Open Journal of
Clinical & Medical
Case Reports

Volume 3 (2017)
Issue 2

ISSN 2379-1039

Idiopathic cervical heterotopic ossification causing neck pain and immobility: A case report and review of the literature

Oliver Gembruch*; Yahya Ahmadipour; Sarah Teuber-Hanselmann; Ulrich Sure; Oliver Müller

***Oliver Gembruch**
Department of Neurosurgery, University Hospital Essen, University of Duisburg-Essen, Hufelandstrasse 55, 45147 Essen, Germany
Phone: 0049 201 723 1230, Fax: 0049 201 723 1220; Email: Oliver.Gembruch@uk-essen.de

Abstract

Introduction: Heterotopic Ossification (HO) is an ectopic bone formation in the soft tissue outside the skeletal system. This rare disorder is mostly related to musculoskeletal trauma, burns, or central nervous system injury. HO may cause pain and immobility of the joints. In some cases, HO is difficult to diagnose in early stages due to non-specific symptoms. In later stages, differential diagnoses of HO include tumors such as osteomas, osteochondromas or osteoblastomas. An occurrence of idiopathic HO has not been described before, so far.

Case Presentation: This is the first case of an idiopathic symptomatic HO in the cervical muscles causing a painful progressive spinal immobility of the neck without preceding trauma. CT-Scan of the cervical spine revealed an enormous calcificated, well defined lesion in the nuchal muscles adjacent to the spinal processes. The patient was admitted to surgery due to progressive immobility of the cervical spine. Histopathologic examinations confirmed the diagnosis of HO.

Conclusions: HO is a primary benign, progressive disorder, leading to disability by restricted mobility and pain. At early stages medical treatment or radiotherapy may control HO. If a conservative approach fails, surgery is indicated to prevent a disabling loss of function and to restore normal mobility.

Keywords

idiopathic; heterotopic ossification; cervical spine; spinal immobility

Abbreviations

HO: Heterotopic ossification; BMP: Bone morphogenetic proteins; TGF: Transforming growth factor; CT: Computed Tomography

Introduction

Heterotopic Ossification (HO) is an ectopic bone formation in the soft tissue outside the skeletal system. HO develops and affects all layers of the skin adjacent to joints and may also occur in the wall of blood vessels and ligaments [1], or at intra-abdominal sites such as the mesentery [2].

HO is likely caused by direct trauma to the muscles or the skeletal system, joint dislocations or arthroplasties of the various joints (approximately 53% in total hip arthroplasty [3]). Also, it has been observed in neurogenic disorders as spinal cord injury (incidence ranging from 20%-30% [4]), traumatic brain injuries (incidence about 10%–20% [5]), and even non-trauma causes like strokes or

brain tumors. Furthermore, HO has been associated with abdominal visceral operations (incidence of around 25% for midline abdominal scars [6]). Rarely, HO is found in burns (incidence of 1%-3%, [7]).

To our best knowledge is this the first case of an idiopathic symptomatic HO in the cervical muscles causing a progressive painful spinal immobility of the neck with a few years' history. Surgical treatment is indicated in this case due to the progressive spinal immobility and the resulting pain, and to reveal a correct diagnosis. In addition, malignant transformation of HO into e.g. osteosarcoma has been reported arguing for removal of the lesion [8, 9].

Case Presentation

Case: A 67-year old female patient presented to our department with a history of progressive neck pain and spinal immobility. She claimed that she had noticed a solid knot, which had grown approximately over the past four years between the processus spinosus of the 2nd cervical vertebra and the 1st thoracic vertebra (Figure 1). The patient was not able to rotate the head to the left side due to a painful and physical restriction of motion because of the size of the HO. The examination of the neck revealed a firm and tender mass fixed to the muscle. Further clinical and neurological examination was without pathological findings.

Radiological findings: On plain X-ray of the cervical spine a large calcificated, well defined lesion in the nuchal muscles adjacent to the spinal processes was diagnosed. The CT-scan of the cervical spine showed a well demarcated lesion consisting of multiple smaller and larger ossicles between the processus spinosus of the 2nd cervical vertebra and the 1st thoracic vertebra (9.5cm x 6.1cm x 4.4 cm). No affection of the bony integrity of the cervical spine was shown (Figure 1). A whole body CT-scan or a scintigraphy was not performed as HO is not a systemic multilocular disease and literature did not show any advantage of a screening.

