Is there an association between Trauma and Musculoskeletal Tumors? A review of the literature.

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ABSTRACT

There is a relatively high incidence of patients recalling an injury before the appearance of a musculoskeletal mass especially in hand and upper limb. Despite the number of such cases, no clear pathogenetic mechanism has been found yet to certify triggering role of tissue injury in tumor development. A tumor may pre-exist before the injury, or it may have grown coincidently after trauma and documentation lacks in most cases. It is interesting to investigate if there is a connection and whether tissue trauma can provoke tumor genesis indeed, or it just accelerates tumor growth and the relative pathophysiological mechanism.

INTRODUCTION

Tumors of the musculoskeletal system comprise a significant topic of orthopaedic surgery. This pathology is characterised by great heterogeneity including benign, intermediate, and malignant bone and soft tissue tumors with the last representing about 4% of all tumors in adults annually. their incidence has been increasing during the past years, possibly due to environmental and lifestyle reasons together with the improved diagnostic ability by the use of CT and MRI scans.
Our knowledge regarding the aetiology of these lesions remains relatively poor (as it happens with most of the neoplasms). However, there is a significant number of patients attending our outpatient clinic, who recall an incidence of regional trauma, preceding the appearance of the pathological lesion.

METHODS AND MATERIALS

A 14-year-old girl with an acute growing mass just above the popliteal fossa after a blunt trauma which took place 15 days before has been the triggering event to conduct a current review of the literature, investigating whether there is a connection between trauma and oncogenesis in musculoskeletal system.
Search Strategy
A systematic review of the literature was conducted following the PRISMA guidelines. The PubMed database was primarily used for the literature search. The keywords employed during the literature search included "post-traumatic tumor," "musculoskeletal tumor," "orthopedic tumor", "orthopaedic tumor", "soft tissue tumor," "hand tumor," "upper limb tumor," and "trauma". No specific inclusion or exclusion criteria were applied due to the limited number of published articles on the topic.

RESULTS

A total of 848 articles were screened during the systematic review by two independent reviewers. After the screening process, 25 articles were ultimately included in the study.(table1). The most studied tumors associated with a history of injury at the region prior to their occurrence, were lipomas and sarcomas. The anatomical locations where such lesions were predominantly observed, were the upper and lower limb, followed by the trunk and head (as shown in the table and pie chart below) (table 2). The majority of the cases involved primary tumors.

DISCUSSION

A 14-year-old patient presented in our department with a large subcutaneous mass in the popliteal fossa of left knee, after a high force blunt injury (blow by a swing) at the site 15 days before(fig1). Histopathology revealed mitotic activity, solid areas of uniform, undifferentiated round cells with a few cytoplasm and indistinct cell borders and partially middle size cells with moderate nuclear pleomorphism, occasionally with prominent nucleoli and eosinophilic cytoplasm, establishing the diagnosis of Ewing sarcoma(fig,3)
Though there is not yet a certain definition of post-traumatic tumor, the development of musculoskeletal and soft-tissue tumors after some form of tissue injury is a question concerning the international scientific community for as many as 100 years. There is an article published in JAMA in September 1923 examining the association between trauma and the formation of bone lesions. In 1943 Shields Warren described certain minimal and necessary criteria for a tumor to be defined as post-traumatic including a mechanism of injury with enough energy to cause pathologic reparative proliferation of cells at the site of trauma.

Figure 1,

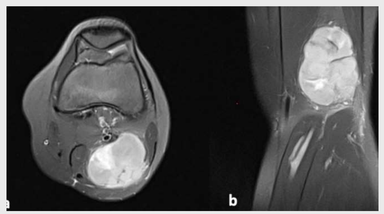


Figure 2.

DISCUSSION

Coming to the present, in most published articles soft tissue sarcomas and lipomas are the commonest tumors occurring after trauma in the region. Moreover, surgery or serious injury after an accident to any part of the body seems to increase the risk of leiomyosarcoma and liposarcoma in the general population according to a case control study in Sweden.

