

DIVING AND HIGH BLOOD PRESSURE (HYPERTENSION)

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As we age, the likelihood of suffering a disease affecting the heart or circulatory system (cardiovascular system) increases. One condition that affects many people over the age of 40 years is hypertension, commonly referred to as 'high blood pressure'. Divers frequently ask "I take medication for my high blood pressure – is it still ok to dive?" In most cases where divers ask questions about medication often it is the underlying disease which has important implications in the diving environment, rather than the medicine itself. In the case of hypertension, both the condition itself and the medication are potentially important. In this article we will discuss the significance of hypertension and anti-hypertensive medications in a diver.

What is hypertension?

Hypertension usually refers to excess pressure in the arterial blood vessels. Arterial pressure is usually expressed as two numbers. The first number is the maximum pressure developed when the heart ejects (referred to as the systolic pressure). The second number is the minimum pressure measured during the period when the heart is relaxing (referred to as the diastolic pressure).

We still use millimeters of mercury (mmHg) as the unit for many physiological pressure measurements and blood pressure measurement is no different. To give you some feel for mmHg, we can compare it to a pressure you are more familiar with: the atmosphere. Remember that the pressure at sea level is 1 atmosphere or 101 kilopascals. There are 760 mmHg in 1 atmosphere.

To give you a sense of normal blood pressure, a systolic pressure of 120mmHg and a diastolic pressure of 80mmHg would be typical in a relatively young fit person. The figures fall in the very young and tend to rise in the elderly. Defining "hypertension" is a somewhat arbitrary process, but a systolic pressure of more than 140 and a diastolic pressure of more than 90 are likely to be considered excessive.

What causes hypertension?

Various medical problems can cause hypertension. Some types of kidney disease and certain endocrine (hormone) disorders are examples, but detailed discussion of causes is beyond the scope of this article. The most important thing to point out is that in the vast majority of hypertensive patients no cause is ever found. In such patients, the mechanism of hypertension is poorly understood. An important implication of this is that patients who have nothing else obviously wrong with them may be suffering from hypertension without knowing it. The only way to find out is to have your blood pressure measured periodically.

Why is hypertension bad?

Hypertension predisposes the patient to many problems. Hypertension can be directly responsible for damage to the kidneys and the eyes. Hypertensive patients also seem more prone to developing disease of their blood vessels, including the coronary blood vessels that supply the heart muscle. The latter, in turn, may reduce exercise tolerance and predispose to heart attacks during times of physical stress. Hypertension may also predispose a patient to a cerebro-vascular accident (CVA or stroke). We reiterate that some of these processes can be underway despite the patient feeling well and being unaware that there is anything amiss.

How is hypertension treated?

Treatments for hypertension can be divided into two groups.

The first is lifestyle alterations which include strategies such as weight loss, increasing exercise, and reduction of salt intake. These can be spectacularly effective, particularly in patients with “borderline” or mild hypertension.

The second is pharmacological interventions. There are many patients taking long term medications for hypertension. Common anti-hypertensive medication types include beta-blockers, angiotensin converting enzyme (ACE) inhibitors, diuretics, and calcium channel blockers. Beta blockers work by reducing the rate and force of contraction of the heart. ACE inhibitors work by multiple mechanisms, including reduced salt and water retention, and relaxation of blood vessels. Diuretics promote water loss in the urine, but they also cause some blood vessel relaxation. Calcium channel blockers can have a similar effect to beta blockers on the heart, but some also cause blood vessel relaxation.

What are the implications of hypertension in diving?

Hypertension is such a common problem in middle age that it is hardly surprising to encounter hypertensive diving candidates. In evaluating a diving candidate with hypertension the diving doctor must confront a number of issues.

First, the diving doctor must consider whether there are any causes for the hypertension that can be treated. This will usually have been addressed by the patient’s GP, but if not, then it is appropriate to delay diving to allow a full evaluation of the potential causes of hypertension. If any underlying causes are found, then the nature of those problems, their treatment, and the eventual control of the hypertension will determine suitability for diving.

Assuming that, as in most cases, no obvious cause for the hypertension is found, then the implications for diving rest on several other issues. Specifically: whether there are any obvious complications of hypertension; whether the hypertension is adequately controlled; and what medications are being used to control it.

