Air Medical Journal 36 (2017) 45–48

Contents lists available at ScienceDirect

Air Medical Journal

journal homepage: http://www.airmedicaljournal.com/

Case Review

Case Study in Critical Care Transport: A 51-Year-Old Male With Ludwig Angina

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A critical care transport air medical team was dispatched to a local community hospital to transport a 51-year-old man with facial swelling to a tertiary medical center with oral surgery services not available at the sending hospital. He required rapid transport and time-dependent intervention.

Upon the arrival of the flight team, the sending physician reported that the patient developed dental pain in his right posterior molar approximately 10 days ago. He has had progressive pain and swelling of the right side of his face since that time. He saw a dentist 2 days ago who drained a tooth abscess and started him on amoxicillin. He had been taking this prescribed antibiotic faithfully for the last 48 hours. However, his swelling and erythema worsened despite appropriate therapy and now spread to under his jaw to his right lateral neck as well as down to his anterior chest (Fig. 1). Earlier today, he presented to the community hospital because of a decreased appetite, fevers at home, and hoarseness. At the community hospital, the physician administered acetaminophen for the treatment of a fever of 101.2°F and intravenous clindamycin (900 mg intravenously) for the noted infection.

When the transport team questioned the patient, he stated that he had significant dysphagia. He was able to manage his secretions, but with any swallowing, he had significant discomfort. He has not been drooling. Upon examining the patient, staff noted that he not only had significant trismus (difficulty opening and closing his mouth) but also had discomfort flexing or extending his neck because of pain and swelling. His position of comfort was noted to be directly erect when seated on the stretcher, but his airway was stable at that point without appreciable stridor. He had a normal pulmonary examination. His pulse oximetry was 98% on room air. When the transport team attempted to lay the patient flat to facilitate transfer to the stretcher, he began to cough and choke on his secretions. Because of concern for deterioration of his airway during transport, the flight staff felt it would be prudent to intubate the patient before taking the patient into the out-of-hospital environment. Additionally, if the patient had to be taken out of the upright seated position during the course of transport, this would allow the appropriate manipulation of his position. The emergency department staff was willing to facilitate this process before leaving their unit.

On his physical examination, the flight team identified that the patient could open his mouth to approximately 2 fingers (± 3 cm) and had a grade II Mallampati score. Additionally, he had a large right peritonsillar abscess. Given these findings including significant trismus, neck immobility, and expected upper airway obstruction, the team identified that this patient would be a difficult airway. Thus, the decision was made to pursue an awake nasotracheal intubation. The patient was topically anesthetized with atomized 4% lidocaine in his bilateral nares and posterior oropharynx. A nasal trumpet was coated in viscous lidocaine and was placed in the left naris. Ketamine and rocuronium were drawn up and held at the bedside. The patient was given 2 mg midazolam for anxiolysis. He was then fiberoptically intubated with a 6.0 endotracheal tube without complication. After the tube was placed, ketamine and rocuronium were administered, and the patient was started on propofol and fentanyl infusions for transport. Sedation was aggressively titrated to maintain patient comfort and protect his airway en route. During the course of transport, no complications ensued.

Hospital Course

When the patient arrived at the receiving facility, he was immediately taken for a computed tomographic scan and was found to have a large sublingual abscess and soft tissue gas consistent with partial Ludwig angina with extension into the pretracheal space and mediastinum (Fig. 2A and 2B). Additional antibiotic coverage was immediately broadened with the administration of vancomycin and piperacillin/tazobactam. The patient was then emergently transported to the operating room with oral surgery for an incision and drainage of the abscess. Because of its size and location, a drain was placed (Fig. 3).

The patient was again taken to the operating room on hospital day 2 with otolaryngology staff for orotracheal intubation and further drainage of the deep space abscesses. Several additional drains were actually placed at this time as well. The patient continued to be febrile with elevated leukocytosis in the intensive care unit and was taken back to surgery on hospital days 7 and 10 for further management. Antibiotics in the form of clindamycin were continued, and near continuous wound irrigation occurred greater than 6 times per day. Because of the prolonged airway compromise secondary to the deep space infection, a tracheostomy was performed on hospital day 12. The

1067-991X/$36.00

http://dx.doi.org/10.1016/j.amj.2016.12.007

Figure 1. Submandibular swelling and cervical erythema noted at the time of transfer to the tertiary medical center consistent with Ludwig angina.

patient was weaned off of the ventilator and was able to ambulate independently. He was transferred to a short-term rehabilitation facility on hospital day 17 and was discharged from the facility to his home.

