

TENSION PNEUMOTHORAX IN DIVERS

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Key Words

Accident, first aid, pulmonary barotrauma, resuscitation, treatment.

Introduction

**TENSION PNEUMOTHORAX
IS THE
ONLY
DIVING-SPECIFIC DISORDER
WHICH CAN KILL AT A DIVE SITE
AND YET IS**

TOTALLY TREATABLE IF RECOGNISED.

The diver in the boat can
MAKE THE DIFFERENCE

BETWEEN LIFE AND DEATH.

Basic assumptions

Divers will (in general) not have pre-existing lung disease.

Divers will rarely have a coagulopathy or other important co-morbidity.

Symptoms

Divers developing a pneumothorax underwater will almost always develop symptoms of shortness of breath and or chest pain during the dive, though these may not be recognised at the time. Shortness of breath will **ALWAYS** get worse during ascent. Chest pain often **IMPROVES** during ascent as the pneumothorax enlarges and the lung no longer touches the chest wall.

Such symptoms developing **AFTER** a dive are of no greater concern than any other pneumothorax.

ONLY

A PNEUMOTHORAX DEVELOPING

DURING A DIVE OR DURING ASCENT

is likely to become a tension pneumothorax as air outside the lung expands with ascent. Spontaneous pneumothorax ashore very rarely results in a tension pneumothorax.

Signs of pneumothorax

- 1 Tachypnoea (rapid breathing, usually shallow).
- 2 Asymmetry of the chest wall, which is best seen from above. The side with the pneumothorax is larger as the lung is no longer in contact with the chest wall and preventing it from expanding. The normal position of the chest wall is due to a balance between the natural expansion of the chest wall and the inward traction of the lung resisting the outward pull. The increased size does not imply tension.
- 3 Tracheal deviation to left or right. This can be seen and felt in the suprasternal notch. The trachea moves away from the pneumothorax due to the traction of the normal lung on the mediastinum and loss of contact with the chest wall on the affected side. Tracheal deviation does not imply tension.

Signs of TENSION pneumothorax

Raised jugular venous pressure (JVP), with the jugular veins standing up high in the neck and hypotension with tachycardia (rapid heart rate) means that life-threatening tension pneumothorax is present. The raised JVP is evidence of obstruction of venous inflow into the heart. This follows the rise in intrathoracic pressure, due to the tension pneumothorax, above the normal central venous pressure which reduces the venous flow into the thorax as the intrathoracic pressure rises. Hypotension and tachycardia (a rapid, difficult-to-feel pulse) are evidence of inadequate cardiac output consequent on the reduced venous inflow. Reducing the high intrathoracic pressure is needed so that venous inflow and cardiac output can improve. Otherwise when the intrathoracic pressure rises above the venous pressure, venous return stops, which stops cardiac output and the person **DIES** there and then.

It is not an oversight that there is no mention of a stethoscope. A stethoscope is useless at sea due to the surrounding noise levels in a dive boat especially with the motor running.

Emergency treatment

The aim is to equalise pressure across chest wall i.e. eliminate tension. It is not necessary to try to get rid of the pneumothorax as such. But venting the high pressure within the chest is ESSENTIAL.

Anatomy (Figure 1)

Go through the chest wall in the 2nd or 3rd intercostal space in the mid-clavicular line on either side. The needle, or knife, needs to be held perpendicular to the

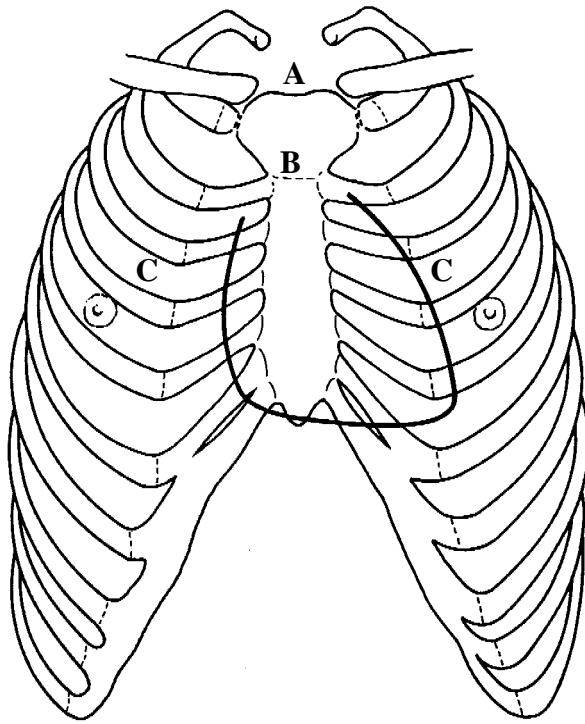


Figure 1. The supra sternal notch lies between the ends of the clavicles (A). The dotted line across the sternum is the angle of Louis (B). The black line overlying the ribs is the approximate position of the heart. The third intercostal space lies between the 3rd and 4th ribs (C). In thin males the nipples lie roughly in the mid-clavicular line.

skin. Using the 3rd space (between the 3rd and 4th ribs) makes it easier to control the knife. This approach will miss the heart, the great vessels and internal mammary arteries (which may be needed for later coronary artery surgery). The 2nd intercostal space in the mid-clavicular line risks the subclavian artery and vein if the needle is angled upwards.

To find the second rib put a finger in the suprasternal notch (between the inner ends of the clavicles) and run it down the manubrium to the angle of Louis (the junction with the sternum), about two fingers breadths down from the suprasternal notch, move outwards and the finger is on the second rib. Slide the finger towards the feet, off the rib and it is on the 2nd intercostal space, between the 2nd and 3rd ribs. Over the third rib the finger is on the 3rd intercostal space.

A lateral approach risks the long thoracic nerve and entering the oblique fissure of the lung which may prevent adequate drainage and so relief of pressure.

Always go down onto a rib as all the variation in depth is outside the rib. From the outer table of the rib there

is a further 6 mm in women and 10 mm in men to the pleural space. The intercostal vein, artery and nerve lie under the lower border of each rib. Keeping the needle close to the top of the rib below keeps it well away from the nerve and vessels.

Technique

To find the intercostal space put a finger on the rib below the space. Push the needle vertically through the skin to hit the rib. Lift the needle slightly so that it no longer is in contact with the rib. Tilt the hub down (towards the patient's feet) slightly and advance it. If it hits the rib repeat the process until it slides over the top of the rib and through the pleura into the pneumothorax. There will be a whistling as the high pressure air in the chest escapes.

Use local anaesthetic if you have it, if you do not, get an assistant (strong and heavy) but do it anyway!

Use a hollow needle or cannula, a chest drain or any sharp clean blade to piece the chest wall and establish continuing escape of air. A chest drain with Heimlich valve is Rolls-Royce treatment.

The follow-up chest X-Ray will always show a pneumothorax so you will always have been correct in your diagnosis and treatment.

Medical kit

A kit for dealing with a tension pneumothorax should have local anaesthetic, a 20 ml syringe, a 23 gauge needle and 14 gauge intravenous needle/cannula plus a 28 French gauge chest drain and tape.

The above paper has been prepared from a poster presentation at the 1997 SPUMS Annual Scientific Meeting in Waitangi, New Zealand.

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