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Local muscle flaps minimize post-operative wound morbidity in patients with neoplastic disease of the spine

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ABSTRACT

Objectives: Patients with neoplastic disease involving the spine either from primary or metastatic disease present a unique challenge given these patients' frequent poor nutritional status at the time of surgery, the delivery of early post-operative chemotherapy or radiation, and placement of large amounts of hardware and avascular bone graft into a wound bed that is atrophic, previously operated or irradiated. As a result, wound morbidity has traditionally been high in this cohort of patients. Herein we review the outcomes of patients at our institution who underwent local muscle flap closure following spinal tumor extirpation.

Patients and Methods: Between 2007 and 2017, 55 patients with oncologic disease of the spine underwent 60 spine surgeries and concomitant muscle flap reconstruction. Charts were retrospectively reviewed for diagnosis and indications for surgery, as well as risk factors for poor wound healing including diabetes, steroid use, body mass index (BMI), history of pre-operative chemo and or radiation therapy, preoperative albumin and hemoglobin levels. Outcomes were postoperative wound related complications including surgical site infection, wound dehiscence and/or need for reoperation.

Results: 60 reconstructions were included in 55 patients. Median follow up was 253 days. Paraspinous muscle flaps were used in all cases. There were 2 major complications (3.3%) related to wound infections which required reoperation and 10 minor wound complications (16.7%), of which 9 were subcutaneous seromas aspirated in the office, that did not require return to the operating room. Median postoperative stay in the hospital was 10 days. Closed suction drains placed at the end of the reconstruction were removed at a median of 17.5 days. Regression analysis found patient BMI to be a significant risk predictor for wound related post-operative complications.

Conclusions: Post-operative wound specific complications that required return to the operating room were uncommon despite the high-risk profile of this subset of patients. These data indicate that muscle flap closure should be routinely practiced in this high-risk cohort of patients.

1. Introduction

Neoplasms involving the spine, either primary or metastatic, present a challenging problem for the surgeon. Although primary malignancy of the spine is relatively rare and ranges between 5–10% of all bone tumors, the incidence of metastatic cancer to the spine in patients who died of malignant disease is reported to be as high as 30.6% [1–3]. The limited lifespan remaining for many patients with metastatic disease of the spine and the poor post-operative outcomes reported in the literature may temper the desire for surgical treatment [4]. Current indications for surgical intervention for neoplastic disease of the spine include progressive neurologic deficit, intractable pain, spinal instability or pathologic fracture, malignancies resistant to radiotherapy or need for histologic diagnosis [5]. Surgical intervention for patients with symptomatic disease recalcitrant to non-operative management has shown to improve quality of life even with limited life expectancies (depending on the primary tumor) [6].

Closure of spinal wounds after extirpation of a spinal neoplasm poses a challenge as these patients are at high risk for postoperative complications given their frequent co-morbidities, high frequency of radiation and/or chemo therapy, requirement for instrumentation and placement of large amounts of avascular bone graft [7]. Additional known risk factors for post-operative wound complications are pre-existing cerebrospinal fluid leak, instrumentation, and greater than six

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operated spinal levels [8–12]. The rate of postoperative complications in these complex cases is reported in the literature to be as high as 30–40%, with surgical-site infection being the most common complication [7,13]. Postoperative wound complications not only increase patient morbidity, often resulting in re-operation, hardware removal and/or failure to fuse, but also can cause critical delays in the delivery of adjuvant therapy and have been shown to lead to prolonged hospital stay, increased health care costs and decreased quality of life [14–18].

Although traditionally the plastic and reconstructive surgeon has been consulted for soft tissue coverage of the spine only after the occurrence of complications from the index procedure, an increasing body of literature indicates that coverage of the reconstructed spinal levels with vascularized muscle flaps at the initial procedure significantly reduces post-operative complications and associated patient morbidity [7,14].

At our institution, close collaboration between the spine and reconstructive surgeons has been standard over the last decade. In order to determine the effects of immediate flap reconstruction in this morbid cohort of patients, we conducted a review of 60 cases over 10 years at a single institution and compared these patients' outcomes to historical controls.

2. Materials and methods

We performed a retrospective review of all patients who underwent resection of a spine-associated tumor (either primary or metastatic) between January of 2007 and March of 2017 who also had immediate coverage with local muscle flaps by a plastic surgeon. Fifty-five patients with 60 reconstructions involving either primary or metastatic neoplasms of the spine using local muscle flaps were included. In each case the paraspinous muscle was mobilized from the overlying muscle layers to allow for advancement and closure in the midline (Fig. 1). When there was significant tension on closure, or in order to allow for improved obliteration of dead space by muscle imbrication, longitudinal paraspinal fasciotomies were performed. Depending on the anatomic location, wound conformation and availability, the superficial muscle layer (trapezius, latissimus dorsi and thoracolumbar fascia) was mobilized as a second layer of vascularized coverage. Following muscle dissection and flap closure, the overlying fasciocutaneous tissues were closed in three layers with absorbable suture (Fig. 2). Closed suctions drains were placed both deep to the paraspinal closure as well as between the fasciocutaneous tissues and the superficial muscle flaps and drain entry sites covered with CHG containing dressings. If obligatory durotomies were made or there was concern for a CSF leak, drains were placed on gravity drainage. Drains were left in place until output dropped below 30cc/24 h.

