An Evidence-Based Case Study of Unilateral Shin Splints: Do Red Flags Function in Paediatric Osteosarcoma?

Anne Rankin, MScPT

ABSTRACT

Physiotherapists use red flags to screen for serious pathology. Paediatric osteosarcoma is a rare disease, occurring predominantly in the area of the knee and shoulder, and it is not always included by physiotherapists on a differential diagnosis list. Traditional red flags do not always correspond to the initial signs and symptoms of osteosarcoma. Physiotherapists should routinely palpate along the length of the bone to detect a potential mass. The detection of a mass or symptoms that do not follow the expected course indicates the need for reassessment and possibly referral for further investigation.

Key Words: osteosarcoma; pediatric; shin splints.

RÉSUMÉ

Les physiothérapeutes utilisent des drapeaux rouges pour dépister les pathologies graves. L'ostéosarcome pédiatrique est une maladie rare qui atteint principalement la région du genou et celle de l'épaule et que les physiothérapeutes n'incluent pas toujours dans une liste de diagnostic différentiel. Les drapeaux rouges traditionnels ne correspondent pas toujours aux signes et symptômes initiaux de l'ostéosarcome. Les physiothérapeutes devraient procéder de façon routinière à une palpation le long de l'os afin de détecter la présence possible d'une masse. La détection d'une masse ou des symptômes qui ne suivent pas l'évolution prévue indiquent qu'il faut réévaluer le problème et référer peut-être le patient pour un examen plus poussé.

CLINICAL CASE

A 15-year-old girl was referred to physiotherapy with a diagnosis of shin splints (medial tibial stress syndrome, or MTSS) by her general practitioner (GP); she reported a 6-month history of left shin pain after starting rugby. Information from her chart is presented with informed patient assent and parental consent.

The client's initial subjective complaints were of constant left ankle and shin pain (which she rated as averaging 2/10 on the numeric rating pain scale [NRPS]). She reported this pain occasionally worsened through the day (NRPS = 8/10) without identified aggravating factors. Her history included pain with weight bearing, but no history of weight loss or changes in bowel or bladder function.

The therapist's objective findings of the client's affected extremity were swelling of ankle and shin; excessive pronation of the left ankle-foot relative to the right; decreased and painful active and passive movement of ankle dorsi and plantar flexion; and full painful active and passive inversion and eversion of her ankle-foot complex. Manual strength testing was painful and graded 4/5 for all ankle muscles tested. The client had palpable

tenderness of the tibialis anterior and posterior, peroneus brevis and longus, and calcaneal fibular ligament. Ligament stress tests and ankle stability testing were not completed because of irritability.

The therapist initiated treatment consisting of ankle range of motion exercises, ice with elevation, ultrasound, and interferential current. The client was followed twice weekly and was noted to have an antalgic gait pattern at her second appointment. Taping of her shin and foot intrinsic muscle strengthening exercises were initiated at that time. During her fifth appointment, she reported decreased pain and good adherence to her home exercise programme; however, the therapist noted that there was an increase in local temperature. Treatment provided by the therapist at this time was soft tissue massage and transcutaneous electrical stimulation. During the client's final appointment (6 wk after initiation of treatment, 8 appointments in total), she was reporting increased pain, and tenderness on palpation and swelling of her shin continued.

The client then presented again to her GP, who ordered plain radiographs that revealed a destructive lesion (see Figures 1 and 2). She was referred to British Columbia

From the Department of Physical Therapy, Faculty of Medicine, University of British Columbia, Vancouver.

Correspondence to: Anne Rankin, Department of Physical Therapy, Faculty of Medicine, University of British Columbia, 212 Friedman Bldg., 2177 Wesbrook Mall, Vancouver, BC V6T 1Z3; anne.rankin@ubc.ca.

Competing interests: None declared.

Physiotherapy Canada 2015; 67(4);365–368; doi:10.3138/ptc.2014-79

Figure 1 Expansile lytic bone lesion demonstrated in the distal diaphysis of the tibia. It progresses into the metaphysis of the bone but does not reach the articular surface.

Children's Hospital for further investigations (see Figure 3), and open biopsy confirmed a diagnosis of localized osteosarcoma.

CLINICAL QUESTION

There are approximately 1,500 new paediatric cancer diagnoses in Canada each year.¹ Osteosarcoma is the most common malignant bone tumour, with an incidence of 4.4 per million;² it occurs most frequently in the long bones, particularly in the distal femur or proximal tibia (60%) and the proximal humerus (9%).³ The distal tibia accounts for 20% of tibial lesions.⁴ Although bone tumours of this type can occur at any age, approximately 30% occur in people younger than age 20 years.^{3,5,6}

Red flags commonly associated with a diagnosis of cancer are pallor, fever, malaise, recurrent infections, weight loss, night sweats, pain that is unchanged with rest or change in position, nighttime pain, and pain that does not diminish with nonsteroidal anti-inflammatory medications (NSAIDs).^{7,8} Red flags associated with paediatric orthopaedic cancers are limp or refusal to walk

Figure 2 Posterior anterior view of the ankle with areas of destruction of the outer cortex.

