

partnership between doctors and hospital managers, but if they are to succeed and be relevant doctors must play a major part in their design. Unfortunately, there is still much confusion and lack of knowledge among doctors even in hospitals where computerisation is advanced (box). My message to doctors is that if you want to influence these systems spend time working out your clinical information needs and ensure that the system is relevant to them.

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Women and scuba diving

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Scuba diving is becoming an increasingly popular sport, and the British Sub Aqua Club estimates that there are 5000 female non-commercial divers in Britain. Doctors are increasingly being asked to advise patients about the risks associated with diving, and, with the growing number of women divers, this must include an assessment of any risks during pregnancy or associated with the menstrual cycle or oral contraceptives. In this paper we review the current knowledge on the potential risks for women associated with diving.

Body fat and decompression sickness

Cognitive changes occur with various phases of the menstrual cycle,^{1,3} and in theory a woman's ability to make safe decisions during diving could be affected by her menstrual state, although to date no studies have been conducted to assess this. Repeated exposure to hyperbaric pressure seems to have no effect on hormone regulation, ovulation, or menstruation, though there has been only one formal study.⁴ In this study two women were subjected to 5 atm (507 kPa) pressure—that is, 40 m of sea water—for 20 minutes seven or eight times during their menstrual cycle.⁴

Most knowledge of decompression sickness in women comes from the American Space Programme and relates to altitude decompression sickness, which may not be a good model for diving. Several altitude studies have found that women form fewer nitrogen bubbles than men for a given exposure^{5,6} but seem to have a higher incidence of altitude decompression sickness,^{5,8} to have more delayed onset of symptoms,⁵ and to be more likely to suffer the more serious type II bends.⁵ One retrospective study of diving decompression sickness presented in 1978 at the National Association of Underwater Instructors International Conference of Underwater Education in the United States showed a 3.3-fold greater incidence in women compared with men.⁹ But a more recent survey¹⁰ and results from studies currently being undertaken by Fife in Texas, US show no differences between men and women in their susceptibility to decompression sickness. Women have on average 10% more subcutaneous fat than men, and it has been suggested that this could influence their susceptibility to decompression sickness (B E Bassett and E H Lanphier, unpublished data). Fat can hold up to five times more inert gas than aqueous tissue and is slower to absorb and eliminate it. This has been put forward as a theory to explain the tendency for women to have a delayed onset of decompression sickness, especially with dives of long duration,¹⁰ although to date there has been no evidence to confirm this, and some reports deny any correlation between percentage of body fat and altitude decompression sickness.⁵

In one study all of the women who developed altitude decompression sickness were in the first 14 days of their menstrual cycle,⁵ and this has been

supported by a recent study which showed an inverse correlation between the number of days since the start of the last menstrual period and the incidence of altitude decompression sickness.¹¹ It has been speculated that the haematological effects of the early contraceptive pill may increase a woman's susceptibility to decompression sickness by encouraging microsludging of the blood peripherally (Bangasser, unpublished data), but again this has not been formally assessed.

Diving in pregnancy

There has been little work done on diving in pregnant women, though two authors have speculated on an increased risk of vaginal infection in women who dive while pregnant.^{12,13} Several retrospective studies have suggested that diving during pregnancy is associated with an increased risk of fetal abnormality,^{14,14a} and Betts showed that diving below 30 m during the first trimester was associated with a rate of abnormality of 16%,¹⁵ although the number of women in this study was small. In contrast Bangasser found no abnormalities in a retrospective survey of 72 women who had dived while pregnant.⁹ A long term retrospective study of the effects of diving during pregnancy is currently being undertaken both in Britain and in the United States.

Some studies in sheep have shown that maternal decompression sickness in late pregnancy is associated with increased fetal morbidity and mortality, whereas dives that did not cause decompression sickness had no effect on the fetus.¹⁶ Bolton-Klug *et al* found no effects of diving on fetal development during organogenesis in sheep.¹⁷ Gilman *et al* found a fetal anomaly rate of 5.3% in hamsters after untreated decompression sickness, reducing to 0.9% in those treated with hyperbaric oxygen.¹⁸ Some animal studies have, however, suggested that hyperbaric oxygen treatment may be toxic to the fetus.¹⁹ There have been conflicting reports about the effects of hyperbaric oxygen on fetal outcome in non-diving pregnant women,^{20,23} but unpublished reports from the Soviet Union suggest that the treatment is successful in pregnant women with cardiovascular problems.^{14b}

Advice for women divers

Early reports from animal studies suggested that the fetus was relatively resistant to decompression sickness,²⁴ but this was later challenged.²⁵ Recent work in sheep and goats suggests that although the fetus produces fewer bubbles than the mother, bubbling can occur in the fetus even when the mother shows no signs of decompression sickness.²⁶ Any circulating nitrogen in the fetus can readily pass into the arterial system.