Discussion

Deep neck space infections (DNIs) are increasingly rare in the postantibiotic era. However, it is important for critical care transport providers to be aware of these disease processes because they can rapidly progress to life-threatening sequelae. DNIs typically arise from the spread of dental or tonsillar infections and are most commonly observed in patients aged 30 to 50 years.[1] Complications include progression to sepsis; carotid sheath infection; jugular thrombophlebitis (Lemierre syndrome); mediastinitis; and, most relevant to transport, significant airway compromise.[1,2] Providers may be called to transport these patients to tertiary referral centers so an understanding of this disease process and management is critical to caring for this patient population.

Epidemiology

Ludwig angina is a bilateral infection of the submandibular space (including submylohyoid and sublingual spaces) first described by Wilhelm Frederick von Ludwig in 1836. Two thirds of these infections develop via odontogenic spread from second or third mandibular molars with the rest occurring from peritonsillar abscesses, suppurative parotitis, or idiopathic sources.[2] Once established, the infection is rapidly progressive and can spread to the parapharyngeal space, retropharyngeal space, and mediastinum[3] (Fig. 4).

Presentation

Patients typically appear systemically ill with significant sublingual swelling, stiff neck, dysphagia, and muffled/"hot potato" voice. Signs including drooling, stridor, dyspnea, and a forward leaning posture are concerning for imminent airway compromise.[1,4,5] Trismus is usually absent but when present is concerning for spread into the parapharyngeal space[1] and thus the possibility of further deep space infection. Spread into these deep neck spaces not only leads to further airway compromise but also creates the potential for the development of complications such as carotid sheath infection, jugular thrombophlebitis, and mediastinitis.[1,2]

Implications for Medical Transport: Airway Considerations

Sublingual swelling causes superior and posterior displacement of the tongue, which is further complicated by lingual swelling. Occasionally, inflammation can spread directly to the epiglottis.[1] Each of these anatomic features place patients in the "difficult to ventilate, difficult to intubate" category. Peritonsillar/parapharyngeal spread of disease is of particular concern because airway trauma during intubation may cause rupture of an abscess into the oropharynx and subsequent aspiration.[6]

Laryngeal mask airway (LMA) placement may be a temporary option in these patients if they have sufficient mouth opening. However, LMAs have many drawbacks and should rarely be used for definitive airway management because distorted pharyngeal anatomy may cause a poor mask seal,[4] placement can lead to abscess rupture, and expected progression of airway swelling can still lead to loss of the airway despite LMA placement. In recent years, the use of supraglottic airway adjuncts has also been a useful tool. However, in patients with this diagnosis, airway distortion continues to remain a concern. Because of significant swelling and deep space abscess development, devices may not seat appropriately in the posterior pharynx, precluding the ability to oxygenate and ventilate the patient accordingly.

Blind nasotracheal intubation has a very poor success rate in these patients because of distorted airway anatomy.[7] Subsequent airway trauma from blind nasotracheal intubation increases the risk of abscess rupture and the progression of edema, culminating in complete loss of the airway.[8] This technique is currently not recommended by professionals who master the art of airway management.

In the early stages of disease and/or in patients without a profoundly distorted anatomy on examination, induction and paralysis may overcome potential trismus and allow for orotracheal intubation.[5] One case series of 10 cases reported a 90% success rate of orotracheal intubation in carefully selected patients.[5] However, in later stages of disease, induction and paralysis may precipitate complete airway obstruction and the inability to ventilate[9] because of the loss of muscle tone and resultant collapse of airway structures.

Thus, the preferred airway management recommendation by most experts is to complete an awake fiberoptic intubation with ready access to surgical