Available online at www.sciencedirect.com

ScienceDirect

EJSO the Journal of Cancer Surgery

EJSO xx (2017) 1–8 www.ejso.com

Pre-operative evaluation prior to soft tissue sarcoma excision – Why can't we get it right?

N.W. Mesko [b], R.J. Wilson [a,*], J.M. Lawrenz [b], J.L. Mathieu [a], M.K. Ghiam [a], S.L. Mathis [c], J.L. Halpern [a], H.S. Schwartz [a], G.E. Holt [a]

[a] *Vanderbilt University Medical Center, Department of Orthopaedics and Rehabilitation, 1215 21st Ave S #4200, Nashville, TN 37232, USA*

[b] *Cleveland Clinic Foundation, Department of Orthopaedic Surgery, 9500 Euclid Ave, Crile Building – A41, Cleveland, OH 44195, USA*

[c] *University of Alabama in Huntsville, Department of Kinesiology, 301 Sparkman Drive, Roberts Hall, Huntsville, AL 35899, USA*

Accepted 6 November 2017

Available online ■ ■ ■

Abstract

Background: To define the association between an appropriate pre-operative workup (pre-operative advanced imaging studies, diagnostic biopsy) and incomplete soft tissue sarcoma (STS) excision.

Patients and methods: This was a retrospective review of 397 consecutive patient records (2000–2008), looking at primary site advanced imaging (MRI or CT) and diagnostic biopsy procedures completed prior to the initial attempt at definitive surgical excision. Downstream effects of an inadequate pre-operative workup were also evaluated, including time to referral to a sarcoma multi-disciplinary care team and perceived alteration of surgical care in order to obtain a complete excision of the altered sarcoma bed.

Results: Thirty-eight percent (149/397) of soft tissue sarcomas identified underwent an incomplete excision prior to referral. A significant difference in the incidence of pre-operative primary site advanced imaging (91% vs. 42%, $p < 0.001$) and a pre-operative diagnostic biopsy (85% vs. 16%, $p < 0.001$) was found between the wide excision group and incomplete excision groups. Pre-operative biopsy ($p < 0.001$), tumor size >5 cm ($p < 0.001$), and a referral from an orthopaedic surgeon ($p < 0.02$) were all associated with reduced risk of incomplete excision in multivariate analysis. Seventy-four percent of patients in the incomplete excision group required an alteration in their definitive wide margin surgical resection, including rotational muscle flap coverage (37%), free flap coverage (11%), or amputation (11%).

Conclusion: A minority of patients referred following incomplete excision of a STS had undergone an appropriate pre-operative workup prior to referral, leading to increased long-term morbidity following definitive re-excision. Education efforts to heighten awareness of suspicious soft tissue lesions remain vital.

Keywords: Soft tissue sarcoma; Incomplete excision; Pre-operative workup; Biopsy; Imaging

Introduction

Soft tissue and bone sarcomas are rare, comprising under 1% of all adult malignancies [1,2]. In the United States, approximately 12,000 new STS cases will be diagnosed in 2014, as compared to 235,000 new annual breast cancer diagnoses [3]. It is estimated that only 1 in 200 soft tissue lumps represent a primary sarcoma, with many physicians going through a career practice without ever seeing a sarcoma. Commonly, this can lead to neglected consideration

* Corresponding author. University of Pennsylvania, Department of Orthopaedic Surgery, 3400 Civic Center Blvd, Philadelphia, PA 19104, USA

E-mail addresses: meskon@ccf.org (N.W. Mesko), Robert.Wilson3@uphs.upenn.edu (R.J. Wilson), lawrenj4@ccf.org (J.M. Lawrenz), jmathieu108@gmail.com (J.L. Mathieu), mkghiam@gmail.com (M.K. Ghiam), Shannon.Mathis@uah.edu (S.L. Mathis), Jennifer.Halpern@vanderbilt.edu (J.L. Halpern), Herbert.S.Schwartz@vanderbilt.edu (H.S. Schwartz), Ginger.E.Holt@vanderbilt.edu (G.E. Holt).

https://doi.org/10.1016/j.ejso.2017.11.001

Please cite this article in press as: Mesko NW, et al., Pre-operative evaluation prior to soft tissue sarcoma excision – Why can't we get it right?, Eur J Surg Oncol (2017), https://doi.org/10.1016/j.ejso.2017.11.001

of sarcoma in the differential diagnosis [1]. Despite attempts targeted at raising awareness of sarcoma, problematic practice patterns persist; specifically, improper surgical techniques and delayed referral patterns [1,4–6].