Surgical treatment: The patient was admitted to surgery due to the progressive neck pain and the restricted range of motion of the cervical spine. Informed consent was obtained. The operation was carried out with the patient in prone position. The enormous lesion could be easily removed via a median incision by blunt dissection of the autochthone muscles of the neck (Figure 2).

Histopathology: Histopathologic examination revealed trabeculae of mature lamellar bone with foci of haematopoiesis as well as foci of metaplastic chondrocytes within connective and adipose tissue. There was no connection to the skeletal system. Signs of malignancy were not found. Thus, the diagnosis of heterotopic ossification was made (Figure 3).

Postoperative course and Follow up: The postoperative stay at the hospital was uneventful. The patient recovered well and the deficit in rotation of the cervical spine could not be observed any longer. The postoperative X-Ray two weeks after surgery showed a regular result (Figure 4). At latest follow up two years after surgery, the patient remained well-being without any neck pain and with normal cervical mobility and without any clinical sign of a recurrence of the HO. The Oswestry Disability Index two years after surgery showed a score of 6% [10]. The modified Japanese Orthopaedic Association scale also showed normal values of 17/18 [11]. It has to be kept in mind that a two-years follow up in our patient does not exclude a later recurrence of HO as the initial lesion progressed slowly over several years.

Discussion

Heterotopic Ossification is an ectopic bone formation in the soft tissue outside the skeletal system. It is hypothesized that injured cells release cytokines that induce differentiation of mesenchymal cells into chondro- and osteoblasts [12]. Such signaling proteins like the bone morphogenetic proteins (BMP, especially BMP types 1-12), or growth differentiation factors (GDFs, types 5–7), have been identified as crucial actors in the pathogenesis of HO [13].

Chondrogenic and osteogenic properties are exhibited in vivo by BMPs 2—7 and GDFs 5–7. The majority of those molecules belong to the transforming growth factor (TGF) ß family [14]. Micha et al. showed that the pharmacological inhibition of TGF β signaling resulted in the attenuation of osteogenic transdifferentiation and suggested that an inhibition of the TGF ß might decrease the ongoing ossification in patients with fibrodysplasia ossificans progressiva [15]. Those morphogenic proteins are also playing a role in normal embryonic development. The axis of the embryo, the differentiation of individual skeletal structures and the supporting tissue are specified by BMPs [16].

Another pathway in the development of HO might be the expression of prostaglandins that regulate the bone formation by affecting pluripotent mesenchymal stem cells such as osteoblasts and osteoclasts. Vanden Bossche and Vanderstraeten proved that the specific prostaglandin E 2 is a dose-dependent inducer of periostal lamellar bone formation [17].

The management of HO is generally agreed to be a conservative treatment, including physiotherapy, pharmacotherapy and radiotherapy. Surgery should be performed in case of neurologic deficits, progressive immobility or pain, only. Active physiotherapy within the pain-free range has a positive impact on the patients with HO [18].

The use of systemic medications has been documented. Yet, there is no consensus about the best treatment regimens and when to start the treatment of HO. Some authors recommend to start with the systematic therapy directly after detecting HO. Elevated alkaline phosphatase levels might be noted or imaging studies may be used to establish the presence of HO [19].

Diphosphonates and nonsteroidal anti-inflammatory drugs (such as indomethacin and ibuprofen) have been successfully used for the treatment and the prophylaxis of HO after adequate trauma, for example after total hip arthroplasty or spinal cord injury. Diphosphonates may impede the osteoid calcification, but the effect on osteoid formation and the overall efficacy is limited. Even more, the treatment with nonsteroidal anti-inflammatory drugs probably leads to a systemic inhibition of prostaglandine synthesis promoting osteoprogenitor development. A widely used and effective therapy regimen can be orally administered indomethacin (e.g. 25–50 mg t.i.d. for 6 weeks) [20].

Maender et al. showed that the perioperative radiation therapy has a positive impact as a prophylaxis of HO [21]. For patients, who already have developed HO after a previous operation or who have contraindications receiving indomethacin, a single irradiation of 7 Gray should be applied as prophylaxis [22]. The preoperative and postoperative radiation therapy appears equally effective to prevent HO. Most studies recommend administering 6 to 7 Gray within the first 2 postoperative days [20]. In our patient postoperative radiotherapy was not administered after interdisciplinary discussion as there are no evidence based data that radiation serves as a postoperative adjunctive therapy after

surgical removal of HO in contrast to the above mentioned prophylactic treatment.

