-0 monofilament suture material in a cruciate pattern. A 22-gauge Huber-point needle was advanced through the skin and the septum of the injection port, and the air was removed.

The dog returned for a scheduled recheck evaluation at the same referral hospital 7 days after pleural access port placement. No signs of respiratory distress were observed; however, moderate to severe subcutaneous emphysema involving the thoracic, abdominal, and right inguinal regions was detected. The dog was then returned to the referral hospital every 3 days for 10 days, and clinicians used the pleural access port to aspirate 520 to 2,800 mL (15.2 to 82.1 mL/kg [6.9 to 37.3 mL/lb]) of air at each visit. For each use of the port, skin overlying the injection port was scrubbed with antiseptic soap and rinsed with 70% alcohol. A 22-gauge Huber-point needle was advanced through the skin and the septum of the injection port, and the air was removed.

Eighteen days after pleural access port placement, the dog was again evaluated at the referral hospital because of severe dyspnea and cyanosis. Evaluation of thoracic radiographs revealed a moderate left-sided pneumothorax and left-sided subcutaneous emphysema.

On the basis of the suspicion of a ruptured pulmonary bulla or a leaking bronchus after the previous surgery, a left-sided intercostal thoracotomy (sixth intercostal space) was performed under general anesthesia as described for exploration of the thoracic cavity. The left cranial lung lobe was inspected for any sign of ruptured bullae, and none were observed. The thoracic cavity was filled with warm sterile saline solution to check for air leakage, and ventilation pressures were increased to 20 mm Hg; no air leakage was detected. The entire left cranial lung lobe was removed; silk suture was used for ligation of the artery, vein, and bronchus prior to transection with Metzenbaum scissors. The thorax was again filled with saline solution, and no air leakage was found. Routine closure of the intercostal thoracotomy was performed by use of absorbable monofilament sutures placed in an interrupted, circumferential pattern. Subcutaneous tissue and skin were closed routinely. Aspiration was performed via the pleural access port that evening, and 1,740 mL (51.0 mL/kg [23.2 mL/lb]) of air was removed along with 30 mL of fluid. The dog was discharged 48 hours after surgery. Postoperative pain medications were prescribed as described. Cephalexin (29.0 mg/kg [13.2 mg/lb], PO, q 8 h) was prescribed for 7 days.

Seven days after lateral thoracotomy, results of a scheduled recheck examination were unremarkable. The pleural access port remained in place, but no additional removal of air was required. The dog was evaluated again at the Cornell University Hospital for Animals 17 months after pleural access port placement because of dyspnea and tachypnea. Euthanasia was elected without further diagnostic evaluation or treatment.

A 13-year-old 15.0-kg (33.0-lb) spayed female mixed-breed dog (dog 2) was referred to Carolina Veterinary Specialists for evaluation because of pneumothorax and presumptive pneumonia. The dog was being treated by the referring veterinarian for iatrogenic hypoadrenocorticism, following treatment with mitotane4d...
Thoracocentesis was performed; 500 mL of air was removed from the left hemithorax, and 240 mL (16 mL/kg [7.3 mL/lb]) of air was removed from the right hemithorax. Radiographic examination after thoracocentesis revealed that the pneumothorax had mostly resolved, but consolidation of the lung lobe persisted. The dog was discharged from the hospital with amoxicillin-clavulanic acid (16.7 mg/kg, PO, q 12 h) for 14 days. Pneumothorax recurred 8 days later, and the dog was referred to Carolina Veterinary Specialists for surgical consultation.

At the referral hospital, physical examination findings included intermittent cough and decreased bronchovesicular signs dorsally. Supplemental oxygen was provided, and IV administration of crystalloid fluids was initiated at a rate of 2.5 mL/kg/h. The dog was then premedicated with hydromorphone (0.1 mg/kg, SC) and midazolam (0.2 mg/kg, SC). General anesthesia was induced with propofol (4.0 mg/kg, IV) and maintained with isoflurane in oxygen delivered via endotracheal tube, and a median sternotomy was performed. Cefazolin (22.0 mg/kg [10.0 mg/lb], IV) was administered preoperatively. The left caudal lung lobe and the caudal part of the left cranial lobe were partially collapsed and did not inflate fully with positive pressure ventilation. All of the lung lobes appeared mildly emphysematous. Warm sterile saline solution was poured into the thoracic cavity to reveal air leakage from the lung parenchyma; none was found. Removal of the left caudal lung lobe and the caudal portion of the left cranial lung lobe was performed because of the partially collapsed appearance of both lung lobes. A vascular stapling device was used for ligation of the artery, vein, and bronchus; transection was performed with a No.15 blade. A thoracostomy tube was placed through the eighth intercostal space prior to closure. Closure of the median sternotomy was performed as described for dog 1. Aspiration of air via the thoracostomy tube was attempted as described every 4 to 8 hours after surgery, with no air produced. The thoracostomy tube was removed as described 48 hours after surgery. The dog was discharged after 3 days of hospitalization. Tramadol (3.3 mg/kg [1.5 mg/lb], PO, q 8 h) was prescribed for 10 days, as well as amoxicillin-clavulanic acid, as described, for 7 days. Histologic evaluation of the excised tissues revealed pulmonary atelectasis with generalized emphysema.