Perhaps the most worrying of hypertension’s potential complications or associations is coronary artery disease (CAD) which compromises blood supply to the heart muscle. Occasionally patients with CAD will suffer symptoms like angina (central chest pain) or undue shortness of breath, often in relation to exercise. Since diving potentially involves quite strenuous exercise, any patient (hypertensive or otherwise) suffering such symptoms should not be diving and needs specialist review to assess and treat their problem.

In contrast to these symptomatic presentations, CAD can be just as “silent” as hypertension itself, and a heart attack can be the first sign that there is any problem. It follows that a hypertensive patient who wants to dive should not be surprised if a diving doctor orders a stress ECG or similar test prior to allowing diving, especially if they are over 40, have a family history of heart disease, high cholesterol, or a smoking habit. In this test the patient exercises while a recording of the heart’s electrical activity is made. It is a reasonably sensitive means of detecting coronary artery disease that is not currently producing any symptoms.

Assuming there are no treatable causes and no obvious complications (and this is frequently the case), consideration must then be given to the adequacy of blood pressure control. Simply put, if control is adequate meaning that blood pressure is within, or nearly within normal limits, then diving should be OK. If not, then diving should be delayed to allow a review of the medication and optimization of control.

This educational article is written with the intention of making balanced information available to all individuals, particularly those involved in diver training or diver safety. You are free to download this information and print copies for wider distribution. If sections of the articles are used in other publications, they should be fully referenced with acknowledgement being given to the NZUA and the author(s) – www.nzunderwater.org.nz

Finally, assuming there are no treatable causes, no obvious complications, and control is adequate, the final consideration is whether the medications are compatible with diving. Here there are no strict rules, and it must be acknowledged that none of the commonly used anti-hypertensive medications are completely incompatible with diving. Nevertheless, it is appropriate to point out a few possible problems and preferences.

First, where possible we try to avoid the use of beta blockers in divers. This is because of the potential for these agents to reduce the heart's ability to respond to increased demands imposed, for example, by increased exercise and even just immersion itself. There is a very rare but potentially fatal condition known as "immersion pulmonary oedema" which is occasionally seen in divers. It is not well understood, but it seems that immersion and other associated phenomenon such as exposure to cold and pressure differences between the chest and the mouth impose a stress on the heart that, in some people, is not compensated for adequately. Fluid leaks from the blood into the lung air sacs and the patient becomes very short of breath. Although the data is limited, it seems more common in divers with a history of hypertension or other cardiovascular disease, and very limited anecdote suggests that treatment with a beta blocker may also be a risk factor. In view of the way beta blockers work (see above) this does not seem so surprising.

Given the poor quality of the data that identifies beta blockers as a risk in diving, it is inappropriate to make hard rules. If there are compelling medical reasons for a diver to be taking a beta blocker (they are very good drugs in some situations), then the overall benefit to the patient may outweigh the risk of using a beta blocker in diving.

Second, we also try to avoid the use of diuretics in divers, mainly because of the potential for them to cause fluid and blood salt imbalances in some situations. Such complications (especially any tendency to dehydration) could be a risk factor for decompression illness.

For patients where there are no particular indications for using other anti-hypertensives, ACE inhibitors are considered an appropriate agent for the treatment of hypertension in divers.

The bottom line on hypertension.

If a diver or diving candidate with hypertension has no obvious treatable causes, no known complications, and is well controlled on appropriate medications, then there is no reason to prevent them from diving. Such a patient must accept that their risk in diving may be slightly elevated because, for example, of a marginally reduced exercise tolerance, of undiagnosed complications, or of a possible predisposition to immersion induced pulmonary oedema. However, these extra risks are usually small, and are acceptable to most hypertensive divers, or those who want to dive. We do recommend that divers with hypertension undergo regular review by their GP to optimize control and to keep an eye out for the emergence of any complications. This is one medical condition that in most cases can be managed to facilitate a rewarding participation in diving.

For more information on these issues, divers should consult a doctor with training in diving medicine. A list of doctors in New Zealand and Australia who have appropriate qualifications in diving medicine can be found elsewhere in this magazine, or can be downloaded from the website of the South Pacific Underwater Medicine Society at <http://www.spums.org.au>. The same list can be obtained by contacting the New Zealand Underwater Association on (09) 623 3252 or via a link from their website <http://www.nzunderwater.org.nz>.