

## SPUMS ANNUAL SCIENTIFIC MEETING 1999

The 1999 ASM had two speakers, Alf Brubakk and Richard Moon, who presented papers on the pathology, natural history and treatment decompression illness, largely limited to decompression sickness, some of which have appeared in previous issues.<sup>1-4</sup> In this issue are the papers presenting two radically opposed views on what is required for the successful treatment of decompression illness (DCI). Also printed in this issue is the edited transcript of the panel discussion to discuss, and perhaps formulate, guidelines for the treatment of decompression illness under different circumstances, which was held on the last day of the meeting.

### References

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- 4 Moon R. Adjunctive therapy in decompression illness: present and future. *SPUMS J* 2000; 30 (2): 99-112

### ALL DIVERS WITH DECOMPRESSION ILLNESS REQUIRE RECOMPRESSION

Richard E Moon

remaining 140, 11 died, 8 from septicemia due to decubitus ulcers and cystitis and 3 from meningitis. He reported that approximately 10% of the remaining cases were permanently affected with slight paresis. The combined mortality and morbidity in this series was over 40%.

### Key Words

Decompression illness, hyperbaric facilities, hyperbaric oxygen, treatment

### Recompression therapy reduces symptoms and improves outcome

The efficacy of recompression therapy dates back to the 19th century, when anecdotal observation indicated that symptoms of decompression illness in divers who are mildly affected would often resolve when they were recompressed during the following shift.<sup>1,6</sup> The scientific rationale for this was provided by Paul Bert, who showed that decompression caused the formation of bubbles in the blood of experimental animals.<sup>6</sup>

### Untreated decompression illness

The course of untreated decompression illness (DCI) or “the bends” has been documented, by several authors, in large numbers of men exposed to compressed air while excavating tunnels and bridge piers in the 19th century.<sup>1-3</sup> In 1854, Pol and Wattelle reported 16 cases of bends and two deaths in a cohort of 64 compressed air workers.<sup>1</sup> In 1881 Woodward reported 119 cases of bends in caisson workers during the construction of the St. Louis Bridge.<sup>2</sup> There were 14 deaths and two men were permanently crippled. Snell noted that bends pain may take several weeks to resolve.<sup>3</sup>

Systematic application of recompression therapy was reported by Moir and Keays.<sup>7-9</sup> Moir did not report a reduction in morbidity, but his report convincingly demonstrated that recompression of compressed air tunnel workers prevented death. In one of the largest case series ever published, Keays demonstrated that recompression would resolve even minor symptoms.<sup>8</sup> Although Keays’ series was not randomised, he observed that recompression therapy was more successful than non-recompression treatment.

There is also excellent documentation of the abysmal course of neurological bends in divers.<sup>4,5</sup> In reporting bends in the pearl divers of Broome, Western Australia, Blick observed 200 cases of “divers palsy”, of whom 60 died before a doctor could be reached. Of the

**TABLE 1**  
**SINGLE RECOMPRESSION SUCCESS RATE OF USN OXYGEN TREATMENT TABLES**  
(from Thalmann).<sup>16</sup>

Source	Cases	Complete Relief	Substantial Relief	Comments
Workman <sup>17</sup>	150	85 %	95.3 % after 2nd treatment	
Erde & Edmonds <sup>18</sup>	106	81 %		
Davis <sup>19</sup>	145	98 %		Altitude DCS
Bayne <sup>20</sup>	50	98 %		
Pearson & Leitch <sup>21</sup>	28	67 %	83 %	
Kizer <sup>22</sup>	157	58 %	83 %	Long delays
Yap <sup>23</sup>	58	50 %	84 %	Mean delay 48 hours
Gray <sup>24</sup>	812	81 %	94 %	
Green <sup>25</sup>	208	96 %		All pain only, USN Table 5
Ball <sup>26</sup>	14	93 % (mild cases)		
	11	36 % (moderate cases)		Many cases with long delays
	24	8 % (severe cases)		
<b>TOTALS</b>	<b>1,763</b>	<b>81 %</b>		

Since Yarbrough and Behnke demonstrated superior results from the use of recompression therapy while breathing 100% O<sub>2</sub>,<sup>10</sup> a number of publications in the modern medical literature have provided evidence of the beneficial effects of recompression therapy (Table 1).<sup>11</sup> An exhaustive retrospective review of published series of cerebral arterial gas embolism revealed that full recovery was significantly more likely with hyperbaric treatment than without (Table 2).<sup>12</sup>

**TABLE 2**

**OUTCOME AFTER TREATMENT OF CEREBRAL ARTERIAL GAS EMBOLISM**

Data from Dutka.<sup>12</sup>

Outcome	Hyperbaric treatment		No recompression	
Full Recovery	346	84.2%	74	24.7%
Residual	45	10.9%	63	21.9%
Death	20	4.9%	151	52.4%
<b>TOTALS</b>	<b>411</b>	<b>100.0%</b>	<b>288</b>	<b>100.0%</b>

Hyperbaric treatment is associated with a statistically significant improvement in outcome ( $\chi^2=266.1$ ,  $df = 2$ ,  $P < 10^{-50}$ ).

**The long term effects of failure to recompress**

In compressed air workers, a group notoriously reluctant to report symptoms of DCI, there has been a high prevalence of bone necrosis.<sup>13,14</sup> It has been suggested that bone necrosis is due to some process other than the long term effects of untreated symptomatic decompression illness. On the other hand, while reported series of compressed air exposure often have a low rate of DCI, anonymous reporting systems indicate that the percentage of workers experiencing symptoms is several fold greater. Kindwall reported a tunnelling project in which the official bends incidence was 1.4%, but during some work shifts 26% of workers anonymously reported symptoms.<sup>14</sup> Long term effects of treated decompression illness in divers is rare,<sup>15</sup> and bone necrosis is considerably less common than in compressed air workers. Thus, it is conceivable that failure to treat clinical cases of DCI might predispose to long-term consequences.

**The theory that recompression therapy may not be necessary for some cases of DCI is untested and unproven**

It has been suggested that vigorous adjunctive therapy, including fluid resuscitation, surface oxygen and possibly adjunctive medications such as lignocaine, may achieve as good an outcome for some mild cases of decompression illness as recompression therapy. However, this is an untested hypothesis and to date there are no clinical data to support the notion that non-recompression therapy is as good as recompression with oxygen.

## Conclusion

Recompression therapy is currently the “gold standard” for treatment of decompression illness. There is thus far no evidence to refute the traditional view, that provided a symptomatic diver presents for therapy in a timely fashion after an episode of decompression illness, recompression therapy should be initiated.

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*Professor Richard E Moon has been a Guest Speakers at the 1997 and 1999 Annual Scientific Meetings. His address is Department of Anesthesiology, Box 3049, Duke University Medical Center, Durham, North Carolina 27710, USA. Phone +1-919-681-5805. Fax +1-919-681-4698. E-mail <moon0002@mc.duke.edu>.*