Figure 3 Homogeneously enhancing lesion within the distal left tibial diaphysis with areas of cortical breakthrough and a small enhancing component extending into the overlying soft tissues anterolaterally. Reproduced by permission of the client's family.

Table 1 Reported Signs and Symptoms

Study	n	Mean (range) age, y	% of clients							
			Systemic symptom*	Swelling or palpable mass	Pain	Night or constant pain	History of trauma	Limp	Decreased ROM	Pathological fracture
Yang et al. ¹¹	51	13† (3–20)	0	76	90	NR	33	NR	39	8
Pan et al. ¹²	30	17 (9–34)	NR	93	100 (53% with weight bearing)	37	53	67	NR	7
Widhe & Widhe ¹⁰	102	15.8 (5.5–29.5)	3	39	85	21	47	31	23	NR
Sneppen & Hansen ⁹	84	28 (8–86)	NR	25	74	21	23	NR	NR	5

*Systemic symptoms are described as fever and weight loss.

†Median age reported for this study.

ROM = range of motion; NR = not reported.

and bone pain, which are associated with the following clinical characteristics: pain that wakes the child at night, lasts more than 2 weeks, is localized, is associated with swelling or deformity, and does not improve with NSAIDs and any palpable mass of recent origin that is located deep in the fascia; is non-tender, firm, and more than 2 centimeters in diameter; or is associated with regional lymphadenopathy or neurological signs.⁷

The clinical question asked was “Do traditional red flags used to screen for serious pathology rule out a potential diagnosis of osteosarcoma in the paediatric population?”

EVIDENCE

A literature search on the presenting signs and symptoms of osteosarcoma was completed using CINAHL, PubMed, and MEDLINE using the following search terms: *osteosarcoma* OR *osteogenic sarcoma* AND (*red flags* OR *clinical presentation* OR *presentation* OR *symptoms* OR *history*; limited to English, full text, all child, 2000–current). The search identified 58 articles; the abstracts were reviewed to identify those relevant to the topic, and the identified articles’ references were also searched. A total of 4 articles describing the presenting signs and symptoms related to this patient group were located and serve as the basis for this case report.^{9–12}

The majority of patients in all four studies sought medical advice for symptoms of pain or pain with a mass (see Table 1). Details of pain history highlighted findings inconsistent with previously identified red flags associated with cancer.⁷ Three of the included studies found that only 20%–37% of patients reported nighttime pain,^{9,10,12} and one reported that as many as 50% of patients could relate the onset of pain to some form of trauma (reported as relatively minor or associated with sporting activities).¹⁰ Antalgic gait pattern was a consistent finding in patients with osteosarcoma: Widhe and Widhe¹⁰ and Pan and colleagues¹² found that one-third to two-thirds of their patient groups had a limp. Interest-

ingly, Pan and colleagues¹² reported that one-third of their patients had a non-painful limp.

Systemic signs and symptoms such as fever and weight loss are routinely used in determining referral to a physician, but the studies reviewed did not find these red flags useful in screening for a potential diagnosis of osteosarcoma in adolescents. Widhe and Widhe¹⁰ identified fever in only 3% of their patient group.

Palpable mass or swelling was a frequently reported symptom. Yang and colleagues¹¹ reported this symptom in 76% of their patients, and Pan and colleagues¹² reported swelling becoming noticeable at a mean of 7 weeks after the onset of pain in 93% of their patient group. In contrast, both Sneppen and Hansen⁹ and Widhe and Widhe¹¹ reported that fewer than 40% had swelling. In a systematic review examining delays in diagnosis of all paediatric cancers, Brasme and colleagues¹³ reported that time to diagnosis was significantly longer in older children (relative to younger children) and in children who reported pain without other symptoms such as swelling. This finding may indicate that younger children are more closely monitored by their parents, that parental advocacy occurs more frequently during younger children’s medical appointments, or both.

Pain or tenderness—and, infrequently, swelling—of the medial and distal tibia are also common symptoms associated with MTSS. Pain associated with MTSS may be intermittent and is not typically provoked by ankle or foot motion. In chronic stages, pain may be aggravated by low levels of activity and may occur at rest.¹⁴ In patients subsequently diagnosed with osteosarcoma, the most common misdiagnosis was tendinitis (31%).¹⁰ NSAID medication was prescribed for 20% of patients misdiagnosed with tendinitis. Commonly, a person diagnosed with an injury related to sports or trauma may be asked to rest or limit activity and may be prescribed an NSAID.¹⁴ This treatment approach may initially decrease pain.

LIMITATIONS OF THE EVIDENCE

The literature identified relied on historical data extracted from health records and thus depended on the effectiveness of history taking and patient reporting. Pan and colleagues¹² also conducted in-person interviews with patients with tumours around the knee joint at the time of diagnosis, and their findings may therefore be influenced by recall error or bias. The studies used differing terminology, which makes direct comparison of findings difficult. However, there does appear to be enough consistency in presenting symptoms to indicate that any differential diagnosis list for pain about the knee should include bone tumour.