Women who want to continue to dive when pregnant have been advised on the basis of published²⁷ and

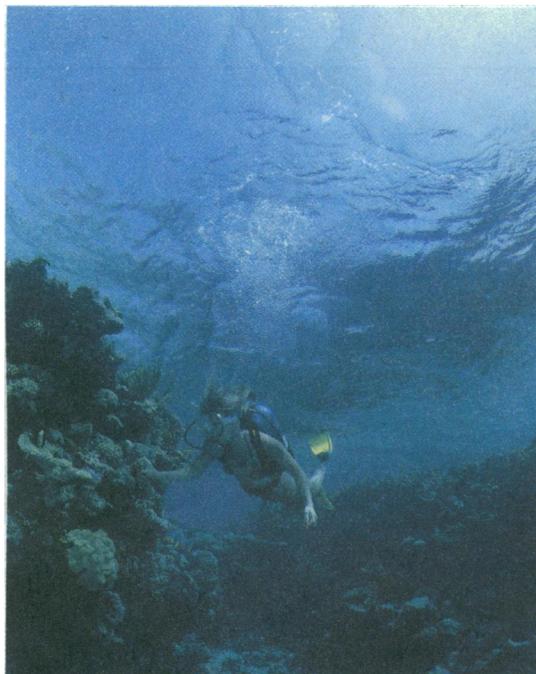
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OCEAN OPTICS

Problems lurking under the surface for women divers?

unpublished findings to stay above a depth of 10 m, but this is an arbitrary recommendation, and no studies to date in animals or humans give clear results about safe limits for depth, duration, or timing of a dive during pregnancy. The British Sub Aqua Club has recently come into line with the main diving organisations in America and is advising women who are pregnant or trying to become pregnant, and want to be absolutely certain that the pregnancy will not be affected by diving, not to dive. Female commercial divers in the United Kingdom are not allowed to dive while pregnant.

Some women may be more susceptible to decompression sickness at specific times of their menstrual cycle, so women should be advised to keep an accurate record of their cycles in their diving log books. There is no firm evidence suggesting that women taking oral contraceptives are at an increased risk of decompression sickness. Current knowledge is based on animal studies, which may not be applicable to humans, and retrospective surveys on diving women, the results of which are often conflicting and based on small numbers. We need to gather more information on women and diving, and this can be provided only by the women themselves and detailed information from recompression chambers. At present a long term broad based retrospective study on a large group of male and female divers is being conducted in the United States; and in the United Kingdom the Diving Diseases Research Centre in Plymouth is coordinating a questionnaire similar to that used in the American study, which is being circulated to diving clubs in Britain. We hope that these surveys will

provide more detailed information on women's diving habits, the effect of diving on the menstrual cycle and pregnancy, and the risk of decompression sickness so that women scuba divers can be better informed of the risks associated with this activity.

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ANY QUESTIONS

Is there any evidence that diet may cause hyperactivity in children?

There is considerable scepticism about the effect of diet in hyperactivity.¹ Work at the Hospital for Sick Children, Great Ormond Street, however, has shown that a limited number of children may be helped by dietary manipulation.² The regimen proposed is a rigorous and difficult one requiring strict supervision to avoid producing deficiencies of essential nutrients. Undoubtedly there is a strong placebo effect, and imposing such an ordeal as a difficult diet on a family may be therapeutic in itself. When

hyperactivity does not respond to advice and behavioural management there is a choice of drug treatment and dietary treatment.³ Drug treatment is effective, but many parents are anxious about using it. When parents think that simple dietary manipulation, such as removal of additives, is helpful there is no good reason to discourage it. — DORA BLACK, consultant child and adolescent psychiatrist, London

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