

Dysbaric osteonecrosis of the shoulder in a sport scuba diver

Peter Wilmshurst, Kenneth Ross

Abstract

The previously unreported occurrence of dysbaric osteonecrosis in an amateur sport scuba diver who had no other identified cause of avascular bone necrosis is described.

(*Br J Sports Med* 1998;32:344–345)

Keywords: osteonecrosis; hyperbaric exposure; shoulder; scuba diver

Case report

In March 1997, a 34 year old man presented with a two and a half year history of increasing discomfort and restricted movement in his right shoulder. The symptoms had not improved with 18 months of treatment by an osteopath or local steroid injections twice in 1996. He had no history of significant injury to the shoulder. He never smoked and drank less than 20 units of alcohol a week. He started amateur sport scuba diving in September 1992 and had done 190 dives, all with compressed air. Only four dives required compulsory decompression stops; 105 dives were deeper than 30 m, including two deeper than 40 m. Before the start of his shoulder symptoms, most of his dives were shallower than 30 m. All dives followed accepted safe decompression profiles. He had no symptoms suggesting decompression illness. Radiography of the right shoulder showed flattening of the humeral head with patchy sclerosis and slight fragmentation in keeping with avascular bone necrosis. A magnetic resonance imaging scan of the shoulder (fig 1) showed partial collapse of the articular surface of the humerus with loss of articular cartilage, typical of advanced avascular necrosis. Scans of both hips were normal.

Haemoglobin concentration, erythrocyte sedimentation rate, liver function, thyroid function, urate concentration, fasting concentrations of lipids and glucose, and antinuclear antibody were normal. Contrast echocardiography showed no evidence of an intracardiac shunt. Chest x ray findings and lung spirometry, flow-volume loops, and transfer factor were normal.

Discussion

Avascular bone necrosis is an occupational illness in professional divers and caisson workers, when it is usually known as dysbaric osteonecrosis. It occurs months to decades after hyperbaric exposure. If lesions are juxta-articular, severe joint degeneration can result. When lesions affect bone shafts, they are asymptomatic. Asymptomatic lesions are a cause for concern because dysbaric osteonecrosis and medullary bone infarcts in general may undergo malignant change.^{1 2} The pathogenesis of dysbaric osteonecrosis is unknown. There is no proven association with decompression illness, although both can affect joints and the risk of each condition is related to the degree of exposure to hyperbaric conditions. The incidence of dysbaric osteonecrosis increases with depth (absolute pressures) and the duration or number of exposures.³ However, dysbaric osteonecrosis has been described after a single long hyperbaric exposure with rapid decompression.⁴

Amateur sport scuba divers are considered to be at low risk because their dives are usually short and shallow. Dysbaric osteonecrosis has been described once before in an amateur sport scuba diver, but in that case the diver had two other risk factors for avascular necrosis: diabetes and trauma.⁵ The case we describe had no other risk factor for avascular necrosis besides hyperbaric exposure. The humeral head was the site of avascular necrosis in our case and that reported by Gorman and Sandow.⁵ This is the commonest site for juxta-articular dysbaric osteonecrosis,^{2 6} but it is a rare site for avascular necrosis with other aetiologies. This suggests that the avascular necrosis in these two amateur scuba divers was the result of hyperbaric exposure, even though their exposures were conservative. As amateur divers go deeper, for longer, and use gas mixtures containing helium, it is probable that more cases of dysbaric osteonecrosis will occur. The interval between exposure and the first symptoms of dysbaric osteonecrosis is usually longer than in the case we describe. Failure to learn from past lessons may cause amateur divers to suffer an epidemic of dysbaric osteonecrosis, similar to those in caisson workers in the last century and in

Royal Shrewsbury
Hospital, Shrewsbury,
United Kingdom
P T Wilmshurst

Eastbourne District
General Hospital,
Eastbourne, United
Kingdom
K R Ross

Correspondence to:
Dr P Wilmshurst, Royal
Shrewsbury Hospital,
Shrewsbury SY3 8XQ,
United Kingdom.

Accepted for publication
10 June 1998

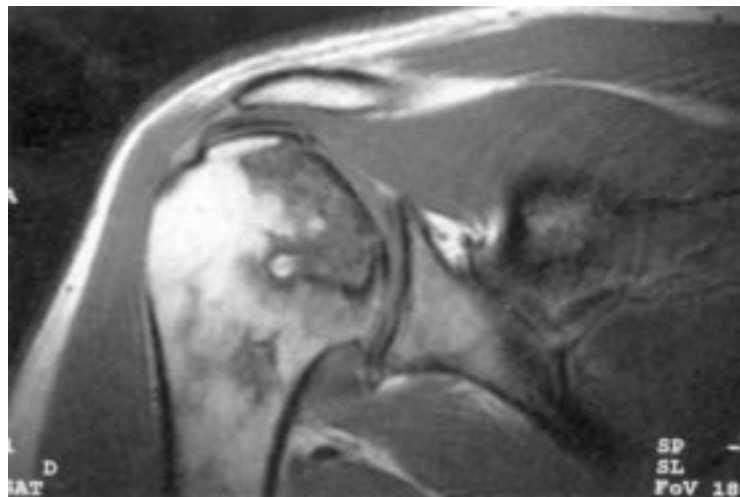


Figure 1 Magnetic resonance image of the right shoulder showing avascular necrosis.

professional divers earlier in this century, before safer work practices were introduced to those occupations.

- 1 Galli SJ, Weintraub HP, Proppe KH. Malignant fibrous histiocytoma and pleomorphic sarcoma in association with medullary bone infarcts. *Cancer* 1978;41:607–19.
- 2 Kitano M, Iwasaki H, Yoh SS, *et al.* Malignant fibrous histiocytoma at site of bone infarction in association with DCS. *Undersea Biomed Res* 1984;11:305–14.
- 3 Decompression Sickness Central Registry and Radiological Panel. Aseptic bone necrosis in commercial divers. *Lancet* 1981;ii:384–8.
- 4 James CCM. Late bone changes in caisson disease. Three cases in submarine personnel. *Lancet* 1945;ii:6–8.
- 5 Gorman DF, Sandow MJ. Posterior shoulder dislocation and humeral head necrosis in a recreational scuba diver with diabetes. *Undersea Biomed Res* 1992;19:457–61.
- 6 Davidson JK. Dysbaric disorders: aseptic bone necrosis in tunnel workers and divers. *Bailliere's Clin Rheumatol* 1989; 3:1–23.

Commentary

Scuba diving is an increasingly popular sport world wide. Most people who participate do so without any ill effects. However, the medical risks of an environment that imposes unique physical, physiological, and psychological stresses on the body should not be forgotten. Research into chronic medical conditions caused by pressure in the sport scuba diver has been limited. Recent papers have looked at long term damage in the central nervous system¹ and the eye² but a paper in this journal is a reminder that the sport scuba diver is susceptible to dysbaric osteonecrosis, just as the professional diver is. It is clear that the underlying causes of this condition are unknown and that this is an interesting area for research. The recent call by the Health and Safety Executive for proposals for research into the long term health effects of diving is a welcome step in this direction, especially as some in the scuba diving community are using helium gas mixtures in an effort to reach ever greater depths.

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- 1 Knauth M, Ries S, Pohimann S, *et al.* Cohort study of multiple brain lesions in sport divers: role of a patent foramen ovale. *BMJ* 1997;314:701–5.
- 2 Polkinghorne PJ, Sehmi K, Cross MR, *et al.* Ocular fundus lesions in divers. *Lancet* 1988;iii:1381–3.