Medical Evacuation of Recreational Divers

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Introduction

- What is a timely evacuation for divers with decompression illness (DCI)?
- For severe DCI, treatment within 12 hours significantly improves outcome (1).
- However, treatment is still quite effective after prolonged (median 48 hours) delay (2, 3).
  - Mild DCI is much less affected by delayed (>24 hours) treatment (1,4).
- We examined a series of diver evacuations stratified by indication, latency and outcome in a sequential sample from the Divers' Alert Network (DAN) database.

Methods

- DAN medical service call center records from April 2006 to February 2009 were searched.
- Evacuations were defined as transport to higher medical care.
- Cases were stratified by DCI and non-DCI presenting symptoms.
  - DCI cases were classified as neurological (special sensory, cortical or motor symptoms) or non-neurological (pain, paresthesia or skin manifestations).
  - Non–DCI cases were classified as diving related or non–diving related.
- Two latencies were defined:
  - Time from symptoms to call.
  - Time from symptoms to evacuation .
- Outcomes after treatment were classified as resolved, incompletely resolved, worse or unknown.

Results

24,275 calls to DAN line received

7245 identified as emergencies

267 flagged as evacuations

107 actual evacuations

Figure 1. Region of Evacuation Origin (%)

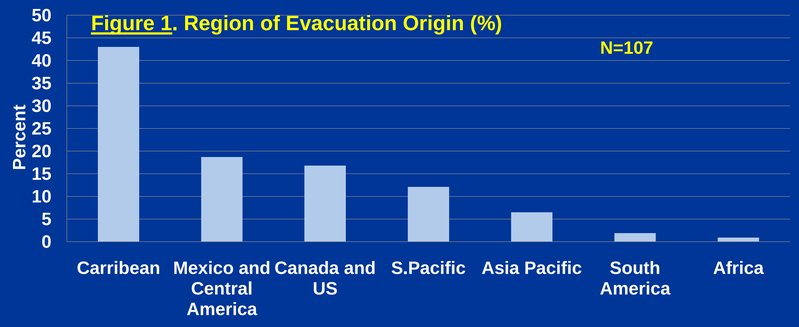


Figure 2. Mode of Transport (%)

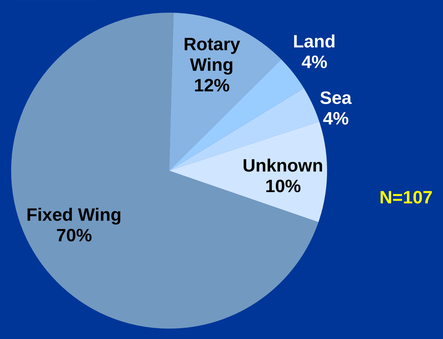


Figure 3. Indications for evacuation.

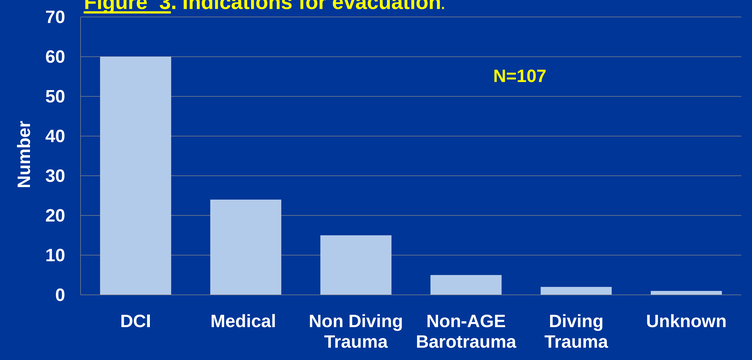


Figure 4. Latency: time from symptom onset to call. * p = 0.03 for difference Neuro/non Neuro medians.

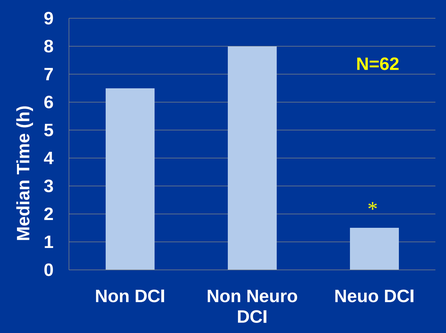


Figure 5. Latency: time from symptom onset to arrival at evacuation destination. p=0.35 for difference in medians.

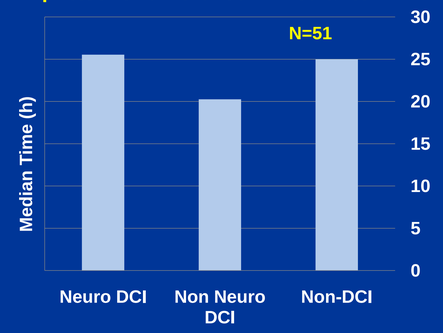


Table 1. Outcome stratified by indication and 12 hour period. *p=0.034 for correlation (Spearman) of time period to *known* outcome.