Surgical treatment should be considered, if there are any limitations in the motion of the joints which interfere the activities of the daily life [23], or if there are acute signs of nerve entrapment with resulting neurological deficits to avoid any irreversible nerve damage [24]. In addition, malignant transformation of HO into e.g. osteosarcoma has been reported in several cases arguing for removal of the lesion [8, 9]. Nevertheless, one has to keep in mind that a further trauma is caused by the operation and this might also increase the risk of recurrent HO.

If no neurological deficits or immobility are present, surgical treatment is indicated after HO has fully matured to decrease the risk of a postoperative recurrence [25].Time of maturation might be estimated using the alkaline phosphataselevels as a measurement of the osteoblastic activity. Unfortunately, in our patient the preoperative alkaline phosphatase level was not measured and, thus, we did not employ this as a follow up parameter. Nevertheless, it might be a quick and non-invasive method to monitor patients in the follow up. A normalization may indicate the completion of ossification [19].

Conclusion

HO is a benign disorder and should be operated if neurological deficits or immobility of the spine or the joints occur to prevent disability. Furthermore, the diagnosis has to be revealed knowing that HO might mutate into malignancy and to further differential diagnosis like osteosarcoma.

Figures

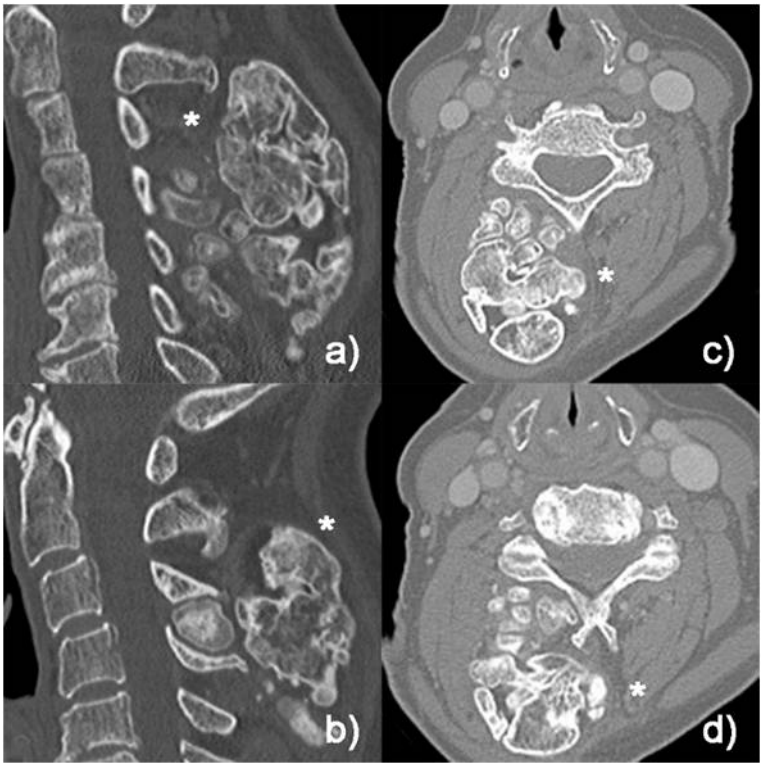

Figure 1: a) and b) preoperative CT-Scan of the cervical spine showing HO ranging from the 2nd cervical vertebra to the 1st thoracic vertebra; c) and d) axial view.

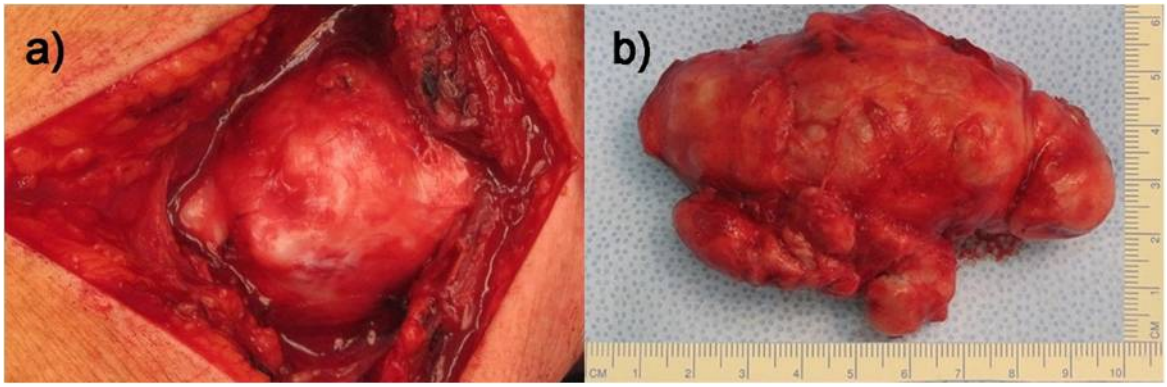

Figure 2: a) intraoperative view showing the HO in situ; b) HO after resection (9.5 cm x 6.1 cm x 4.4 cm).