Inadvertent incomplete STS excision continues to comprise a large percentage of initial operations for STS, with incidences reported between 24% and 60% [7–9]. The majority of these initial procedures have historically been performed at low-volume institutions, despite strong evidence supporting fewer complications, lower mortality rates, and better functional outcomes when undergoing initial resection at high-volume sarcoma centers with a multi-disciplinary sarcoma team (MDST) [4,5,10–12]. In 2006, the United Kingdom introduced the National Institute for Health and Clinical Excellence (NICE) guidelines – *Improving Outcomes for People with Sarcoma* [13]. As a result, STS cases were centralized to hospitals with both a fully functioning MDST and a volume of greater than 100 new STS cases per year. The guidelines highlighted "red-flag" symptoms that should immediately trigger a referral to an MDST center prior to any intervention (Table 1). Previous authors have associated an 86% chance of malignancy if all four cardinal symptoms are present [14]. Similar recommendations have been published by the British Sarcoma Group (BSG), the European Society for Medical Oncology (ESMO), and the National Comprehensive Care Network (NCCN) in the United States. Despite nationally disseminated guidelines, little change has been identified in the incidence of incomplete sarcoma excision around the globe.

The rationale for re-excision of inadequately excised STS is predicated on the concept that many re-excised specimens contain residual disease [7], which in turn have been linked to local recurrence rates, and to a lesser degree reduced survival [15,16]. Numerous studies have described the patient and tumor characteristics of incompletely excised sarcomas – using local recurrence, metastases-free survival and overall survival as primary endpoints, and functional outcome as a secondary endpoint [7–9,15]. No study to our knowledge, however, has attempted to equate the adequacy of a pre-operative workup with initial excision margins. The primary objective of this study, therefore, was to ascertain the relationship between the adequacy of a pre-operative diagnostic workup of a new soft tissue mass and the incidence/risk of an incomplete STS excision. We hypothesized that those patients without an adequate pre-operative imaging or biopsy workup would be at higher risk for incomplete STS excision.

Table 1
"Red flag" symptoms for soft tissue lumps and bumps.

Characteristic [2,5,10]
1. Mass >5 cm (size of golf ball)
2. History of rapid tumor growth
3. Deep mass location (in relation to fascia)
4. New onset of pain in a previously painless lump
5. Mass recurrence

Above are well-accepted warning signs that should raise suspicion for a potential sarcoma in the context of a new or transformed soft tissue mass. This should then be followed up with advanced imaging of the lesion (MRI or CT). Within the United Kingdom, an education campaign to capture all masses greater than the size of a golf ball (43 mm diameter) has been used to standardize the size that should trigger referral of a soft tissue mass to one of the centralized soft tissue sarcoma referral centers.

Patients and methods

Study and control groups

Following institutional internal review board approval, we conducted a retrospective case control study utilizing a prospectively collected sarcoma database at a tertiary sarcoma referral center. All new adult STS diagnoses identified over an 8-year period, between January 2001 and December 2008, (n = 397) were included for study. Patients were divided into two groups. The first group (n = 149) consisted of patients who were referred from an outside facility after undergoing an inadvertent STS excision by any physician. All resection specimens were obtained and reviewed by a sarcoma pathologist to confirm gross/microscopic margin involvement. Group 2 (n = 248) served as the control group, consisting of those patients who were referred from an outside institution prior to undergoing definitive resection underwent a definitive, planned sarcoma excision with intra-operative pathology consultation to confirm both the diagnosis and "negative" resection margins (defined as all margins being ≥1 mm from the closest tumor cell if bordered by a fascial plane or periosteum, for planned marginal excisions ≥1 mm around important neurovascular structures, or ≥1 cm of intervening tissue surrounding the lesion if normal muscle/fat comprised the border) [17–19]. Patients lacking medical records allowing for adequate outcome assessment, an age ≤18 years, or who had less than 2 years of follow-up were excluded. All included patients had a minimum 2 years follow-up (mean 4.1 years for wide excision, 4.6 years for re-excision) unless death intervened. Two patients underwent a wide excision procedure at an outside institution with secondary review of the histology completed by our sarcoma pathology team to verify no evidence of margin involvement. These patients were included in the control group for study.

Surgery

Those patients who underwent an incomplete excision elsewhere underwent a second, definitive re-excision procedure in order to obtain negative margins. In those patients with marginal or intralesional excision after pathology review, a wide re-excision was offered. Limb-salvage surgery was offered to those patients where it was felt that the ability to obtain adequate surgical margins would still maintain critical neurovascular structures required for limb function. Amputation was offered if adequate resection would have

Please cite this article in press as: Mesko NW, et al., Pre-operative evaluation prior to soft tissue sarcoma excision – Why can't we get it right?, Eur J Surg Oncol (2017), https://doi.org/10.1016/j.ejso.2017.11.001