

Differences between spondylo-osteomyelitis and spondylosis deformans in small odontocetes based on museum material

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Summary

In this article the differences between spondylo-osteomyelitis, which is an infective disease, and spondylosis deformans, a degenerative condition, in small odontocetes are discussed. Some cases of spondylo-osteomyelitis are described from museum-material, and a key to differentiate, based on cleaned vertebrae, between the two diseases is given.

Key words: spondylo-osteomyelitis, spondylosis deformans, odontocetes, vertebrae, museum specimens

Introduction

During the study on the occurrence of spondylosis deformans in White-beaked dolphins, *Lagenorhynchus albirostris* (Kompanje, 1995), some cases of vertebral deformations came to my attention that could not be diagnosed as spondylosis deformans. At first sight, the pathological changes resembled spondylosis deformans, but further inquiry then showed atypical features. A diagnosis as either spondylo-discitis or spondylo-osteomyelitis due to a most presumably bacterial, infection seems plausible in these cases. Since in the literature all vertebral deformations in Cetacea are usually diagnosed as spondylosis deformans, a discussion on the differential diagnosis between the two diseases seems useful. This article uses the terminology of Junghanns (1977).

After Slijper (1931; 1936) almost all vertebral deformations in Cetacea are diagnosed as *spondylitis deformans*. Slijper gave this incorrect name to the bony protuberances and ankylosis that develop at the margins of the vertebral bodies in the vicinity of the intervertebral disc. The correct name for this condition is nowadays *spondylosis deformans*. Spondylosis deformans is a degenerative disease of the intervertebral disc and its surrounding structures, found in man and other mammals of advancing age. Degeneration of the intervertebral

disc is demonstrated during autopsy on a White-beaked dolphin (Kompanje, 1995) spondylitis deformans is an obsolete name for spondylosis deformans (Junghanns, 1977; Kompanje, 1993). In some species this degenerative disease is quite common (Kompanje, 1995). Most deformations in the vertebrae of small odontocetes can thus be diagnosed as spondylosis deformans, some as spondylo-osteomyelitis or spondylo-discitis. Although not common, infections of the intervertebral disc and its surroundings are of great importance for differential diagnosis in studies on the occurrence of vertebral pathology in Cetacea. In quite a number of the cases regarded as degenerative, an infection may be present in its initial or advanced stages. Primary haematogenous discitis could only arise if there is a vascular supply to the vertebral disc. In terrestrial mammals the developing intervertebral disc receives a vascular supply to its outer zone during embryonic and infant stages (Kramer, 1981). In adult mammals, including dolphins, the intervertebral disc is avascular. Most of the primary and haematogenous adult disc infections are caused by a true spondylitis (*spondylo-osteomyelitis*), especially those infections involving the vertebral end-plate (epiphysis).

At first sight the deformations of the cleaned affected vertebrae resemble the features of spondylosis deformans. An incorrect diagnosis is easily made. As a result of this incorrect diagnosis the conclusion was reached that spondylosis deformans occurs at any age in Cetacea (Slijper, 1936; Kinze, 1986). Since spondylosis is a degenerative disease of the intervertebral disc associated with aging, this phenomenon only occurs in adult animals.

Material

In the collections of the National Museum of Natural History, Leiden, The Netherlands, three cases of spondylo-osteomyelitis in Harbour porpoises *Phocoena phocoena* (male RMNH 33036; male RMNH 4354; female RMNH 28590), one case

in a White-beaked dolphin *Lagenorhynchus albirostris* (female RMNH 32233), one case in a White-sided dolphin *Lagenorhynchus acutus* (male RMNH 23587) and one case in a Sowerby's Beaked whale *Mesopodon bidens* (female RMNH 7512) were discovered.

Results

Figure 1 shows a lumbar vertebra of a White-beaked dolphin with the typical deformation of the vertebral bony plate as a result of degeneration of the intervertebral disc (Osteochondrosis intercorporalis). This is the third stage of spondylosis deformans. Marginal osteophytes as well as perforation and sclerosis of the bony plate are clearly seen. *Sclerosis* is understood as the formation of eburnised bone with a shining surface, due to intravital polishing between two uncovered joint surfaces.