RECOMMENDATION FOR CLINICAL QUESTION

Bone cancer is relatively rare, and therefore physiotherapists do not always consider bone tumour as a possible differential diagnosis. The signs and symptoms identified in lists of red flags are not always present and do not eliminate the potential diagnosis of malignancy. Bone tumour should be included in any differential diagnosis list for child and adolescent patients reporting shoulder, knee, or shin pain.^{14–16} Palpation along the length of long bones to detect a potential mass should be a routine part of physical examination completed by physiotherapists, and the detection of a mass or symptoms that do not follow the expected course should trigger reassessment and possibly referral for further investigation. Although potential silos in the literature make it difficult for clinicians to remain up to date on signs and symptoms of rare diseases, it is imperative for physiotherapists to be aware of less common diseases and their presentations.

REFERENCES

1. Childhood Cancer Canada Foundation. Childhood cancer information—facts and figures [Internet]. Toronto: The Foundation; c2011 [cited 2014 Oct 5]. Available from: http://childhoodcancer.ca/education/facts_figures
2. Arndt CA, Rose PS, Folpe AL, et al. Common musculoskeletal tumors of childhood and adolescence. *Mayo Clin Proc.* 2012;87(5):475–87. <http://dx.doi.org/10.1016/j.mayocp.2012.01.015>. Medline:22560526
3. Ritter J, Bielack SS. Osteosarcoma. *Ann Oncol.* 2010;21(Suppl 7):vii320–5. <http://dx.doi.org/10.1093/annonc/mdq276>. Medline:20943636
4. Ottaviani G, Jaffe N. The epidemiology of osteosarcoma. *Cancer Treat Res.* 2009;152:3–13. http://dx.doi.org/10.1007/978-1-4419-0284-9_1. Medline:20213383
5. Ilaslan H, Schils J, Nageotte W, et al. Clinical presentation and imaging of bone and soft-tissue sarcomas. *Cleve Clin J Med.* 2010;77(Suppl 1):S2–7. <http://dx.doi.org/10.3949/ccjm.77.s1.01>. Medline:20179183
6. Kager L, Zoubek A, Pötschger U, et al.; Cooperative German-Austrian-Swiss Osteosarcoma Study Group. Primary metastatic osteosarcoma: presentation and outcome of patients treated on neoadjuvant Cooperative Osteosarcoma Study Group protocols. *J Clin Oncol.* 2003;21(10):2011–8. <http://dx.doi.org/10.1200/JCO.2003.08.132>. Medline:12743156
7. Fragkandrea I, Nixon JA, Panagopoulou P. Signs and symptoms of childhood cancer: a guide for early recognition. *Am Fam Physician.* 2013;88(3):185–92. Medline:23939697
8. Goodman C, Snyder T. Differential diagnosis for physical therapists: screening for referral. 5th ed. St. Louis (MO): Elsevier/Saunders; 2013.
9. Sneppen O, Hansen LM. Presenting symptoms and treatment delay in osteosarcoma and Ewing's sarcoma. *Acta Radiol Oncol.* 1984;23(2–3):159–62. <http://dx.doi.org/10.3109/02841868409136005>. Medline:6331085
10. Widhe B, Widhe T. Initial symptoms and clinical features in osteosarcoma and Ewing sarcoma. *J Bone Joint Surg Am.* 2000;82(5):667–74. Medline:10819277
11. Yang JYK, Cheng FWT, Wong KC, et al. Initial presentation and management of osteosarcoma, and its impact on disease outcome. *Hong Kong Med J.* 2009;15(6):434–9. Medline:19966347
12. Pan KL, Chan WH, Chia YY. Initial symptoms and delayed diagnosis of osteosarcoma around the knee joint. *J Orthop Surg (Hong Kong).* 2010;18(1):55–7. Medline:20427835
13. Brasme JF, Morfouace M, Grill J, et al. Delays in diagnosis of paediatric cancers: a systematic review and comparison with expert testimony in lawsuits. *Lancet Oncol.* 2012;13(10):e445–59. [http://dx.doi.org/10.1016/S1470-2045\(12\)70361-3](http://dx.doi.org/10.1016/S1470-2045(12)70361-3). Medline:23026830
14. Edwards PH Jr, Wright ML, Hartman JF. A practical approach for the differential diagnosis of chronic leg pain in the athlete. *Am J Sports Med.* 2005;33(8):1241–9. <http://dx.doi.org/10.1177/0363546505278305>. Medline:16061959
15. Krych A, Odland A, Rose P, et al. Oncologic conditions that simulate common sports injuries. *J Am Acad Orthop Surg.* 2014;22(4):223–34. <http://dx.doi.org/10.5435/JAAOS-22-04-223>. Medline:24668352
16. Fredericson M, Wun C. Differential diagnosis of leg pain in the athlete. *J Am Podiatr Med Assoc.* 2003;93(4):321–4. <http://dx.doi.org/10.7547/87507315-93-4-321>. Medline:12869603