Management of Bites

If possible, the pressure immobilisation type of first-aid should be applied to the bitten area. Paralysis will wear off and the patient fully recover if adequate artificial ventilation is promptly instituted. This may have to be maintained for some hours.

Finally, there are still many venomous creatures that should be investigated. There are many Australian venoms that we know nothing about, such as some of our ant venoms. I hope that if anyone gets a chance to encourage collaboration and local research into the venoms in his area, he (or she) will do so.

Question

Is topical local anaesthetic any good for relieving pain in sea wasp stings?

Dr John Williamson

In our experience, no. The pain is much too severe to respond to that sort of application. We did ask the College of Dermatologists what they thought about the routine application of lignocaine as a cutaneous treatment for stings and they reacted violently. They thought it was a bad idea because a percentage of the population is allergic to lignocaine which has toxic actions of its own. That is a very conservative approach. Anyway with box jelly fish stings lignocaine does not seem to help at all.

With other minor stings, it does seem to help. But we do know that in the treatment of any marine sting, particularly jelly fish stings, the placebo effect is quite profound. We believe that that is why methylated spirits held its own for so long. As long as somebody sees and feels that something is being done, they feel a bit better about it. This particularly applies naturally to the parents of stung children. There is no doubt that in the single blind studies we have done, the placebo effect of treating a sting is quite profound. That is a legitimate approach, because it is cheap and it does no harm, but you have got to exclude the placebo effect when you are evaluating treatment.

Question

Could Dr Sutherland give us his views on the potential toxicity of the Toowoomba Funnel-webb. During the summer months, this spider can be found in quite large numbers in the Toowoomba Range. In the last two years, I have managed three bites. On two occasions, the spider had to be actually prised off the finger or the toe that it had bitten. In none of these cases did the patient come to any harm. In fact, talking to colleagues who have been in Toowoomba for some time, I have not been able to find any documentation or medical records to suggest that anyone in the Toowoomba area has come to harm as a result of one of these bites.

Dr S Sutherland

Only one in ten people, or it might be one in five, that are bitten by a male Funnel-webb gets sick because it has usually lost its venom. We have done some work on some of the Toowoomba spiders that have been identified and classified. The venom seems to be particularly toxic and we know the Sydney Funnel-webb antivenom neutralizes it.

I do not wish it on the Toowoomba people but you will get a case of envenomation in time and that is why you hold the antivenom. You might get a case tomorrow, or you might not get one for five years. Incidentally no-one knows why the Funnel-webb venom is only effective against the primates.

DECOMPRESSION SICKNESS

CASE REPORTS

J Orton

I have two cases of decompression sickness to present. One was definitely decompression sickness and the other suspected. The famous American Catholic speaker Bishop Fulton Sheen once told his flock, “There is no pleasure without pain”. His theological comments were not actually directed at anything we are talking about today but they may well have been directed at sports diving.

The first case was a 29 year old, fit fellow who was PADI trained with no significant past history, who developed obvious neurological decompression sickness following repetitive diving. He had about 70 hours experience diving. He had been on a weekend diving trip where he had really pushed himself right to the limits of the tables and in addition there were a lot of other contributing factors. He did four dives on the Saturday, none over 60 feet, that is day one, and two dives on the Sunday, one to 60 feet and one to 80 feet. Both these dives were within the US Navy tables no decompression (no stops) limits, but they were only just within. He was obviously pushing it a bit. Using the Royal Navy system, he was beyond the limits of the tables for repetitive dives and he should have done a stop on the first day. Now consider the additional factors. There had been a lot of merry making the day before with a bit of alcohol involved. Significantly, he did not even go to bed the night before his first day’s diving. He was up all night, Friday night. He was taking Sudafed (pseudoephidrine) tablets for what he said was “blocked ears”. He had a very vigorous approach to the whole weekend’s diving. He was always in the water, always swimming and he did a lot of snorkelling between the dives. There was also a lot of vigorous activity while he was in the water doing his tank dives as well.

During the ascent on the last dive he became disco-ordinated. He got vertigo and felt quite weak. He got up to the surface and had a rest and improved a bit but still felt weak. However he was able to help stow the gear. He had some difficulty passing urine after that last dive. There was some hesitancy and dribbling. On the way back, he

kept on telling people that he was not well. But back on shore that Sunday night he did not give up. He went to a barbecue, had a few drinks, but finally went home to bed. On the Monday he woke up still feeling unwell and noticed his weakness was increasing. He was quite drowsy and had a headache. He was quite nauseated after breakfast but did not vomit. He went to his local doctor. There he was noted to be quite drowsy. He was unable to stand up. When asked to come into the doctor's room, he had to push himself up using his arms on his thighs, he did not have the strength in his lower limbs to stand. The examination on that day showed obvious weakness in all muscles and all limbs. He could not straight leg raise. But there were no sensation changes. So the diagnosis of neurological decompression sickness was made. It took a little while to organise recompression but that evening it was underway in the Australian Institute of Marine Science (AIMS) recompression chamber about 40 kilometres from Townsville. This is quite a good size chamber and reasonably good backup medical facilities.

