Compression pain in a diver with intraosseous pneumatocysts

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Hart BL, Brantly PN, Lubbers PR, Zell BK, Flynn ET Jr. Compression pain in a diver with intraosseous pneumatocysts. Undersea Biomed Res 1986; 13(4):465–468. — A 30-yr-old diver experienced pain in the area of the sacroiliac joint during the descent phase of air diving to less than 10 ATA. Computed tomography of the pelvis demonstrated two gas-filled cysts within the ilium. The mechanism by which this lesion causes pain is discussed and reports of gas within bone are reviewed.

Barotrauma
air diving
bone cysts

Barotrauma can occur at any location in the body that cannot readily equalize with changes in environmental pressure. Unlike fluid-filled spaces, localized, noncommunicating sites of gas develop significant pressure differentials under these conditions. The most common such site is the middle ear space with an obstructed eustachian tube. The sinuses are also readily affected if their ostia are blocked, and other locations are less commonly involved. This report describes an unusual case of a diver who had pain associated with gas-containing lesions within bone.

CASE REPORT

A 30-yr-old male, Navy diver complained of sharp pain in the area of the right sacroiliac joint occurring during the compression phase of a hyperbaric chamber dive. He was dry, wore light clothing, and stood throughout the hyperbaric exposure. The pain stopped as soon as compression was completed. He continued to have similar pain on subsequent air dives to pressures ranging from 2 to 4 ATA. The compression rate on all of these dives varied between 1.8 and 2.3 ATA/min. With additional diving the pain sometimes recurred during decompression and persisted for several hours as a dull ache. The pain was not affected by posture or movement, and physical
examination was unremarkable. There was no history of previous trauma to the back or hips. However, the patient reported that similar pain had occurred on a few occasions in the past: during a 50-ft free ascent training dive 5 yr earlier, during a 9.6 ATA dry chamber dive 2 yr before, and during several scuba dives the previous year. In all these dives the pain occurred only during descent or compression and stopped as soon as maximum depth was reached. He had made numerous dives without problems.

An A-P radiograph of the pelvis demonstrated a 1.0 × 0.7-cm lytic defect in the right ilium adjacent to the sacroiliac joint (Fig. 1). The lesion was well circumscribed, had a sclerotic border, and lacked a tumor matrix. A nonenhanced, computed tomographic examination of the lesion was obtained with 1.5-mm slices (Fig. 2). Two well-circumscribed lesions with sclerotic margins were identified. No tumor matrix or associated soft tissue mass was present. The lesions were oriented anterior-posterior to each other so they projected as a single lesion on the A-P radiograph of the pelvis. The attenuation coefficients of the lesions were that of gas (< −800 Hounsfield units).

Radiographic examination of both hips and a Tc-99 m-methylene diphosphonate (MDP) bone scan were normal.

DISCUSSION

The pain this diver experienced upon compression was related to the presence of a noncommunicating collection of gas within the ilium near the sacroiliac joint. Although intraosseous pneumatoceysts have been reported before (1), we are not aware of any reports of pain in association with diving.

Fig. 1. A-P radiograph of the pelvis reveals a juxta-articular lytic defect in the caudal-medial aspect of the right ilium.
DIVER WITH INTRAOSSEOUS PNEUMATOCYSTS

Fig. 2. CT scan shows two gas-filled cysts present in the right ilium.

The mechanism by which a pocket of gas causes pain is presumably similar to that of ear or sinus barotrauma or squeeze. As environmental pressure is increased, the isolated cavity of gas remains at or near atmospheric pressure. The lining of the cavity becomes edematous and possibly hemorrhagic. The varying severity of symptoms in this subject may have been related to the degree of obliteration of the cyst by fluid after barotrauma. In addition, symptoms seemed to be correlated with a rapid compression rate during diving, indicating that a rapid pressure change was necessary to cause pain in this particular lesion.

All 5 subjects reported by Ramirez et al. (1) had intraosseous gas in the same location as this man, within the ilium and near the sacroiliac joint. The reason for a possible predilection for this location is unknown, as is the etiology of the gas-filled cysts. None of the cases, including the present one, demonstrated any evidence of surrounding bone or soft tissue abnormality. Two of the lesions observed by Ramirez et al. were excised. One was a benign cyst, and the other had additional features that permitted it to be identified as an intraosseous ganglion. There was no evidence in either lesion of osteonecrosis.

Gas has been observed infrequently within bone in the past. The advent of computed tomography in recent years has permitted the identification of intraosseous gas with more confidence and greater frequency. Conditions associated with intraosseous gas include anaerobic osteomyelitis (2), damaged vertebral bodies (3-5), knee surgery (6), and osteonecrosis (7, 8). The sources of gas from infection and surgery are expected and readily understandable. The appearance and persistence of gas in posttraumatic conditions or in benign bone cysts is more problematic.

Although osteonecrosis is associated with intraosseous gas, it is unlikely that the case reported here is a form of dysbaric osteonecrosis. Numerous studies of dysbaric osteonecrosis have not noted such a condition, and histologic examination of other radiographically similar cysts has not shown evidence of osteonecrosis (1). In addi-
tion, this patient experienced symptoms early in his diving career, the first incident happening after only a few dives. His unusual problem is apparently the result of a benign, preexisting cyst.

Clinically there is no reason to expect problems from this lesion other than pain. It was possible to avoid pain in this diver by reducing descent rates. The problem has since diminished, and the man’s diving career has not been curtailed. Continuing pain on compression would be most easily stopped by ceasing to dive. Surgical treatment is possible (1), but the risks must be weighed carefully in view of the voluntary nature of the pain-producing activity.

A gas-containing bone cyst, like other pockets of gas in the body, can become a source of pain during environmental pressure changes. The persistence of gas in this site for a long period serves as yet another reminder that the movement of gases within the body is poorly understood.

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REFERENCES