

Women and Diving

Part 3 – Diving During Pregnancy

By *Dr. Lynn Taylor*

This is the third in the “Women & Diving” series and will review diving during pregnancy and addresses some of the commonly asked questions. The next article will address the controversial question of gender and the risk of decompression illness.

Diving during pregnancy

Researching the medical and scientific literature reveals that there is little scientific data available regarding diving while pregnant. Clearly there are ethical restrictions in conducting clinical studies on pregnant women. As a result, most of the information comes from anecdotal case reports, retrospective diver surveys, animal models and theory, all of which have limitations in extrapolation to the ‘average’ pregnant diver. Factors which cannot be controlled for in these type of ‘data’, such as variations in depths, times, number of dives, ascent rates etc, may have an important (but unquantifiable) influence on ‘risk’. The results of animal studies are conflicting. This article provides a summary of the information that is available which will hopefully provide the reader with a framework on which to have an informed discussion. If you are pregnant and are considering continuing to dive, it would be wise to

discuss it with a doctor who has additional specialist training in diving medicine, as they may be able to put the ‘risks’ into perspective in relation to your specific medical condition.

What are the concerns about diving during pregnancy?

There are two main theoretical concerns regarding diving during pregnancy.

Firstly, the effect of a high partial pressure of oxygen (PO_2) on foetal development. The higher PO_2 results from the depth of diving, or from the mother requiring hyperbaric treatment if she develops symptoms of decompression illness (DCI).

The second concern is the possibility of foetal DCI and the consequences of any bubble in the venous circulation passing directly into the arterial circulation. The placenta should filter out bubbles formed in the mother but there are some concerns that the bubbles could partially block the blood supply to the foetus causing oxygen shortage (hypoxia) and foetal cell damage. Bubbles in the venous system of the foetus are of concern. As the lungs are not functioning, any bubbles will pass directly into the arterial circulation via the foramen ovale (hole between the right and left atrium chambers of the heart).

These bubbles could cause serious damage as they can then pass directly to the brain of the foetus.

I’ve just found out I’m pregnant. What should I do?

If you have just discovered you are pregnant and conception occurred during a week’s diving holiday, you can probably relax, the diving in itself should not be a reason to consider a termination. In these very early stages there appears to be very little cause for concern. It takes about 7 days for a fertilised embryo to attach to the wall of the uterus and another 7-10 days before there is any effective maternal-placental



blood circulation. The cells are undifferentiated at this stage (ie. they haven't yet started to become individual structures) and so it is not until later that damage to a single cell is likely to result in any malformations.

See your doctor and arrange to have an ultrasound in the second trimester, with emphasis on limb and spinal development as well as the cardiac structures and the configuration of the great vessels around the heart.

What about diving later in pregnancy?

One of the first published surveys is of a questionnaire given to 72 women who dived for at least part of their pregnancy. All babies born were normal and the rates of complications were not significantly greater than the general pregnant population. The results of a similar survey were published in 1980, when 208 self-selected female divers replied to a questionnaire placed in diving magazines. In this survey, the incidence of birth defects was 5.5% in those who dived during pregnancy, which was higher than the 2% incidence found in the normal population. However due to the small sample size this was not significantly different. A more recent publication has shown that there may be a higher incidence of spontaneous abortion amongst women who dived more than one dive a day, or had made dives with decompression stops whilst pregnant. Again numbers were small and did not reach statistical significance.

There is also some data which suggest that deeper dives (20m+) may be associated with foetal abnormalities. However, in some of these cases, other influencing factors were present, such as a rapid ascent. One published case describes numerous birth defects in one child born to a mother who undertook about 20 dives during pregnancy, including an emergency ascent from 18m.

To put all this into perspective, there are probably thousands of women who have continued to dive whilst pregnant, without subsequent ill-effect to their babies. The mothers were either unaware that they were pregnant, or chose to accept the possible increased risk and continue diving.

What other maternal 'risks' or discomforts should be considered?

Aside from any concerns to the foetus, pregnancy also brings about physiological changes which can affect the mother.

One theoretical concern is the possible increased risk of decompression illness to the mother due to the physiological changes which occur while pregnant. During pregnancy, maternal body fluid distribution is altered and this redistribution decreases the exchange of dissolved gases in the central circulation. Theoretically, this fluid may be a site of nitrogen retention.

Fluid retention during pregnancy may also cause swelling of the throat and nasal passages leading to nose and ear stuffiness. This may increase a pregnant women's risk of ear or sinus squeezes while diving.

Pregnant women experiencing morning sickness, which could then couple with motion sickness from a rocking boat, may have to deal with nausea and vomiting during a dive. This is an unpleasant experience and could lead to more serious problems if the diver panics.

If a pregnant women does dive and she gets DCI will she be treated?