Figures 2 and 3 shows the second and third thoracic vertebra of a female Harbour porpoise (RMNH 28590) with pathological changes. Irregular thick osteophytes can be seen on the margins. The appearance of these osteophytes is quite different from those seen in spondylosis deformans. Cavities (clocae) and fistulae are seen in the vertebral bony plate, most probably the result of

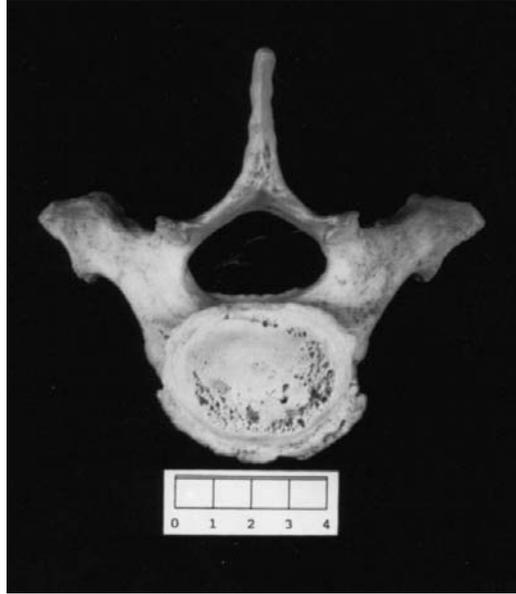


Figure 1. A lumbar vertebra of a White-beaked dolphin (*Lagenorhynchus albirostris*) with the typical deformation of the vertebral boneplate as a result of degeneration of the intervertebral disc (spondylosis deformans) (Adult ♀ RMNH 18067).



Figure 2. Second and third thoracic vertebrae of a ♀ Harbour porpoise (*Phocoena phocoena*) (RMNH 28590). Irregular osteophytes and clocae with sequestra of vertebral bone plate.



Figure 3. Cervical and first two thoracic vertebrae of *Phocoena phocoena* ♀ (RMNH 28590). Irregular osteophytes of the thoracic vertebrae.

bacterial infection and subsequent pus formation. In one of the cloacae a sequester is seen, a feature consistent with osteomyelitis. All these features are atypical for spondylosis deformans.

Figures 4 and 5 show the grotesque deformations of caudal vertebrae (2–5) of an adult female Sowerby's beaked whale. New bone formation, irregular osteophytes, cloacae and fistulae can clearly be seen. Three vertebrae are fused together. There are separate pieces of new bone formation, in which cloacae can be seen (Fig. 6). The distal epiphysis of the second and the proximal epiphysis of third caudal vertebra showed erosion and destruction of the normal bony plate. The proximal epiphysis of the second caudal vertebra and the distal epiphysis of the third caudal vertebra, as well as all other vertebral epiphysis are normal. So, most probably an infection started in the intervertebral disc between the second and the third caudal

vertebra. The infection must have spread from the intervertebral space between the second and third caudal vertebra to the following three vertebrae. These features are typical for an chronic infection, and atypical for spondylosis deformans.

Discussion

During autopsy on fresh dolphins infection of the intervertebral disc and/or its surroundings is very difficult to discover. It may be demonstrated either by radiography in advanced cases or after cleaning the vertebrae by maceration. In order to find a discitis or degenerative disc disease in fresh dolphins, one must open all intervertebral spaces during autopsy by cutting the ligaments and splitting the intervertebral discs. This is difficult and time-consuming. After having found affected discs or vertebrae, and pus is found, the pus can be cultured in the hope to determine the micro-organism(s) causing the infection. This will offer important additional information.

Discitis or spondylo-osteomyelitis due to direct infection (penetrating traumatic lesions) is easily discovered when wounds are visible during the gross postmortem examination of the dead dolphin. Nevertheless, most deformed vertebrae as the result of an infection are only found in museum-specimens after cleaning the skeleton for the collection. It is possible to prove an infective cause of vertebral deformation without demonstration of the infective agent itself. It is almost always possible to differentiate between the different conditions. Any pathological process that affects the vertebrae may lead to the formation of osteophytes. Sometimes these osteophytes are quite bizarre in form (Figs 4 & 5). Such localized grotesque processes are almost always caused by the osteomyelitis due to bacterial infection. A destructive spondylo-osteomyelitis of the cervical vertebrae in a Harbour porpoise was caused by Haematolytic *Streptococci* (M. Garcia Hartmann, pers. comm.). The adult intervertebral disc is in normal anatomy avascular, so hypothetically haematogenous discitis can only occur in early infancy. In pathological conditions the adult intervertebral disc in terrestrial mammals again shows vascularisation (Jansen, 1977). This isn't yet demonstrated in Cetacea. These infections are accompanied by osseous reactions with broad spurs of new bone and destruction of the epiphysis (Kramer, 1981).

Concluding, it can be stated that vertebral deformations in immature odontocetes, and deformation atypical for spondylosis deformans in some adult animals can be diagnosed as spondylodiscitis or spondylo-osteomyelitis caused by a bacterial infection.