Fourteen days after median sternotomy, the dog was reevaluated because of increased respiratory effort and coughing. Evaluation of thoracic radiographs revealed severe, bilateral pneumothorax. Given that surgical removal of additional lung tissue was not feasible, a pleural access port was placed. A 4-cm dorsoventral skin incision was made over the ninth intercostal space on the left side, and a subcutaneous pocket was made just caudal to the skin incision. The port injection hub was secured to the underlying fascia within the subcutaneous pocket by use of nonabsorbable, 2-0 monofilament suture material. The fenestrated catheter tubing was introduced into the pleural space through the left seventh intercostal space by use of small hemostats. The tubing was connected to the port hub and secured with the provided connecting device. Subcutaneous tissue over the port was closed with absorbable 3-0 suture and staples. The port was accessed by use of a 22-gauge Huber-point needle, and 300 mL (20.0 mL/kg [9.1 mL/lb]) of air was removed from the pleural space. A soft, padded bandage was placed over the thorax and port site. The dog was discharged from the hospital the following day. Amoxicillin-clavulanic acid was prescribed as described for 7 days.

Beginning 4 days after placement of the pleural access port, the dog was reevaluated 7 times, every 1 to 2 days, because of cough and restlessness. The port was accessed by the attending surgeon (AKC) or an emergency clinician, and ≤ 735 mL (≤ 49 mL/kg [22.3 mL/lb]) of air was aspirated on an outpatient basis. With removal of air from the port, clinical signs were resolved. The port was accessed and flushed in a manner similar to that described for dog 1. At 1 visit, thoracic radiographs were obtained and moderate pneumothorax was detected, but negative pressure was present when aspiration was attempted via the port. Routine thoracocentesis was performed for removal of 1,800 mL (120 mL/kg [54.5 mL/lb]) of air. Two days later, heparinized saline solution was used to flush the pleural access port, a clog was dislodged, and 733 mL of air was removed. Radiography repeated 14 days after port placement revealed no signs of pneumothorax (Figure 1). At the time of follow-up evaluation 23 months after port placement, pneumothorax had not recurred further.
Discussion

Spontaneous or idiopathic pneumothorax occurs when air enters the pleural space in the absence of a traumatic or iatrogenic cause.\(^1,2\) The most common cause of idiopathic pneumothorax in dogs is pulmonary blebs or bullae; however, the source of air leakage is often not identified during physical examination or via thoracic radiography.\(^3,4\) Initial treatment of idiopathic pneumothorax usually involves stabilization of the patient with supplemental oxygen administration as well as the use of thoracocentesis or placement of a thoracostomy tube for thoracic drainage. Additional imaging with CT or MRI may help to reveal the cause of pneumothorax. Conservative treatment with thoracocentesis or thoracostomy tubes is often unsuccessful, with a recurrence rate of approximately 50%.\(^5\) Therefore, the use of pleural access ports is not recommended as a first-line treatment. Definitive treatment is surgical, involving the removal of the diseased portions of lung (partial or complete lung lobectomy).\(^5\) Results of surgical treatment vary; the authors of 1 study\(^1\) reported excellent results in 12 dogs, with no recurrence of pneumothorax. However, recurrence of pneumothorax after definitive treatment of spontaneous pneumothorax in dogs has been reported.\(^6\)

For some owners, financial constraints may preclude multiple surgeries in dogs that have recurrent pneumothorax. In some patients, removal of large portions of lung during initial surgical treatment can also preclude additional surgery. For these dogs, an alternative method for long-term treatment of pneumothorax must be used. Mechanical pleurodesis, involving intraoperative abrasion of the pleural surfaces, has been reported to prevent recurrence of spontaneous pneumothorax in dogs.\(^7\) A recent report described the use of blood pleurodesis in a dog with persistent pneumothorax following diaphragmatic hernia repair. Other forms of chemical pleurodesis, including the use of talc or tetracycline antimicrobials, have also been reported.\(^1,5,8\) However, short- and long-term complications of pleurodesis can include signs of pain, bacterial infection, recurrence of air leakage from the lungs, and tension pneumothorax. In the dogs described in the present report, pleural access ports were successfully used in situations where additional surgery was postponed because of financial concerns (dog 1) or was prohibited by previous extensive removal of lung tissue (dog 2).