	Outcome % (n)	Latency from symptom onset to arrival at destination					
		12h	12-24h	24-36h	36-48h	>48h	Total
Non-neuro DCI	Resolved	75(3)	0	50(1)	50(1)	100(1)	50(6)
	Incompletely Resolved	25(1)	33.3(1)	0	50(1)	0	25(3)
	Unknown	0	66.7(2)	50(1)	0	0	25(3)
Neuro DCI *	Resolved	75(6)	100(1)	0	66.7(2)	0	45(9)
	Incompletely Resolved	12.5(1)	0	100(7)	33.3(1)	100(1)	50(10)
	Unknown	12.5(1)	0	0	0	0	5.1(1)
Non-DCI	Resolved	0	0	33.3(1)	100(1)	33.3(2)	21 (4)
	Incompletely Resolved	0	71.4(5)	33.3(1)	0	33.3(2)	42(8)
	Worse	50 (1)	14.3(1)	0	0	16.7(1)	15.8(3)
	Unknown	50(1)	14.3(1)	33.3(1)	0	16.7(1)	21(4)

Figure 6. Cumulative percent of known resolved cases vs. evacuation indication.

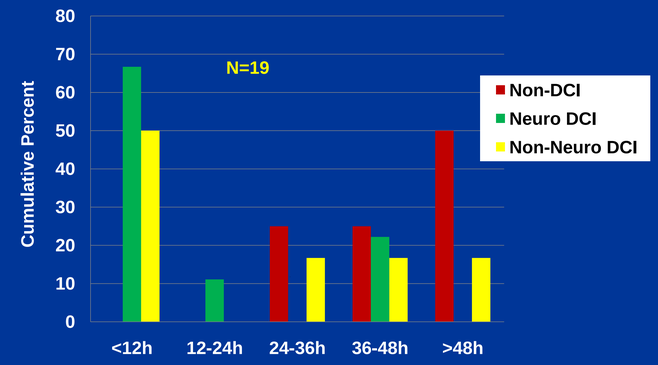
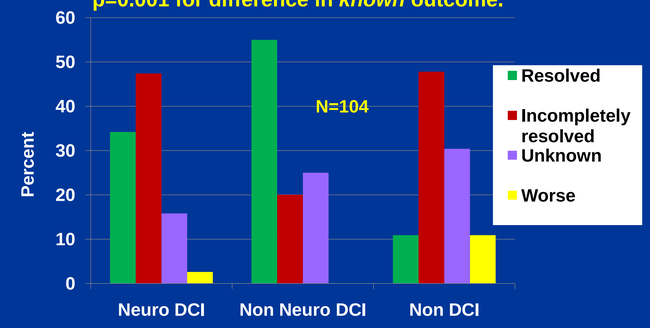


Figure 7. Indication vs. outcome (percent). p=0.001 for difference in *known* outcome.



Summary and Conclusions

- For neuro DCI shorter evacuation times had more favorable immediate post treatment outcomes.
  - 6 of 8 neuro cases evacuated in < 12 hours resolved compared to 3 of 12 evacuated in > 12 hours.
- Non-neuro DCI outcome was not correlated with latency.
- Outcome of DCI was better than non DCI.
  - 46/47 DCI cases with known outcome were completely or partially resolved
- Evacuations have inherent risk.
  - US EMS workers have double the occupational fatality rate of the national average (5).

Conclusion

- Timeliness of evacuation of divers with DCI is dependent on indication and latency:
  - Neuro DCI – minimize delay to <12 hours from symptom onset.
  - Non-neuro and delayed (>12h) neuro DCI – maximize evacuation safety.

References

1. Ball R. Effect of severity, time to recompression with oxygen, and re-treatment on outcome in forty-nine cases of spinal cord decompression sickness. Undersea and Hyperbaric Medicine 1993;20(2):133-145.
2. Cianci P, Slade SJJr. Delayed treatment of decompression sickness with short, no-air-break tables: review of 140 cases. Aviat Space Environ Med 2006;77:1003-8.
3. Barratt DM ,Van Meter K. Decompression sickness in Miskito Indian lobster divers: review of 229 cases. Aviat Space Environ Med 2004;75:350-3.
4. Mitchell SJ, Doolette DJ, Wacholz CJ, Vann RD. Management of Mild or Marginal Decompression Illness in Remote Locations Workshop Proceedings. Durham,NC.: Divers Alert Network; 2005
5. Maguire BJ, Hunting KL, Smith GS, Levick NR. Occupational Fatalities in Emergency Medical Services: A Hidden Crisis. Ann Emerg Med 2002; 40:625-632.

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