Bone Tumors and Tumor-Like Lesions Associated with Knee Trauma

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Abstract
Bone tumors and tumor-like conditions are rare entities of bones, and most are located around the knee. It is continuous dilemma if the bone lesion origins from the trauma. Our team has been consulted for 17 knee trauma associated with bone lesions. Lesions of bone were diagnosed as: tumor-like lesions; benign bone tumors; benign soft tissue tumor; aggressive bone tumor; malignant bone tumors. Three patients had foot thrombophlebitis and for their treatment has been consulted cardiologist. From 13 patients with tumor-like lesions and benign bone tumors only 4 were operated. Corticosteroids were applied in the bone cysts in 2 patients. Patients with aggressive bone tumors had their lesions excised and bone cement was used for the defect. Malignant bone tumors were treated with preoperative neoadjuvant and following surgery postoperative chemotherapy regimen. Bone lesions can be easily overseen. The fact that more than 60% of bone tumors are in the vicinity of the knee makes the diagnostic decision of knee trauma more difficult.

Key words: bone tumors, knee, trauma.

Introduction
In the modern world we live in a society obsessed by sport. At recreational level, this allows an escape from the pressures of modern life. At all levels, injury is a constant threat, and, of all injuries, those of the knee fulfill the athlete's greatest fear of spending a long time out of action. This is confirmed by a study from Sheffield, which showed the knee to have been the most commonly injured joint and soccer and rugby to have the highest risks (Steve Bollen., 2000), (Nicholl JP, Coleman P, Williams BT., 1991).

In the same time, more than 60% of bone tumors and tumor-like lesions are located in the knee or its vicinity. Male adolescents or young active persons are at the highest risk of injury and bone tumors, too (Larson SE, Lorentzon R., 1974), (Samardziski M, Janevska V, Vasilevska Nikodinovska V, Atanasov N., 2015).

Our experience confirmed that trauma “revealed” most of the inactive bone tumors and tumor-like lesions (or “leave me alone” lesions) and in cases with aggressive or malignant tumor just provoked the pain, swelling or induced pathological fracture in already affected bone. In these cases, history of the illness showed mild or irritant pain, swelling or even “night pain” before the trauma of the knee.

Material and methods
In the period from 2014 to 2015 the bone tumor team at the Clinic for Orthopedic Surgery has been consulted for 17 knee trauma associated with bone lesions. The patients’ age varied from 11 to 63 years (average 32). Lesions of bone were diagnosed as: tumor-like lesions (8 patients); benign bone tumors (4 patients); benign soft tissue tumor (1 patient); aggressive bone tumor (2 patients); malignant bone tumors (2 patients) (Table 1). Of all respondents, three were with foot thrombophlebitis and for their diagnosis (cardiac ultrasound and vascular Doppler investigation) and treatment has been consulted cardiologist.

All patients underwent appropriate diagnostic protocol. Patients with tumor-like lesions and benign bone tumors (total of 13) were diagnosed and followed-up. Standard diagnostic protocol consisted of basic laboratory findings, radiographs of the lesion site in two or more planes, Technetium bone scan, CT, CT angiography (if necessary) and MRI.
Table 1. Diagnosis and treatment of the patients in our study

<table>
<thead>
<tr>
<th>Bone lesion</th>
<th>Type</th>
<th>Number</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tumor-like lesions</td>
<td>Simple cyst</td>
<td>2</td>
<td>Corticosteroid application</td>
</tr>
<tr>
<td>Benign bone tumor</td>
<td>Osteochondroma</td>
<td>4</td>
<td>Excision</td>
</tr>
<tr>
<td>Benign soft tissue t.</td>
<td>Hemangioma</td>
<td>1</td>
<td>None, follow-up</td>
</tr>
<tr>
<td>Aggressive bone tumor</td>
<td>Giant cell tumor</td>
<td>2</td>
<td>Curettage + bone cement</td>
</tr>
<tr>
<td>Malignant bone tumor</td>
<td>Osteosarcoma</td>
<td>2</td>
<td>Preoperative chemotherapy, surgery, postoperative chemotherapy</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>17</td>
<td></td>
</tr>
</tbody>
</table>

Patients with aggressive bone tumors (giant cell tumors), before the biopsy were diagnosed with standard diagnostic protocol (as described above) and then treated case dependent following strict multidisciplinary protocols (respectfully) with surgery and chemotherapy.

