How to Manage Axillary Wounds

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1. Introduction
Axillary wounds are common in horses and often result from a traumatic insult, which may include running into a stationary object or being impaled by a sharp object, such as a fencepost or stick; or kick injuries from other horses. At first, these wounds may appear to be relatively minor; however, they must be monitored carefully because they can result in severe complications. The most common complication is the development of subcutaneous emphysema. The importance of subcutaneous emphysema is that it can lead to pneumomediastinum and eventually pneumothorax, which can be life-threatening. Infection is another complication of these wounds. Initial management of axillary wounds can affect what complications may develop.

2. Materials and Methods

Clinical Assessment
Clinical assessment begins with evaluation of the general condition of the horse and a thorough physical examination, including temperature, heart rate, respiratory rate, intestinal borborygmi, and evaluation of mucous membranes. The patient should then be sedated for full evaluation of the wound. After cleaning the surface of the wound with warm water and povidone iodine solution, sterile gloves should be worn to palpate the wound. The depth and direction of the wound should be determined. Potential involvement of the elbow joint, cranial mediastinum, and cranial thorax should be evaluated.

Treatment
Once the extent of the wound has been determined, it should be cleaned, debrided, and lavaged. The overuse of high-pressure lavage should be avoided to prevent further dissemination of contaminants into deep fascial planes. Methods to lavage the wound include the use of a catheter-tipped syringe or a 35-mL syringe with an 18-gauge needle on the end (Fig. 1). Lavage should be performed with povidone iodine solution diluted in water. After the wound is cleaned, a sterile gauze or laparotomy sponge should be packed into the wound. Packing the wound is important because it will prevent air from migrating into the subcutaneous fascial planes. At this point, an initial attempt at partial primary closure to appose the edges of the wound may be attempted; however, dehiscence should be expected. The closure can be performed in two layers: the first layer should attempt to close any muscle and fascial layers and the second layer to close the skin. An opening in the wound closure should be left for the sterile gauze packing to be changed. After partial primary closure is performed, stay sutures can be placed with non-absorbable suture material to create a lattice, to shoe-string–tie a stent in place over the wound. After the stent is place, a “figure 8”
The horse should be administered flunixin meglumine (1.1 mg/kg, q 12 h, IV) and broad-spectrum antibiotics. A tetanus toxoid should also be administered. To help avoid progressive accumulation of air within the soft tissue, limiting movement is indicated. Therefore, the horse should be on strict stall rest until the wound is healed. The horse can be allowed to lie down, but if he rolls or is very active in the stall he should be cross-tied to prevent excessive movement.

The bandage should be changed every 24 to 48 hours or as needed, on the basis of the amount of drainage and condition of the bandage. The wound should be lavaged and cleaned at each bandage change and new sterile gauze packing inserted into the wound. To promote granulation tissue formation, topical medications can be applied to the gauze before it is packed into the wound. Additionally, 15 to 30 mL of procaine penicillin G (300,000 IU/mL) can be applied to the gauze to provide local administration of antibiotics.

Secondary Complications
Subcutaneous emphysema may develop as a secondary complication. Subcutaneous emphysema may not be present on initial evaluation of the horse; it develops as air progressively accumulates in the subcutaneous tissue as the wound acts as a one-way valve. Once the source of the subcutaneous emphysema has been addressed, residual subcutaneous emphysema is usually self-limiting and rarely requires additional treatment. However, if the subcutaneous emphysema is extensive and the risk of complications from the amount of subcutaneous emphysema is high, small intravenous catheters may be inserted subcutaneously to aspirate some of the air. Inserting subcutaneous catheters is not without its own potential complications (ischemia of overlying skin, local infection); therefore, this technique should only be performed when deemed necessary to prevent complications from subcutaneous emphysema. Additionally, the horse’s temperature should be monitored because the subcutaneous emphysema has an insulation-like effect. At warmer times of the year or in warm climates, there is a potential for serious hyperthermia.

When subcutaneous air dissects through the muscle layers and fascial planes into the mediastinum, pneumomediastinum ensues. A diagnosis of pneumomediastinum is based on radiographic findings. Otherwise, pneumomediastinum in the horse is often clinically silent and there is no specific treatment beyond treatment of the underlying cause. Cases should be monitored for complications including pneumothorax, impairment of venous return to the heart, and rupture of the mediastinal pleura, which has been reported in humans but is yet to be reported in horses.

