

REPORT OF DIVING INCIDENT,

Dr DR Kerr, MBBS, Anaesthetics Registrar

On Thursday 29th January, my buddy and I went for a dive off Glacier Point. The dive lasted about one hour and maximum depth was probably 15 feet. Visibility was poor and during the dive we surfaced 3-4 times to check our position. The purpose of the dive was also to examine a model of an underwater refuge I had been working on. This consisted of a large plastic bag tethered to a rock and filled with air from our exhale ports. At one stage this broke loose and in an attempt to prevent it surfacing I held onto it, but as I was ascending rapidly I let go after about 2 metres. We also used the bag to raise an old oil drum on the sea bed. This we also accompanied to the surface, but at standard ascent rates.

After the dive, all was well until about 24 hours later when, I developed a severe dull aching pain in my left shoulder, more in the axilla than on the shoulder tip. There was radiation down my arm and down both back and front of my chest. The pain came on over about half an hour and at first felt muscular in origin, but by the time it had developed fully I thought it was more likely to be a pneumothorax.

Symptoms began to subside after I arrived home and since I had no respiratory distress I decided to wait and see what developed. About 4.00 am I was wakened by very loud clicking sounds associated with each heartbeat. This was recognised as Hamman's sign, diagnostic of pneumomediastinum. The sound was up to 10 feet away in a quiet room.

At this stage I had slight discomfort behind the sternum and when I bent over I could feel air bubbling from the apex to the base of my left lung. Next morning I went to the Sutherland Hospital where X-ray confirmed the presence of a small pneumothorax but did not show mediastinal air.

Fortunately I avoided an intercostal drain but spent 3 days in hospital and a week at home while the air absorbed. During this time I also developed a feeling as though I had some food caught in my oesophagus at the thoracic inlet. I presume this was due to air tracking in the mediastinum. At no stage did I develop subcutaneous emphysema.

After recovery from this incident I decided to investigate myself as fully as possible as being a keen diver. I wished to establish the risks involved in continuing the sport and to seek an explanation for the incident.

The first thing to do was to review the X-rays. I had had a full medical before commencing diving in early 1974. I obtained the chest ray from that time plus those taken in hospital and one after recovery. Radiological opinion suggested no abnormalities and certainly no obvious areas of overdistention or air trapping in any of the films.

The next step was to submit to a complete respiratory function work-up with Professor Colebatch at Prince Henry Hospital Respiratory Laboratory. This included total body plethysmography static and dynamic compliance testing with oesophageal balloons and determination of residual volume and airways resistance as well as the usual spirometry.

Professor Colebatch has recently published a paper¹ on Barotrauma in divers and was particularly keen to investigate. This work suggests that divers subject to barotrauma to the lungs constitute a population with decreased pulmonary compliance, possibly due to increased lung elastic tissue. He further suggests that this elastin is not uniformly distributed throughout the lungs and that this leads to relative

overdistention in those areas poor in elastin, driving ascent. He also feels that the air trapping hypothesis due to subpleural blebs or mechanical airways obstruction is an overworked hypothesis.

The results of these tests showed that I had a normal lung with very little tendency to fit his observations made on other divers with pulmonary barotrauma. There was no suggestion of air trapping or increased airways resistance. His advice was that it would be extremely unlikely that I would again suffer barotrauma should I continue to dive provided safe diving practices were followed.

Next I presented these findings to a thoracic surgeon familiar with diving problems and asked for an opinion as to the existence of subpleural blebs and as to the possibility that the incident might be a spontaneous pneumothorax unrelated to diving. He thought that the second possibility was very unlikely on the basis of my build and history of diving and also thought that air trapping in blebs would be unlikely.

Finally I consulted Dr Ian Unsworth of the Prince Henry Hyperbaric Unit. He agreed with the findings but advised that I should consider giving up diving as, although I may have normal lungs on all tests and a possible cause for barotrauma in the rapid 2 metre ascent mentioned above, the fact remains that I did develop a pneumothorax and that this probably increases the risk of further barotrauma in future. Air embolus is a more serious form of barotrauma that I may be subject to and if a rapid ascent were necessary in an emergency I would be at increased risk.

Armed with this knowledge and advice I have decided to cautiously continue diving but with the following self imposed changes in technique:

1. Only one ascent to the surface per dive.
2. Very slow ascent rates, at least half the recommended rate.
3. Attempt to maintain minimum lung volumes whilst diving and to avoid using lung volume as a method of buoyancy control.
4. Close attention to avoidance of glottis closure during diving.
5. Uniform use of buoyancy compensation vest and contents gauge to ensure surface flotation and adequate air supply on the bottom.

In addition I will in future dive with a buddy capable of resuscitating me and with facilities for tapping tension pneumothorax on the dive boat (ie. Cannula and Heimlich flutter valve).

I hope to report my future diving experience in this newsletter.

DR Kerr

1. MJ Colebatch et al. Increased elastic recoil as a determinant of Pulmonary Barotrauma in Divers. *Resp Physiol* 1976; 26: 55-64.

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Nothing's for free

Mr Bell, British based managing director of Shell Oil Exploration said that his firm is now spending \$1500 a minute on their North Sea oil operations.