Figure 4. Third, fourth and fifth caudal vertebrae of *Mesoplodon bidens* (RMNH 7512). New bone formation, irregular osteophytes, cloacae, fistulae and ankylosis can clearly be seen. The chevron of the fourth vertebrae is fused to the new bone formation.

Key to differentiate between degenerative and infective vertebral disc-disease in cleaned vertebrae (museum specimens)

- Marginal osteophytes in a juvenile dolphin are the results of an infection. Degenerative disc disease (*spondylosis deformans*) occurs only in adult animals.
- Osteophytes or deformations on the laminae, the transverse processes and the spinal process are the results of an infection. *Spondylosis deformans* is restricted to the vertebral body and the articular processes.
- Cloacae with or without sequestra in the vertebral body are caused by the formation and drainage of pus and are therefore typical for spondylo-osteomyelitis.
- Bizarre and grotesque ankylosis between several vertebrae, which is not restricted to the vertebral body alone is typical for spondylo-osteomyelitis. Ankylosis due to degenerative disc disease is relatively more smooth and less irregular. When ankylosis occurs in spondylosis the epiphysis always shows destruction (*osteochondrosis intercorporalis*). If spondylo-osteomyelitis is spread over more than two vertebrae, most

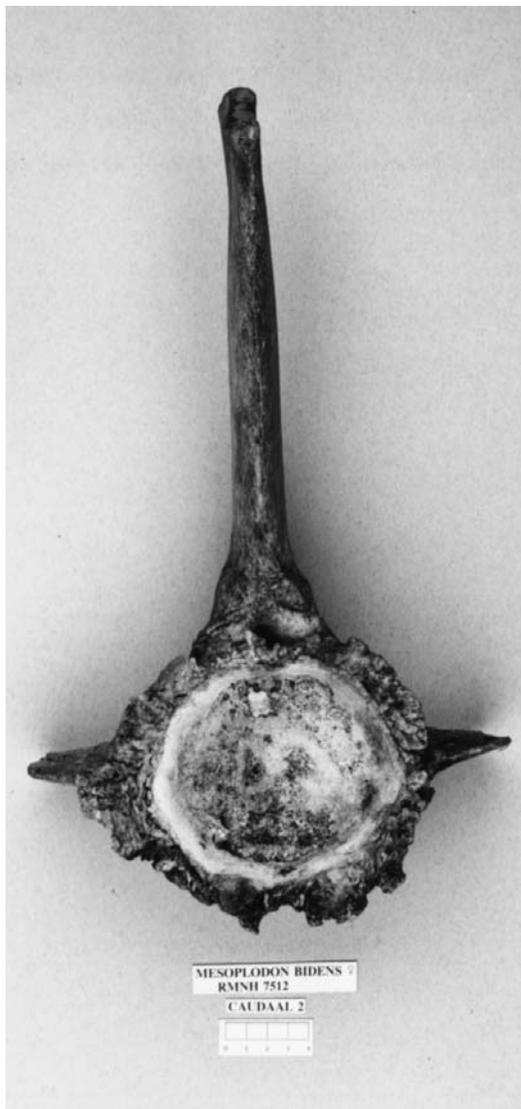


Figure 5. Distal epiphysis of the second caudal vertebrae of *Mesoplodon bidens* (RMNH 7512). Marginal osteophytes and erosion of the epiphysis.

intervertebral spaces and epiphysis can be normal.

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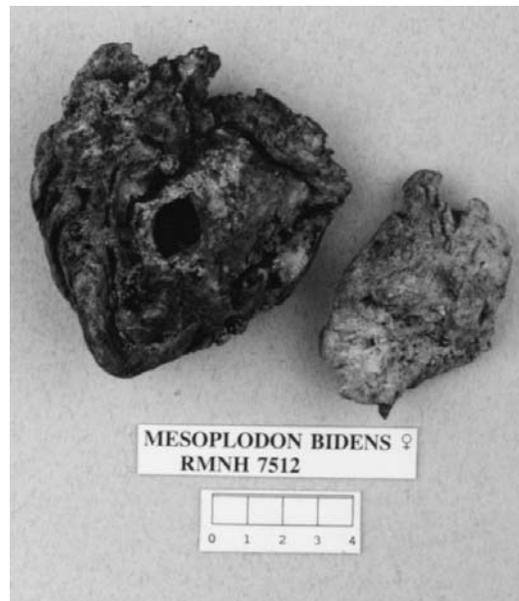


Figure 6. Separate pieces of new bone. *Mesoplodon bidens* (RMNH 7512). In the left piece, a cloaca can be seen.

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