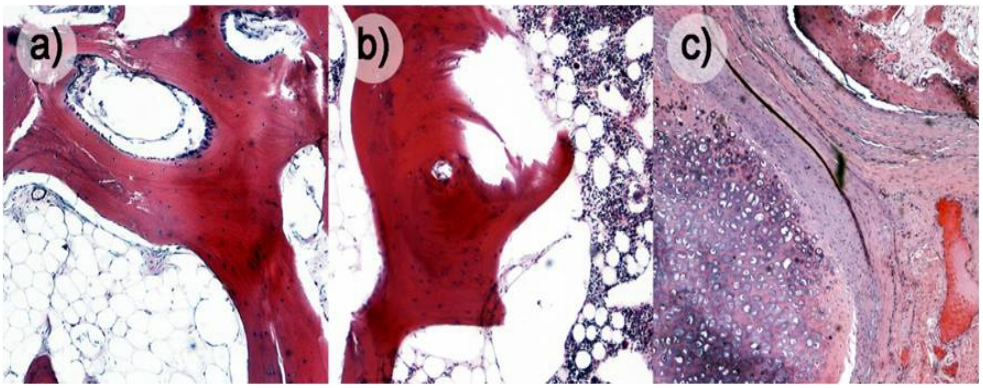

Figure 3: Trabeculae of mature lamellar bone within adipose tissue (a) with blood-building bone marrow (b) and foci of metaplastic chondrocytes (c). Haematoxylin-eosin staining, Magnification: 40fold.

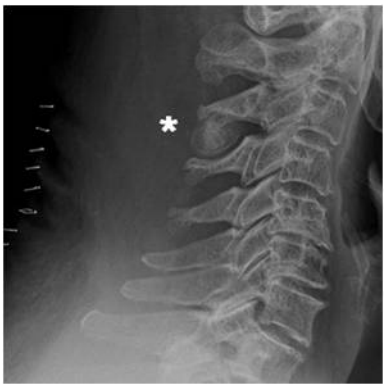

Figure 4: postoperative X-Ray-control two weeks after surgery.

Author's Contributions

Oliver Gembruch was a major contributor in writing the manuscript and was part of the neurosurgical team. Yahya Ahmadipour was part of the neurosurgical team and was a contributor in writing the manuscript. Sarah Teuber-Hanselmann performed the pathological examination and was also a contributor in writing the manuscript. Ulrich Sure was also a contributor in writing the manuscript. Oliver Müller performed the neurosurgical procedure and was a contributor in writing the manuscript. All authors read and approved the final manuscript.

References

1. Bostrom K, Watson KE, Horn S, Wortham C, Herman IM, Demer LL. Bone morphogenetic protein expression in human atherosclerotic lesions. J Clin Invest. 1993; 91: 1800–1809.

2. Wilson JD, Montague CJ, Salcuni P, Bordi C, Rosai J. Heterotopic mesenteric ossification ("intraabdominal myositis ossificans"): report of five cases. Am J Surg Pathol. 1999; 23: 1464–1470.

3. Thomas BJ. Heterotopic bone formation after total hip arthroplasty. Orthop Clin North Am. 1992; 23: 347–358.

4. Stover SL, Niemann KM, Tulloss JR. Experience with surgical resection of heterotopic bone in spinal cord injury patients. Clin Orthop. 1991; 263: 71–77.

5. Garland DE, Blum CE, Waters RL. Periarticular heterotopic ossification in head-injured adults: incidence and location. J Bone Joint Surg Am. 1980; 62: 1143–1146.

6. Kim J, Y. Kim Y, Jeong WK, Song SY, Cho OK. Heterotopic ossification developing in surgical incisions of the abdomen: analysis of its incidence and possible factors associated with its development. J Comput Assist Tomogr. 2008; 32, 872–876.

7. Boyd BM, Robers WM, Miller GR. Periarticular ossification following burns. South Med J. 1983; 52: 1048.

8. Konishi E, Kusuzaki K, Murata H, Tsuchihashi Y, Beabout JW, Unni KK. Extraskeletal osteosarcoma arising in myositis ossificans. Skeletal Radiol. 2001. 30: 39–43.