Patients with malignant bone tumors (high-grade osteosarcoma), before the biopsy were diagnosed with standard diagnostic protocol (as described before) and then treated case dependent, following strict multidisciplinary protocols with neoadjuvant chemotherapy surgery and post operative (adjuvant) chemotherapy. Depending on the response to neoadjuvant chemotherapy, patients were classified as “good or poor responders” and followed certain chemotherapy regimen. All of these patients were diagnosed and treated multidisciplinary, following the directions of the “sarcoma consillium” (Wittig JC, Bickels J, Priebat D, Jelinek J, Kellar-Graney K, Shmookler B, Malawer M. 2002), (Samardziski M, Zafiroski G, Tolevska, C, Zaffiro-Ivanovska B, Kostadinova-Kunovska S, Kalicanin-Markovska M., 2009).

Results

Both patients with bone cyst were treated with multiple application of corticosteroid in the cyst. One of these patients is considered for further operative treatment, due to “activity” in the bone cyst. Four of the patients with osteochondroma had their tumors excised. The rest 7 patients had their symptoms due knee trauma and their bone lesions were considered as non active (“leave me alone”) entities. There was no indication for operative treatment considering the bone lesion but knee trauma was different problem. Some of them had internal knee injuries as: menisci lesions, anterior cruciate ligament or cartilage problems. These patients were operated accordingly.
Both patients with giant cell tumors (aggressive bone tumors) were operated, the tumor curetted and the bone defect was packed with bone cement (metal-acrylate). One of these patients had recurrence of high tumor activity. Considering the need of radical tumor resection and special knee endoprosthesis reconstruction, the patient is scheduled for operative treatment abroad.

Knee trauma just provoked the pain, swelling or induced pathological fracture in already affected bone in 2 patients with osteosarcoma. After the biopsy both patients were diagnosed with high-grade osteosarcoma. A special multi-modal (poly-chemotherapy) protocol with neoadjuvant chemotherapy surgery and post operative (adjuvant) chemotherapy was applied. Both patients were “bad responders” after the neoadjuvant thermotherapy and histology of the excised tumor showed more than 20% of viable tumor. Such result will define final treatment and long-term prognosis of these patients is bad.

Discussion

The exact etiology of bone tumors and tumor-like lesions is unknown (Prichard DJ, Finkel MP., 1975). Trauma as cause of bone tumor is posing an academic dilemma that provokes discussion decades ago. Despite advances in the understanding of cancer, from the late 1800s until the 1920s, cancer was thought by some to be caused by trauma. This belief was maintained despite the failure to cause cancer in experimental animals by injury. In 1923 Foster discussed the problem without definite conclusion (Foster. SD., 1923). People often think that a knock or injury to a bone can cause a cancer. But research studies do not support this. It is more likely that an injury causes swelling, which shows up a cancer that is already there. Or a bone affected by cancer may be weakened and so is more likely to become damaged in an accident. Doctors may then spot the tumour when they are investigating the accident. It seems that trauma is the knee factor in revealing the existence of the bone lesion or the tumor (Fletcher CDM, Unni KK, Mertens F., 2002), (Miller RH., 2003). Extensive imaging of the lesion must be done following strict protocol of diagnosis. This includes radiographs of the lesion in 2 planes, Technetium bone scan, CT, and MRI investigations (Perdikakis E., Skiadas V., 2013).

Systematic analysis of this imaging finding will lead to logic conclusion if the lesion is primary problem or just circumstantial diagnosis after knee trauma (Samardziski M, Zafiroski G, Janevskva V, Miladinova D, Popeska Z., 2004). In most of the cases included in our study, lesions of the knee structures were primary problem. Considering all of the data taken in the history of the knee trauma, mechanism of the injury, onset of the symptoms and other imaging results will result in diagnosis of an inactive (“leave me alone”) bone lesion. These patients should be followed by the examiner with plain radiographs for some reasonable time. In such cases indication for operative treatment primary would be the knee trauma (Özkan EA, Göret CC, Özdemir ZT et al., 2015), Vlychou M, Athanasou N., 2008), (Alyas F, James SL, Davies AM, Saifuddin A., 2007).
Conclusion

Many people think that a knock or injury to a bone can cause a cancer. Scientific research studies do not support this. It is more likely that an injury causes swelling, which shows up a cancer that is already there. Most of the literature showed the knee to have been the most commonly injured joint and most of the malignant bone tumors happened to be located at the knee area. Bone tumors are very rare conditions and associated with knee trauma could be misdiagnosed and that can lead to catastrophic treatment results.

Literature


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