Intraoperative details collected included pathology of the tumor, number of vertebral levels involved, incidence of postoperative wound complications such as infection, seroma, dehiscence and/or need for reoperation. Additional patient variables such as BMI, smoking history, diabetes mellitus, steroid use, preoperative chemotherapy/radiation, as well as pre-operative hemoglobin and albumin levels were analyzed. Wound complications were defined as major and minor; major wound complications were defined as return to the operating room, while all non-operative complications (e.g. superficial wound breakdown, seroma, non-operative SSI) that were treated on an outpatient basis were classified as minor. Regression analysis was performed to evaluate for any association of patient demographics or operative factors with post-operative complications.

3. Results

Of the 60 reconstructions, 50 (83%) were prophylactic meaning that there was no evidence of an active infection or cerebrospinal fluid leak at the time of muscle flap reconstruction. Of the 55 patients included in this series, 36 were male (65%) and 19 were female (35%). Four

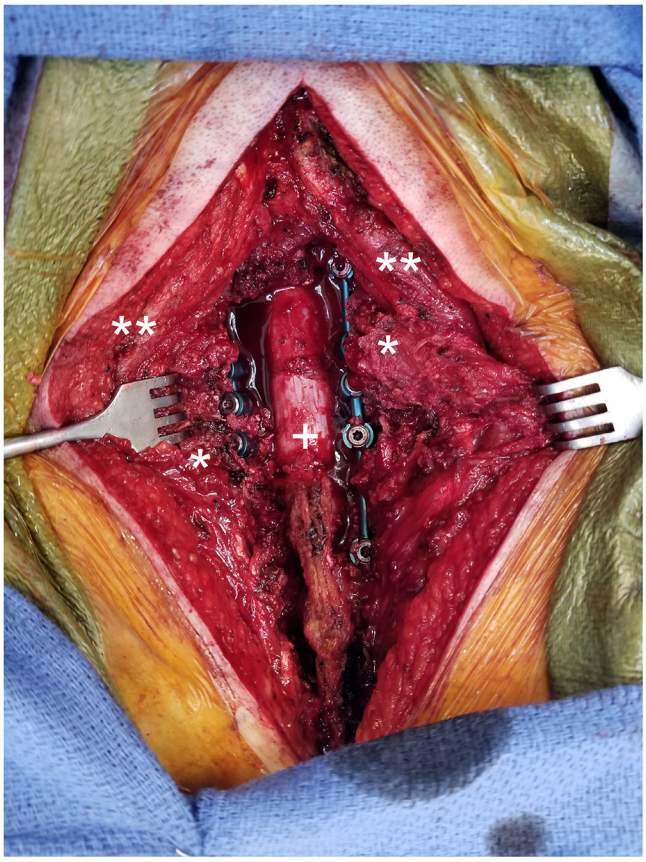

Fig. 1. Image depicting open spinal wound of patient who underwent posterior approach for extirpation of a cervical spine chordoma at C3 with C3-C6 laminectomy and C2-T2 segmental instrumentation. (+) marks the exposed chord following laminectomy with close-by hardware.
(*) paraspinous muscle layer adjacent to vertebral column and spinal hardware. (**) marks dissected trapezius muscle at the level of distal cervical spinal column. A drain is placed between the instrumentation and spinal cord (+) and the paraspinous muscle layer (*).

patients had additional surgeries of the spine, with one patient undergoing two operations adding up to a total of 60 spine surgeries with reconstruction by a Plastic Surgeon. The mean age at operation was 55.2 ± 17.3 years. Patient mean body index was 25.4 ± 5.7 kg/m^2. Co-morbidities included diabetes mellitus (13%), CAD (8%), HTN (47%), steroid use (28%), history of active tobacco use (30%), history of paralysis (15%) and history of extremity weakness (60%). The majority of patients were classified as ASA 2 (20%) and ASA 3 (72%), with only 2% of patients classified as ASA1 and 3% ASA 4. Preoperatively, hypoalbuminemia (albumin level < 3.5 g/dl) was present in 53% of patients and anemia (hemoglobin < 10 g/dl) in 27%. Twenty-one patients presented with primary neoplasm of the spine (38%), while 34 patients (62%) had metastatic disease. In 22 cases the patients had prior spine surgery (37%), 27 cases (45%) underwent pre-operative radiation therapy and 30 cases (50%) had pre-operative chemotherapy. Patient demographics and risk factors are summarized in Table 1.

Paraspinous muscle flaps were used in all 60 reconstructions, latissimus dorsi in 22 (37%), trapezius flaps in 25 (42%), and thoracolumbar fascia in 4 (7%) reconstructions. In the majority of cases, more than one type of muscle flap was used, with sixty-seven percent of our reconstructions performed with paraspinous muscle flaps plus one extrinsic superficial muscle layer and thirteen percent with paraspinous muscle flaps plus two extrinsic superficial muscle layers. In all reconstructions, bilateral flaps of the respective muscle(s) were used. An average of 5.2 ± 2.3 spinal levels were instrumented and/or decompressed; the cervical spine was involved in 20% of cases, thoracic spine