The use of pleural access ports has been reported in the treatment of recurrent pleural effusion in dogs.\(^7\) To the authors’ knowledge, the present report is the first to describe the use of permanent subcutaneous pleural access ports for management of recurrent pneumothorax in dogs. In dog 1, the port was used clinically for a period of 17 days, allowing the owner time to raise funds for additional surgery. In dog 2, the port was functional for 14 days, after which pneumothorax resolved and thoracocentesis was no longer required. In both instances, use of the port was palliative, and definitive treatment was discussed at length with the owners prior to port placement. However, access to the pleural space through the port eliminated the need for repeated thoracocentesis or thoracostomy tube placement.

In the dogs described in the present report, a port designed specifically for drainage of pleural fluid was used.\(^\text{b}\) The port hub is similar to that of a vascular access port, specifically designed for use with a Huber-point needle to allow for repeated puncture of the rubber diaphragm. Unlike a vascular access port, the catheter tubing with a pleural access port is fenestrated to allow for increased drainage over a larger surface area within the pleural space. A previous report\(^7\) of pleural access port use described a port constructed by use of a vascular access port hub connected to Jackson-Pratt drain tubing, a construct that was created prior to the widespread availability of the pleural access port.

Pleural access ports are simple to place in a minimally invasive surgical procedure. No intraoperative complications were encountered in the 2 dogs of the present report. Postoperative complications in dog 1 included the development of subcutaneous emphysema, which resolved within 14 days. Subcutaneous emphysema may have been prevented in dog 2 by placement of a soft, padded bandage after port placement. In dog 2, difficulty in aspirating the port was encountered but was overcome by flushing with heparinized saline solution. Reported complications of pleural access port use for treatment of pleural effusion include infection and partial obstruction.\(^2\) Signs of infection were not observed in either of the dogs of the present report. Although aspiration of air via the port was consistently performed in both dogs at referral hospitals, in the authors’ opinion, use of the port by the owners or referring veterinarians is feasible.

The use of a pleural access port for treatment of recurrent pneumothorax has several potential benefits. Following postoperative healing, use of the port eliminates inflammation and potential pain associated with repeated thoracocentesis or placement of a thoracostomy tube. Because the port is implanted subcutaneously, the risk of ascending infection is minimized. Placement and use of pleural access ports can be performed on an outpatient basis, and owners and general practitioners can be instructed on their use. Evaluation of this type of device in a larger population of canine patients is required to accurately de-
termine its efficacy in treatment of pneumothorax. However, findings in the dogs of the present report suggested that these ports may provide successful, palliative treatment of pneumothorax in dogs when surgical treatment is not an option.

a. Famotidine, Baxter Healthcare Corp, Deerfield, Ill.
c. Pleural Port, Norfolk Vet Products, Skokie, Ill.
d. Lysodren, Bristol-Myers Squibb Co, New York, NY.
f. TA Premium 30, United States Surgical, Norwalk, Conn.

References

Sectional anatomic and magnetic resonance imaging features of the head of juvenile loggerhead sea turtles (Caretta caretta)
Alberto Arencibia et al

Objective—To compare anatomic features of cross-sectional specimens with those of MRI images of the heads of loggerhead sea turtles (Caretta caretta).

Animals—5 cadavers of juvenile female loggerhead sea turtles.

Procedures—Spin-echo T1-weighted and T2-weighted MRI scans were obtained in sagittal, transverse, and dorsal planes with a 0.2-T magnet and head coil. Head specimens were grossly dissected and photographed. Anatomic features of the MRI images were compared with those of gross anatomic sections of the heads from 4 of these turtles.

Results—In the MRI images, anatomic details of the turtles’ heads were identified by the characteristics of signal intensity of various tissues. Relevant anatomic structures were identified and labeled on the MRI images and corresponding anatomic sections.

Conclusions and Clinical Relevance—The MRI images obtained through this study provided valid information on anatomic characteristics of the head in juvenile loggerhead sea turtles and should be useful for guiding clinical evaluation of this anatomic region in this species. (Am J Vet Res 2012;73:1119–1127)