If a pregnant 'Mum' develops symptoms of DCI, there are some theoretical concerns regarding treatment in a recompression chamber with hyperbaric oxygen (HBO). Effective treatment generally involves taking a diver to 18m on 100% O₂, giving a PO₂ of 2.8bar (in diving we limit to a max of 1.4 or 1.6). It is known that high PO₂ can cause harmful changes in foetal blood supply and premature closing of certain specialised blood vessels and blindness (due to retinal fibroplasia). However in reality, we know many women have been successfully treated with HBO for CO poisoning whilst pregnant, with no ill effects.

As with all medical dilemmas, the decision to treat will be made by assessing the benefit vs risk. The benefit to the mother would almost certainly outweigh any potential risk to the foetus.

Can I dive during the months that I am breast feeding?

As far as the baby is concerned, the mother's breast milk is not unduly affected by diving. Although nitrogen accumulates in all of the tissues and fluids of the body, insignificant amounts of this nitrogen would be

present in the mother's breast milk and there is no risk of the infant accumulating this nitrogen.

From the mother's perspective, there is no physiological reason for a woman who is breast-feeding her child to avoid diving, provided there is no infection or inflammation of the breast. It would be more the practicalities of breast feeding on a dive trip that would require attention.

After the birth, when can I return to diving?

After a vaginal delivery, women can usually resume light to moderate activity within 1-3 weeks, depending on factors such as prior level of conditioning; exercise and conditioning during pregnancy; pregnancy-related complications; postpartum fatigue; and anaemia, if any. Obstetricians generally recommend avoiding sexual intercourse and immersion for 21 days postpartum. This allows the cervix to close, decreasing the risk of introducing infection into the genital tract. Most diving physicians recommend waiting 4-6 weeks after delivery before returning to diving.

After a cesarean delivery (often called a C-section, made via a surgical incision through the walls of the abdomen and uterus), wound-healing has to be included in the equation. Most obstetricians advise waiting at least 4-6 weeks after this kind of delivery before resuming full activity. Given the need to regain some measure of lost conditioning, coupled with wound healing, and the significant weight-bearing load of carrying dive gear, most diving medicine specialists would

recommend waiting at least eight weeks after a C-section before returning to diving.

Any moderate or severe medical complication of pregnancy, twins, pre-term labor, hypertension or diabetes may further delay return to diving.

What do the medical associations and professional agencies recommend?

Divers Alert Network (DAN) presents a balanced view of the information available and summarises: "Due to the limited data available and the uncertainty of the effects of diving on a foetus, diving represents an increased exposure for the risk of injury during pregnancy. There's a baseline incidence of injury including cases of decompression illness in diving. One must consider the effects on the fetus if the mother must undergo recompression treatment."

The South Pacific Underwater Medicine Society (SPUMS) statement reads: "The safety of diving while pregnant has not been established. Risks of diving to the foetus are under investigation but pregnancy shall be considered a contraindication to diving."

The Recreational Scuba Training Council guidelines, which are

endorsed by the Undersea and Hyperbaric Medical Society and used by dive training agencies such as PADI (Professional Association of Diving Instructors) defines pregnancy as a severe risk contraindication. "Pregnancy: The effect of venous emboli formed during decompression on the foetus has not been thoroughly investigated. Diving is therefore not recommended during any stage of pregnancy or for women actively seeking to become pregnant"

The British Sub Aqua Club (BSAC) Sports Diving Medical Association safe diving practices read: "Medical evidence as to the safety of diving whilst pregnant is not conclusive. However there is evidence that deep diving may cause harm to the foetus.



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Certainly decompression illness and its subsequent treatment could be harmful to the foetus. Consequently if a woman is pregnant, or is trying to become pregnant, she is strongly advised not to dive". It also advises: "Those women who decide they wish to continue to dive whilst pregnant, or trying to become pregnant, should only undertake shallow dives, ideally less than 10m and no deeper than 20m, and remain well inside no-stop times. Even at shallow depths there remains a risk of pulmonary barotrauma which could require recompression treatment and cause harm to the foetus." □

Summary

- There is very little human data or evidence relating to dives done by pregnant women, most recommendations are based on theoretical concerns.
- As with all recommendations the aim is to minimise any potential risk to the foetus and so the recommendation is generally not to dive during pregnancy.
- If you have recently been diving and discovered you are pregnant, the risks to the unborn child are probably small. See a doctor trained in diving medicine.
- After an uncomplicated birth, a mother should be able to return to diving after 4-6 weeks.
- There are no concerns of trans-mission of nitrogen to the baby via a diving mother's breast milk.

ABOUT THE AUTHOR

Lynn Taylor PhD, is a very keen technical diver and prolific writer. She is a DAN Oxygen Instructor, PADI dive instructor, coordinator of DAN SEAP-NZ, and Dive Incident & Accident Recorder for NZUA.

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