CLAVICULAR OSTEOMYELITIS: A RARE COMPLICATION OF HEAD AND NECK CANCER SURGERY

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Abstract: Background. We report the 10th case in the English-language literature describing clavicular osteomyelitis that presented after radical treatment for laryngeal carcinoma and discuss the pertinent diagnostic and therapeutic measures. It presented a diagnostic dilemma. The differential diagnosis included tumor recurrence, metastatic bone disease, and post-radiotherapy complications.

Methods and Results. A 45-year-old man who was a heavy smoker and known drug abuser presented with acute airway compromise and was diagnosed with squamous cell carcinoma involving the glottis and subglottis. Total laryngectomy, total thyroidectomy, and bilateral neck dissection were performed, and the patient underwent chemoradiotherapy. On follow-up 1 year later, the patient was seen with left stomal dehiscence and a large area of cellulitis extending across the left clavicle and down to the axilla. At surgery, a large anterior chest wall abscess was found. Biopsy showed no evidence of tumor. After aggressive treatment, the patient remains disease free.

Conclusions. This condition is rarely encountered after major head and neck surgery. Aggressive surgical debridement and antibiotic therapy remains the mainstay of treatment. Prompt diagnosis and treatment are mandatory due to the potential life-threatening complications associated with the condition. Bony resection will aid in adequate flap placement.

Keywords: clavicular osteomyelitis; head and neck surgery; radiotherapy; pectoralis major flap

Clavicular osteomyelitis is a rare but important entity that should be familiar to all head and neck surgeons as a potential complication. Involvement of the clavicle in an infective process is exceptional and usually secondary to spread of infection from adjacent areas, often associated with some predisposing factors such as head and neck surgery, radiation therapy, subclavian vein catheterization, or immunosuppression in transplant patients.1 Aggressive surgical attention is of primary importance, and appropriate antibiotic therapy will assist in complete recovery.2 A literature search using Medline was performed in which only 9 previous case reports of clavicular osteomyelitis have been documented after head and neck cancer surgery, none of which describe life-threatening hemorrhage as a complication. This process developed after major surgery and chemoradiation for squamous cell carcinoma of the glottis. We report the case of a patient with clavicular osteomyelitis associated with head and neck surgery, and describe the complications associated with this condition along with our management issues. We discuss its possible pathogenesis, differential diagnosis, and therapeutic options.
In May 2005, a 45-year-old man admitted to the Accident and Emergency Department was seen with acute airway compromise. The patient was a heavy smoker and a known drug abuser. He proceeded to undergo a tracheostomy under local anesthesia, followed by laryngoscopy which revealed a bulky glottic tumor causing severe airway obstruction. Biopsies revealed invasive moderately differentiated squamous cell carcinoma. CT and positron emission tomography scans showed a T4N0M0 tumor involving the glottis and subglottis. A total laryngectomy, with total thyroidectomy and bilateral selective neck dissections, was performed. The patient underwent adjuvant chemoradiotherapy consisting of 6 weeks of cisplatin and 34 sessions of 70 Gy. The patient continued to smoke cigarettes, marijuana, and heroin directly through the stoma. He denied cocaine abuse.

On routine outpatient follow-up 1 year after treatment, a wound dehiscence on the left side of the stoma was noticed. Biopsies showed inflammatory tissue only with no evidence of recurrence. A barium swallow showed no evidence of a pharyngocutaneous fistula. On review 1 month later, he complained of worsening pain and swelling around the left stomal dehiscence and over the head of the ipsilateral clavicle. On examination, there was a large area of cellulitis extending from the stoma, across the left clavicle, and over the left chest down to the axilla. Purulent secretions were evident in relation to the stomal dehiscence. The patient was admitted and a CT scan of the neck and mediastinum performed. This showed marked irregularity of the parastomal soft tissues on the left. The clavicle showed poor definition of the cortical margins with marked lucency consistent with osteomyelitis. Intraosseus gas was also evident (Figure 1). At this time, no abscess was evident. Broad spectrum, intravenous antibiotics were commenced and repeat biopsies performed. Again, these showed no evidence of malignancy. The patient’s general condition continued to decline, so he was brought to the operating room for exploration of the dehiscence under anesthesia. At surgery, a huge anterior chest wall abscess extending from the stoma to the left axilla was found. In addition, the soft tissues covering the medial half of the clavicle were necrotic, and the clavicle itself appeared discolored and moth-eaten. The clavicle was freely mobile from the sternum. Drainage of the anterior chest wall abscess was performed through the open neck wound, and also through a separate incision in the axilla. Extensive surgical debridement of the affected soft tissues and curettage of the necrotic bone was also performed (Figure 2). Cultures from the drainage grew *Staphylococcus aureus*, and blood cultures grew *Streptococcus milleri*. Further biopsies were taken; these once again revealed nonspecific inflammatory tissue with no evidence of tumor. During treatment with high-dose intravenous antibiotics (flucloxacinil 2 g, 4 times daily; benzylpenicillin 2.4 g, 3 times daily; and clindamycin 500 mg, 3 times daily), the patient suffered a massive hemorrhage from his left innominate vein. He underwent emergency surgery in which the hemorrhage was controlled with nylon sutures, under the guidance of our cardiothoracic colleagues. Because of the extensive bony sequestration, the medial end of the left clavicle was resected. Pus was noted within the clavicle after resection. Cultures of the clavicle grew...
Escherichia coli. A contralateral pectoralis major pedicled flap was used to cover the dehiscent area. Proper placement of the flap into the base of the dehiscent area was impeded by the sternum, and left first and second costal cartilages, leaving a potential space between the base of the dehiscence and the flap. Thus, there was inadequate protection of the local vessels. Two weeks later, the patient suffered another large hemorrhage on the ward. He underwent emergency surgery again to control the bleeding. The manubrium and first 2 costal cartilages were resected, and adequate placement of an ipsilateral pectoralis major flap was achieved. The patient subsequently developed bilateral pleural effusions requiring bilateral chest drains, followed by acute respiratory distress syndrome. However, 2 years after his initial presentation with laryngeal carcinoma, he remains well and disease free.