9. Wheeler K, Makary R, Berrey H. A case of malignant transformation of myositis ossificans. Am J Orthop (Belle Mead NJ). 2014; 43: E25-7.

10. Fairbank JC, Pynsent PB. The Oswestry Disability Index. Spine. 2000; 25: 2940-2952; discussion 2952.

11. Benzel EC, Lancon J, Kesterson L, Hadden T. Cervical laminectomy and dentate ligament section for cervical spondylotic myelopathy. J Spinal Disord. 1991; 4: 286–295.

12. Kaplan FS, Glaser DL, Hebela N, Shore EM. Heterotopic ossification. J Am Acad Orthop Surg. 2004; 12: 116– 125.

13. Kaplan FS. Skin and bones. Arch Dermatol 1996; 132:815–818.

14. Kingsley DM. The TGF-beta superfamily: new members, new receptors, and new genetic tests of function in different organisms. Genes Dev. 1994; 8: 133–146.

15. Micha D, Voermans E, Eekhoff ME, van Essen HW, Zandieh-Doulabi B, Netelenbos C, et al. Inhibition of TGFβ signaling decreases osteogenic differentiation of fibrodysplasia ossificans progressiva fibroblasts in a novel in vitro model of the disease. Bone. 2016. 6; 84: 169-180.

16. Wozney JM, Rosen V, Byrne M, Celeste AJ, Moutsatsos I, Wang EA. Growth factors influencing bone development. J Cell sci Suppl. 1990;13:119–156.

17. Vanden Bossche L, Vanderstraeten G. Heterotopic ossification: a review. J Rehabil Med. 2005. 37: 129–136.

18. Crawford CM, Varghese G, Mani MM, Neff JR. Heterotopic ossification: are range of motion exercises contraindicated? J Burn Care Rehabil. 1986; 7: 323–327.

19. Orzel JA, Rudd TG. Heterotopic bone formation: clinical, laboratory and imaging correlation. J Nucl Med. 1985; 26: 125–132.

20. Pakos EE, Ioannidis JP. Radiotherapy vs. nonsteroidal anti-inflammatory drugs for the prevention of heterotopic ossification after major hip procedures: a meta-analysis of randomized trials. Int J Radiat Oncol Biol Phys. 2004; Nov 1; 60: 888-895.

21. Maender C, Sahajpal D, Wright TW. Treatment of heterotopic ossification of the elbow following burn injury: recommendations for surgical excision and perioperative prophylaxis using radiation therapy. J Shoulder Elbow Surg. 2010; 19: 1269–1275.

22. Knelles D, Barthel T, Karrer A, Kraus U, Eulert J, Kölbl O.Prevention of heterotopic ossification after total hip replacement: a prospective, randomized study using acetyl salicylic acid, indomethacin and fractional or single dose irradiation. J Bone Joint Surg Br. 1997; 79: 596–602.

23. Peterson SL, Mani MM, Crawford CM, Neff JR, Hiebert JM. Postburn heterotopic ossification: insights for management decision making. J Trauma. 1989; 29: 365–369.

24. Djurickovic S, Meek RN, Snelling CF, Broekhuyse HM, Blachut PA, O'Brien PJ, et al. Range of motion and complications after postburn heterotopic bone excision about the elbow. J Trauma. 1996; 41: 825–830.

25. Peters WJ. Heterotopic ossification: can early surgery be performed, with a positive bone scan? J Burn Care Rehabil. 1990; 11: 318–321.

Manuscript Information: Received: October 05, 2016; Accepted: January 20, 2017; Published: January 25, 2017

Authors Information: Oliver Gembruch[1]*; Yahya Ahmadipour[1]; Sarah Teuber-Hanselmann[2]; Ulrich Sure[1]; Oliver Müller[1]

[1]Department of Neurosurgery, University Hospital Essen, University of Duisburg-Essen, Hufelandstrasse 55, 45147 Essen, Germany
[2]Department of Neuropathology, University Hospital Essen, University of Duisburg-Essen, Hufelandstrasse 55, 45147 Essen, Germany

Citation: Gembruch O, Ahmadipour Y, Teuber-Hanselmann S, Sure U, Müller O. Idiopathic cervical heterotopic ossification causing neck pain and immobility: A case report and review of the literature. Open J Clin Med Case Rep. 2017; 1214

Journal: Open Journal of Clinical and Medical Case Reports is an international, open access, peer reviewed Journal focusing exclusively on case reports covering all areas of clinical & medical sciences.

Visit the journal website at **www.jclinmedcasereports.com**

For reprints & other information, contact editorial office at **info@jclinmedcasereports.com**