During the time before recompression the patient was given oxygen to breathe from a mask. The recompression treatment consisted of an extended table 62 on 100 per cent oxygen. After just 5 minutes at 18 metres he said his head felt clearer, his breathing felt much easier and he had an obvious increase in muscle power, to the extent that he could straight leg raise straight away. All within five minutes so the diagnosis was clear. After an hour, he could sit up unaided. He had three hours at 18 metres then we came up to 9 metres for an hour. Then he was noted to be quite a bit weaker than previously and he did not feel as clear mentally. So we took him back down to 18 metres for another two hours. At this depth he had no symptoms. He had four hours at 9 metres with no further symptoms. When he got back to the surface he said he felt completely well.

Over the next 12-24 hours he had a slow return of symptoms particularly the weakness. It was decided to continue recompression treatments until no further demonstrable improvement was seen. So he had repeated hyperbaric oxygen treatment until there was no residual weakness and no residual deficit and quite clear mentation. He subsequently made quite an uneventful recovery with no deficit at all.

To summarize, a fit 29 year old man pushed himself right to the limits of the tables and thrashed himself physically all weekend. He suffered weakness and mental changes from neurological decompression sickness and was successfully treated with recompression. In this case symptoms were present on ascent. I think that it is important to make people realise that if that happens, something must be wrong. He told people on the way back that he did not feel well, yet no one in the party thought that he should see a doctor. He spent a total of about 20 hours in the chamber over the next few days during the treatment. I consider that his sports diving mentality, there is no pleasure without pain type of fun, must have contributed some way in getting the bends, even though he was within the tables.

The second case was a 30 year old Female with quite a bit of experience diving, again PADI trained, again after a weekend of very vigorous diving, who developed some rather vague symptoms which were attributed to slight decompression sickness. There was subsequently little or no improvement with recompression treatment. She was taking out a group of novices to teach them some of the aspects of tank diving. The first day was fairly easy with a lot of snorkelling. The dives were not actually deep enough to be included in the tables, so it was a fairly easy day's diving. But there was a lot of snorkelling, a lot of activity. The second day she worked very hard in and out of the water all the time. She was looking after lots of people jumping in and out of the water. She was quite cold as she was not wearing the right gear or enough of it. And she "bounced" twice, that is two quick trips to the surface and back down again. Looking at the US Navy tables one need not count the first day because the dives were more than 12 hours before those on day 2. Using the US Navy repetitive dive tables she was just on the no decompression limits with her stated depths of 40, 50 and 60 feet. If one used the Royal Navy tables which are more conservative, she had exceeded the no stops limits. But if, as one should do, one adds 10 feet, for each adverse factor such as cold exposure, doing a lot of work and bouncing twice, it turns out that she was well over the no stop limits. Even using the less conservative US tables she should have made stops of ll minutes at 20 feet and 48 minutes at 10 feet. In my opinion she had gone well over the no stop limits.

On day 4 she presented with very vague symptoms, mainly a pain in the back of the neck. She felt unwell slightly. Her examination was quite normal. This pain was difficult to elucidate. She said she had actually noticed it on the bottom during the last (night) dive. She was with a group of novices that night and she bent over to pick up a torch that had dropped and felt this pain come on. Suddenly the torch was floating up to the surface and so was one of her novice divers, shooting up with the torch. That led her to do her second 'bounce' It was decided that there was insufficient evidence for a clear diagnosis of decompression sickness in view of the vagueness of her symptoms and the absence of any signs at all. Although she had obviously gone over the no-stops limits we felt that the patient rather than tables should be treated. She was treated overnight with oxygen by face mask. She was discharged the next day with instructions to take it easy and return if she had any further problems or return of her symptoms. Return she did on day 9 with persistence of her symptoms, pain in the neck and generally feeling a bit unwell. It was considered then, after some discussion with Des Gorman of the School of Underwater Medicine, that she might well have been suffering from decompression sickness, slight as her symptoms were. So recompression treatment was organized. Although there was some suggestion of improvement here and there, generally speaking I have to say that she did not really improve very much. She still has some pain in the neck and still felt a little unwell at the end of her treatment.

Where does that leave us? The decision to recompress was based in some way on a theoretical understanding of what happens with neurological bends. It is thought that there

are micro-emboli of gas bubbles in capillary networks in the spinal cord and subsequent oedema and ischaemia of the spinal cord. Some people would clearly argue that this should be treated quite aggressively and vigorously with early recompression. Should decompression be used diagnostically in this regard? That is another possibility, another question to raise.