DISCUSSION
The clavicle is an exceedingly rare site for osteomyelitis, and hence, there is no consensus in the literature on its etiology or management. It has been reported following central line, and Swan-Ganz catheter placement. However, infection may also occur from hemogenous dissemination, spread of contiguous infection, or direct traumatic seeding of bacteria. Risk factors include prior radiotherapy, immunosuppression, systemic bacterial infection, and loss of periosteal integrity. Patients with head and neck cancer are often malnourished, and this, coupled with alcohol and tobacco abuse, leads to small vessel disease and delayed wound healing. Piazza et al stated that clavicular osteomyelitis appears within days to weeks of surgery. Our case differs from this in that initial presentation was 12 months after surgery. This may be explained by our patient's persistent drug abuse, and hence, debilitated state. Pharyngocutaneous fistula may lead to direct seeding of oral flora in a wound bed. Hypothyroidism, associated with laryngectomy and radiotherapy, may lead to delayed wound healing and increased risk.

Garnick et al described the pathogenesis of osteomyelitis. Blood supply to the bone is compromised secondary to an inflammatory reaction, which leads to increased intraosseous pressure. Purulence dissect the periosteum from the bone, furthering the vascular compromise. Bony necrosis serves as a nidus for further bacterial involvement. Garnick et al also describes chronic osteomyelitis in the setting of persistent infections secondary to the presence of sequestered bone.

Gerszten et al discussed the epidemiology of osteomyelitis and found that the most common bacteria found in osteomyelitis is Staphylococcus aureus. Other common organisms include Klebsiella and Staphylococcus epidermidis. Winslow and Meyers found that osteomyelitis related to head and neck surgery may be positive for Streptococcus, Bacteroides, and Escherichia coli, and that blood cultures are positive in 50% of patients.

Presentation of clavicular osteomyelitis is acute, with fever and swelling of the affected shoulder and arm. A history of local surgical procedures, with or without radiation, may be elicited. Diagnosis is based on laboratory and radiological findings. In patients with head and neck cancer, of paramount concern is recurrence of malignancy. Biopsies are essential, as are cultures from the affected area. Our patient underwent 3 separate biopsies, which revealed inflammatory tissue only. Probert et al stated that a differential diagnosis should include sternoclavicular arthritis, osteoradionecrosis, aseptic necrosis, bony metastases, and primary clavicular neoplasms, although exceedingly rare.

Gold et al discussed the importance of radiology in confirming the diagnosis. Conventional plain films show a diffuse periosteal reaction, bone rarefaction, and lytic lesions. Sequestra and sclerosis appear later. CT may delineate abscess formation and subcutaneous or intraosseous gas formation. MRI may be helpful if the diagnosis is uncertain and may be helpful in distinguishing cellulitis from osteomyelitis. According to Jacobson et al, the 3-phase bone scan helps distinguish soft tissue inflammation from bony involvement, although the false-positive rate is high. Its specificity in postoperative patients remains imperfect.

The literature agrees that aggressive and early treatment is strongly indicated. Treatment is aimed at eradication of infection to prevent serious consequences such as sepsis, mediastinitis, and hemorrhage from the great vessels. Intravenous antibiotics should be instituted as soon as the diagnosis is suspected and continued for 4–8 weeks. Wide local debridement is the mainstay of treatment. Clavicular osteomyelitis often involves the sternoclavicular joint and this area should be explored surgically to ensure eradication of the infection. Total excision of the clavicle causes no functional disability and ensures that devascularized bone does not act as a nidus for further infection. Flap coverage of the
defect may be required. Additional coverage between the stoma and the clavicle will protect the great vessels and provide necessary bulk. As seen in our case, torrential hemorrhage with exposure of the great vessels is a realistic and serious consequence of the infective process. We learned that bone should be resected to allow adequate flap placement, and this should be performed at the first opportunity.

Prevention is paramount. Sternoclavicular skeletonization should be avoided during stomato-plasty. Subclavian catheterization should be avoided in conjunction with head and neck surgery where possible, as bacterial seeding may occur where the periosteum is damaged due to repeated attempts at cannulation.4

CONCLUSION

Clavicular osteomyelitis is a rare complication of major head and neck surgery. Its frequency increases in those who have received radiotherapy and present predisposing factors. Early diagnosis and aggressive medical and surgical treatment are indicated to prevent potentially life-threatening complications. Bony resection should be performed early to allow adequate flap placement.

REFERENCES