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Incidence and Risk Factors for Pulmonary Embolism After Primary Musculoskeletal Tumor Surgery

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Where Are We Now?

The paper from Ogura et al. identified surprisingly low pulmonary embolism (PE) and fatal PE rates, which are on par with the best studies of primary joint replacement. Unfortunately, because of how the data were collected, we have no information about the approaches the authors used for deep vein thrombosis (DVT) prophylaxis. We can infer from the author's discussion that chemoprophylaxis was likely less aggressive than what would be considered so in U.S. populations. That being the case, the low frequency of PE the authors observed does not support aggressive anticoagulation in the sarcoma resection population. Even

considering the subset of bone tumor resection patients, the study found only 0.81% incidence of PE.

However, there is concern that orthopaedic oncology patients are at greater risk for venous thromboembolism. In a recent multicenter study of orthopaedic oncology patients undergoing skeletal reconstruction for tumor with mega-prostheses, Ramo et al. [6] did not find a difference in PE rate between patient groups with and without chemoprophylaxis. Researchers observed nonfatal PEs in 7 out of 423 (1.6%) patients. This is similar to the 1.8% PEs reported in a study by Damron et al. [1] with a variety of chemoprophylaxis regimens. Another study in a relatively heterogeneous group of orthopaedic oncology patients, showed no difference in PE rates retrospectively comparing low-molecular-weight heparin with mechanical prophylaxis versus aspirin with mechanical prophylaxis [5]. Warfarin did not reduce the risk of DVT in a subset of adult orthopaedic oncology patients with an overall non-fatal PE rate of 0.60% [3]. In a population of 299 patients treated almost exclusively with mechanical prophylaxis, researchers observed a nonlethal PE rate of 0.75% [4]. Multiple studies taken together, including the current one, do not suggest that there is an abnormally high rate of venous thromboembolism in the orthopaedic oncology population, nor that chemoprophylaxis effectively reduces PE.

Where Do We Need to Go?

It is tempting to compare the effects and benefits of venous thromboembolism prophylaxis in patients undergoing bone resection and endoprosthetic reconstruction for primary bone malignancy with patients undergoing primary arthroplasty for

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arthritic conditions. In fact, the current procedural terminology codes used in the procedures are often the same, triggering compliance reviews and analysis of practice patterns, and identifying deviations from accepted conventional arthroplasty venous thromboembolism prophylaxis norms.

Clearly, anticoagulation has inherent risks. These are well-documented in the arthroplasty population, and include complications such as prolonged wound drainage, hematoma, reoperation, and possibly increased infection risk. Deep vein thrombosis prophylaxis is less about preventing limb complications from thrombus, and more about prolonging life expectancy by avoiding premature death by PE.

Not all wound complications are the same. When we treat the population undergoing resection of primary malignant bone tumors, we generally consider: 1) substantially larger operations with resultant potential dead spaces, 2) segmental bone replacement rather than resurfacing, 3) exposed surfaces of partially resected muscles, and 4) potentially immunologically and metabolically compromised populations due to the effects of chemotherapy. These patients have a much higher underlying risk of wound healing complications compared with uncomplicated arthroplasty patient populations [6]. Because of these factors, in particular major bone loss and deficient soft tissue envelopes, many patients experiencing major wound complications following resection of sarcomas are at risk for amputation.

Additionally, we work with a population with a below average remaining life expectancy. Some of these patients will develop and succumb to metastatic disease—up to 50% for major pelvic resections of high-grade sarcoma even in the absence of detectable metastases at the time of resection. In short, the risks of anticoagulation are higher and the potential benefits are lower. Therefore the risk/benefit ratio is significantly skewed when compared to the arthroplasty population. It is appropriate to question whether these patients should have the same aggressive DVT prophylaxis regimens as those recommended by organized medicine for conventional joint replacement [2].

How Do We Get There?

Given the relatively small number of primary bone malignancies (estimated at 2,500 annually in the United States), and their varied clinical presentations and treatment regimens, these questions will remain difficult to answer. A funded, multicenter collaboration with detailed data collection could potentially provide some answers. However, if the data on survival are available for the Ogura et al. study, it is likely that somewhere between 375 and 1,125 (10% to 30% of patients) will ultimately succumb to their disease, making cancer survival a more pressing problem to investigate than death from PE. Given the paucity of patients with primary musculoskeletal tumors, the rarity of PE, and the generally recognized more urgent need to focus on cure; it is likely that these questions regarding optimal prophylaxis of thromboembolic disease in the sarcoma resection population will go unanswered for some time.

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