Montgomery et al. presented a series of 6 post-traumatic sarcomas out of 501 cases of bone or soft tissue sarcomas, Yang et al. have reported 17 cases (33%) with history of trauma in a series of 51 children with osteosarcoma Tumor formation at surgical sites is reported in literature as well.
Bednar et al. reporting 11 of 46 cases, and Baron et al. 15 patients with diagnosed osteoid osteoma in an area of previous injury or surgery

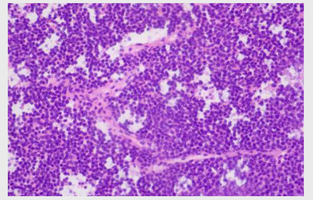


Figure 3.

DISCUSSION

Krebs and Olsen in 1963 concluded that trauma may subserve neoplasms to grow by destroying the surrounding capsule, producing haematoma, or consuming the defence mechanisms of the immune system, but there is no sign of direct oncogenetic mechanism.
authors have concluded that though the presence of micrometastases was prerequisite for the recurrency of the disease, trauma had triggered tumor growth promoting neo-angiogenesis, and local release of cytokines and growth factors. Accordingly, post-traumatic and post-operative neuromas are quite common.
Research in aetiology of tumor formation has been promoted by advances in molecular biology. However, except for case reports and case series, there is a difficulty to conduct prospective randomized studies due to the heterogeneity of tumors and their relatively low incidence

CONCLUSIONS

It seems that cases in which trauma can be a contributing or even an initiating factor to the development of a musculoskeletal tumor cannot be excluded, though there is a lack of solid scientific evidence to support this theory. Further research in the field of pathophysiology and molecular biology is necessary. On the other hand, traumatic lesions may mask pre-existing tumors at the region, making early and accurate diagnosis quite challenging, something that could prove devastating for the patient in case of malignancy.

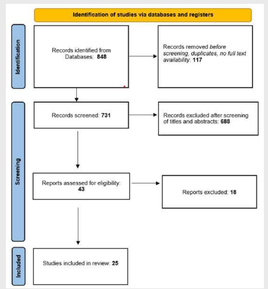
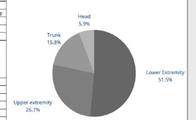


Table 1.

ARTICLE	TYPE OF STUDY	GENDER	ANATOMICAL LOCATION
Foster SD (1923)	case report	male	upper extremity
Montogomery C et al. (2019)	case series	5 male, 1 female	1 elbow 1 distal femur 4 tibia
Yang JY et al. (2009)	case series	8 male, 9 female	1 trunk 9 upper extremity 13 lower extremity
Cohen S et al. (2008)	case report	female	upper back
Uda H, Mizuzeki T, Tsuge K (2002)	case report	male	3rd metacarpal bone
Riley ND, Camilleri D, McNally MA (2014)	case report	male	tibia
Soon M, Low CK, Chew J (1999)	case report	male	tibia
Schulze W et al. (2001)	case report	male	distal tibia
Aust MC et al. (2007)	case series	10 male, 21 female	5 chest 4 back 9 upper extremity 8 lower extremity 2 other
Brooke RI, MacGregor AJ (1969)	case report	male	buccal mucosa
Moreira AC et al. (2019)	case report	female	clavicle
Magee T, Rosenthal H (2002)	case series	15 male, 13 female	no record
El Saghir NS et al. (2005)	case report	male	head
Kox Z et al. (2013)	case report	female	lower back
Brust K et al. (2021)	case report	male	skull base
Baron D et al. (1992)	case series	1 male 1 female	2 lower extremity
Rabdi JM, Ibrahiem K, al-Tweigeri T (1998)	case series	1 male 2 females	1 upper extremity 2 lower extremity
Krebs C, Olsen K (1963)	case series	5 males	1 trunk 2 upper extremity 2 lower extremity
Rozner L, Isaacs GW (1977)	case series	2 males, 22 females	lower extremity
Bodnar MS et al. (1993)	case series	no record	11 upper extremity
Olsson HL, Wagner P (2017)	case control	no record	no record

Table 2.



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