Another big factor that comes up is the cost benefit of recompression when one considers the enormous increase in the amount of sports diving that is being done and the big demand that a recompression treatment makes, particularly on human resources, not to mention the cost in dollars. In North Queensland where the human resource commodity is spread so thinly it is quite a demand. I think these cases, particularly the latter case, raises that important point.

These two cases of decompression sickness, one with obvious demonstrable neurological lesion where the US Navy, less conservative, tables were not exceeded but where the guy had obviously thrashed himself around that weekend and really overdone things, the second have a very marginal case where the diagnosis was in doubt and the treatment was not effective in that it did not improve her, ie. suspected bends only, where the US tables were obviously very well exceeded, leave us with the dilemma that we have always been in. Just what value are decompression tables in helping us decide when to treat someone and just how should we be interpreting them?

DECOMPRESSION SICKNESS AN OVERVIEW

Bart McKenzie

I have to try to compress decompression sickness into 25 minutes, which is going to be no mean feat.

To start with there are a few basic physical principles. The first one is the concept of pressure. There is about 100 km of atmosphere above us and that exerts a certain amount of pressure which is called one atmosphere pressure. Ten metres of sea water exerts the same pressure as one atmosphere. So at 10 metres there are two atmospheres of pressure acting on the diver. At 20 metres there will be a pressure of three atmospheres, and so on. A diver does not have to go very deep before there is a considerable pressure acting on him or her.

Now to mention a few gas laws. The first one is Boyle's Law which states that volume varies inversely with pressure. If one takes an inverted open jar and pushes it down under the water, as the water pressure increases the volume will decrease. This has a lot of importance in the treatment of various things in diving medicine. If a diver has gas bubbles in his tissues and one applies increased ambient pressure to the diver then the bubbles will decrease in size. This may eliminate his symptoms. If the diver goes up in an aeroplane while he had bubbles in his tissues, the bubbles get larger. This has relevance to the transportation of divers. If he was breathing from compressed gas equipment and took a breath at some depth and came to the surface holding his breath, then that would spoil his whole day. The next concept is Henry's Law. When gas is in contact with a liquid some of the gas will dissolve in the liquid. Double the partial pressure of the gas over the liquid then twice as much gas will be dissolved in the liquid at equilibration. So when a diver is breathing compressed air under water nitrogen is taken up by his tissues and that has certain consequences which I will go into later. An important concept is diffusion. If someone was to pass flatus on one side of the room then it would not be long before people on the other side of the room were looking accusingly at each other. That is the process of diffusion. You can use diffusion and diffusion gradients in the treatment of decompression sickness by modifying gas partial pressures. Another important law in diving is Murphy's Law which states that if something can go wrong it will go wrong, usually at the most inconvenient time.

I would like to stress that diving is great fun. However, like all things that are great fun it has some drawbacks. One of the big drawbacks of diving is decompression sickness. A sports diver breathing under water has a demand valve which delivers gas to him at a pressure which is roughly equivalent to the ambient water pressure. So the deeper he goes the higher partial pressure of nitrogen he is breathing. This nitrogen is taken up. It equilibrates instantly in his alveoli and then it is delivered by the blood to the various tissues. Tissue uptake of nitrogen is dependant on several factors, the main one being the blood flow of the tissues. So tissues that have a high blood flow take up nitrogen quickly and equilibrate quickly. While tissues that have a low blood flow do not equilibrate so quickly. When a diver comes back to the surface he has an excess of nitrogen dissolved in his tissues. If the partial pressure of nitrogen exceeds a certain critical limit the nitrogen will come out of solution and form bubbles. This is analogous to the situation of carbonated beverages. If one looks at a bottle of champagne before taking the cork out there are no bubbles in it. There is carbon dioxide in the bottle but it is dissolved under pressure and the cork holds the pressure in. When the cork is taken out the pressure is released, the bubbles come out of solution quickly and everybody has a good time. But divers with bubbles do not have a good time.

When diving with compressed air equipment started about 150 years ago the divers found that if they spent a long time under water, especially at great depth, they would develop the symptoms of decompression sickness. They also figured out by trial and error that if they came up in stages, rather than coming straight up, that could minimise the symptoms and sometimes stop them from getting decompression sickness altogether. So there were various ad hoc decompression routines built up over the years. However early in this century Haldane worked out some decent decompression tables which would allow divers to dive to practically any depth that they wanted to, at that time, and come back using decompression stops and not get decompression sickness. He based his tables on two basic hypotheses. The first was that the gas uptake by a tissue, or gas uptake by the body occurs in an exponential fashion and also that gas elimination occurs in an exponential fashion. He also dreamed up some hypothetical