If pneumomediastinum progresses, it can result in pneumothorax and specifically a tension pneumothorax. Tension pneumothorax occurs when a flap of skin or soft tissue acts as a one-way valve, allowing air into the cavity on inspiration but preventing its escape on expiration. This is a rapidly progressive form of pneumothorax that classically consists of progressive respiratory distress, tachycardia, hypotension, and absent lung sounds. Delays in the development of pneumothorax are commonly encountered; therefore, serial evaluations should be performed to identify progressive changes in pulmonary function. Radiographs or ultrasound can be used to confirm the diagnosis. However, when subcutaneous emphysema is present, ultrasound has limited diagnostic value to evaluate a pneumothorax.
Pneumothorax can be unilateral or bilateral. The development of bilateral pneumothorax should be considered because the mediastinum of horses is generally described as incomplete, having small fenestrations in the caudal and ventral portions of it. Diagnostic radiographic features of bilateral pneumothorax include complete absence of pulmonary parenchyma and hyperlucency in the caudodorsal lung fields and retracted dorsal margins of both right and left lung lobes. Diagnostic features of unilateral pneumothorax include retraction of one lung margin and visualization of the vessels in the contralateral lung. Ultrasonographic diagnosis is based on a static, hyperechoic line that does not move with the respiratory cycle. The presence of subcutaneous emphysema may limit or prevent ultrasonographic examination because the ultrasound waves will not penetrate the subcutaneous air.

Pneumothorax that is causing respiratory distress or is severe on radiography should be treated. Aspiration of air from a dorsally located chest trocar in the 12th to 15th intercostal space is therapeutic. The chest trocar is placed midway between two adjacent ribs at the level of the ventral aspect of the tuber coxae (Fig. 3). Intravenous catheters may also be used to aspirate air from the thorax. The decision to use a catheter versus a chest trocar is based on the clinician’s expectation of the pneumothorax resolution. A catheter is appropriate if the clinician expects the pneumothorax to resolve after aspirating the air one time, but, if not, a chest trocar is more appropriate because it can be sutured in place and used for repeat aspiration. Furthermore, if the pneumothorax does not resolve with passive aspiration of air through a chest trocar, suction may be applied. If suction is used, a low negative pressure is preferable to minimize re-expansion pulmonary edema/hemorrhage; alternatively a system that uses the three-bottle technique should be used. Removal of the chest trocar is based on the clinical condition of the horse and radiographic evidence of pneumothorax resolution. Pneumothorax may be treated conservatively if the horse does not show signs of respiratory distress and there is a mild pneumothorax on radiographic evaluation.

3. Results

Medical records from seven horses with a diagnosis of an axillary wound that were examined at Texas A&M University Veterinary Teaching Hospital (VMTH) were reviewed. Ages ranged from 8 months to 16 years and included four geldings, one mare, one colt, and one stallion. All seven cases presented to the hospital with subcutaneous emphysema. The time between wound occurrence and development of subcutaneous emphysema was able to be determined in five of seven cases (3.2 ± 0.84 days; range, 2–4 days). In the remaining two cases, the development of subcutaneous emphysema was recorded as “progressive.” Radiographs were taken in five cases. Pneumomediastinum was diagnosed in three cases and suspected in two cases. A bilateral pneumothorax was diagnosed in three cases and a unilateral pneumothorax was diagnosed in one case. Treatment at the VMTH was similar across all cases. All wounds were initially cleaned, explored, packed, and bandaged. All patients received non-steroidal anti-inflammatories (NSAIDs) and antibiotics. The antibiotics that were used included trimethoprim sulfa (30 mg/kg, q 12 h, PO), procaine penicillin G (22,000 IU/kg, q 12 h, IM) in combination with gentamicin (6.6 mg/kg, q 24 h, IV) and chloramphenicol (50 mg/kg, q 6 h, PO). Phenylbutazone (2.2 mg/kg, q 12 h, PO) and flunixin meglumine (1.1 mg/kg, q 12 h, IV) were the NSAIDs chosen for pain management. Treatment to relieve subcutaneous emphysema was performed in two cases. In one case, 14-gauge hypodermic needles were inserted subcutaneously over the shoulders bilaterally to release air, and, in the other case, incisions were made lateral to the withers to allow air to escape from the subcutaneous space. Three of the four cases with pneumothorax were treated by aspiration of the air from the pleural cavity. In each of these cases, chest trocars were placed bilaterally in the caudodorsal thorax. All patients survived to discharge.

4. Discussion

An important finding of this study is recognition that there is a repeatable association between equine axillary wounds and the development of secondary complications. These complications include the development of subcutaneous emphysema, pneumomediastinum, and pneumothorax. On the basis of the results of this study, subcutaneous emphysema develops to a clinically significant extent approximately 3 days after injury and progresses extensively if the primary cause is not treated.
Another important finding of this study is that optimal treatment of axillary wounds should include packing and sealing the wound with a sterile laparotomy sponge or gauze that is changed daily until healing by second intention occurs. Primary closure is insufficient to prevent secondary complications. Restriction of movement and close monitoring are necessary to limit the occurrence and severity of complications.

References and Footnote


*Pleur-evac, Chest Drainage System, Teleflex, Research Triangle Park, NC 27709.*