

ELECTIVE (SSC5a) REPORT (1200 words)

A report that addresses the above four objectives should be written below. Your Elective supervisor will assess this.

My elective was with DDRC Healthcare in Plymouth, who are hyperbaric and diving medicine specialists. I had previously only experienced this branch of medicine through knowledge I had gained from recreational SCUBA diving courses, and so was keen to get a more in-depth view of the specialty. Unfortunately my time at DDRC was limited as I had to self-isolate with COVID, but despite this I was still able to learn the principles of hyperbaric and diving medicine, have contact with patients, and gain an appreciation of how DDRC functions as a charity and private organisation.

Identify the prevalent medical conditions treated by hyperbaric medicine in the UK and worldwide

The field of hyperbaric medicine developed initially to treat decompression illnesses (DCI) – conditions occurring in divers, caisson workers, and aviation and aeronautic workers due to changes to gas and pressure in the environment (1). In the United Kingdom, divers are the most common group who are affected by DCI. The numbers of diving-related injuries has been impacted by COVID-19. However, data preceding this showed 354 diving incidents in 2019, as reported by the British Sub-Aqua Club (2). Of these, the most common incident type was DCI. Globally, the Divers Alert Network in 2017 reported 8468 diving-related incident calls, of which barotrauma was the most common reason, followed by DCI (3).

DCI can be subdivided into two types of illness: decompression sickness (a problem of evolved gas) and arterial gas embolism (a problem of escaped gas). Of these, decompression sickness (DCS) is the most common (1). DCS refers to the condition of nitrogen inappropriately dissolving out of solution and forming gas bubbles which can obstruct vessels and cause associated inflammation in tissues. This can occur in any tissue in the body but is most common in nervous tissue and articular cartilage. Arterial gas embolisms occur when nitrogen bubbles enter the arterial circulation – either from pulmonary damage, right to left circulatory shunts, or overwhelming of the pulmonary filter (1). These conditions are treated by recompressing the patient in a hyperbaric chamber.

Hyperbaric oxygen therapy (HBOT) is also used as an option to aid the healing of problem wounds – most commonly these include advanced diabetic and vascular ulcers, late radiation-induced tissue damage and other soft tissue ischaemia. Other less common indications for the use of HBOT include severe carbon monoxide (CO) poisoning and arterial gas embolisms not caused by decompression illness (typically iatrogenic) (4).

Describe the interplay of NHS, emergency and private services offered within a charitable organisation and how this differs to the usual structure of NHS services

DDRC is a registered charity aiming to improve knowledge, education and safety in diving and altered gas and pressure environments, and to treat medical conditions arising from these situations. These objectives are undertaken through a number of different activities.

To improve diver safety, DDRC run a 24/7 diving emergency helpline staffed by an on-call doctor. This allows divers to call in and receive medical advice and, if necessary, be directed to the nearest diving medicine specialist for assessment and treatment. Further activities to improve diver safety include educational activities and resources that are free to access, and research programmes into diver health.

A large part of the charity is focused on providing elective hyperbaric treatments to patients, most commonly those with problem wounds. If suitable, their treatment is funded by the charity along with any accommodation needs due to the long duration of treatment – sometimes up to 8 weeks.

The charitable aspect of DDRC is funded through donations, private work and NHS contracts. DDRC has a contract from the NHS to provide emergency hyperbaric treatments, most commonly to divers with DCI, but also to patients with arterial gas embolisms and severe cases of CO poisoning. Doctors working at DDRC conduct Fitness to Dive and Seafarer/Occupational Health medical assessments. They also run medical training courses, mainly for commercial divers and offshore workers. The costs of these courses and assessments are paid by the patient or employer and any profits go towards the charity. Furthermore, the activities themselves help to provide safe diving for those with co-morbidities that have the potential to limit the ability to dive both recreationally and commercially.

Describe the populations most at risk of decompression illnesses globally

As mentioned above, people at risk of DCI are those who undertake recreational diving, and those with professions that require them to work under altered pressures. There are a number of factors that can increase the risk of DCI for divers. Risks posed by the diving profile include deep dives, longer dives, bounce dives and multiple dives per day – all of which increase the nitrogen load in the body. Rapid ascent and missed decompression stops also increase the risk of both pulmonary barotrauma and DCS (1).

Other risk factors for DCI include increased age, female sex, dehydration, ascent to altitude after diving, exertion during or after a dive, and alcohol use. Underlying medical conditions such as obesity, right to left circulatory shunts (such as a patent foramen ovale) and respiratory conditions causing gas-trapping (such as asthma and chronic obstructive pulmonary disease) can increase the risk of DCI even in safer dive profiles (1).

Learn and describe how hyperbaric chambers work, its therapeutic effect and the pathophysiology of the common conditions treated

Hyperbaric chambers work by increasing the atmospheric pressure within a sealed chamber, mimicking the increased pressure of the underwater environment. Different protocols for length of time and depth of treatment are used depending on the patient and pathology being treated. Commonly pressures the equivalent of 18 metres are reached for around 8 hours or more. Whilst in the chamber, oxygen is breathed with short air breaks to minimize the risk of oxygen toxicity (5).

Initial treatment of DCI includes oxygen administration, increased fluid intake and urgent transfer for assessment by a diving physician (1). Definitive treatment of DCI is by recompression therapy, which will help treat the condition both through the direct effect of increased pressure and through the inhalation of hyperbaric oxygen. The increased pressure will decrease the volume of the bubbles and reduce the direct effect they are having on tissues and/or circulation. Oxygen breathed in at these higher pressures will result in a higher diffusion gradient to bring nitrogen out of solution promoting clearance via the lungs. Hyperbaric oxygen also exhibits anti-inflammatory properties and thus will improve healing of tissues with secondary damage from DCI (5), which is also the principle by which HBOT is used for problem wound healing.

Bibliography:

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