DECOMPRESSION ILLNESS (DCI) AND SURVIVAL ANALYSIS

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INTRODUCTION AND METHODS

- Progress in the analysis of DCI severity and response to therapy has been slow.
- DCI treatment is considered successful if manifestations resolve or improve .
- Time to resolution is a measure of treatment efficacy but has been difficult to assess as manifestations respond at different rates.
- We review key DCI milestones and suggest survival analysis as a logical method for assessing treatment success (1).

RESULTS

- The classifications DCS-1 (simple bends) and DCS-2 (serious) were introduced for compressed air work in 1960 (2) and adopted for diving and aerospace in the 1970s.
- In the 1980s, these traditional DCS classifications were declared artificial, misleading, and diagnostically inconsistent, and classification by manifestation was proposed under the designation decompression illness (DCI; 3).
- A more quantitative approach assigned weights to manifestations according to clinical judgment (4). The sum of the weights was a case severity score that was found to be significantly associated with residual symptoms (5).
- The need for clinically judged weights was avoided when logistic regression assessed the association of manifestations with residual symptoms (6). However, logistic regression was limited to a single point in time.

Figure 1. Kaplan-Meier (K-M) Survival Curves.

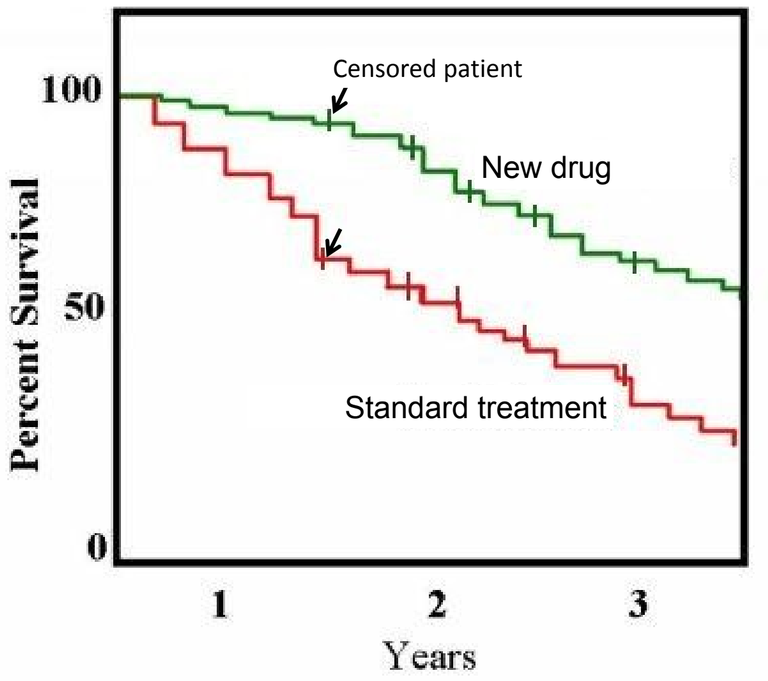
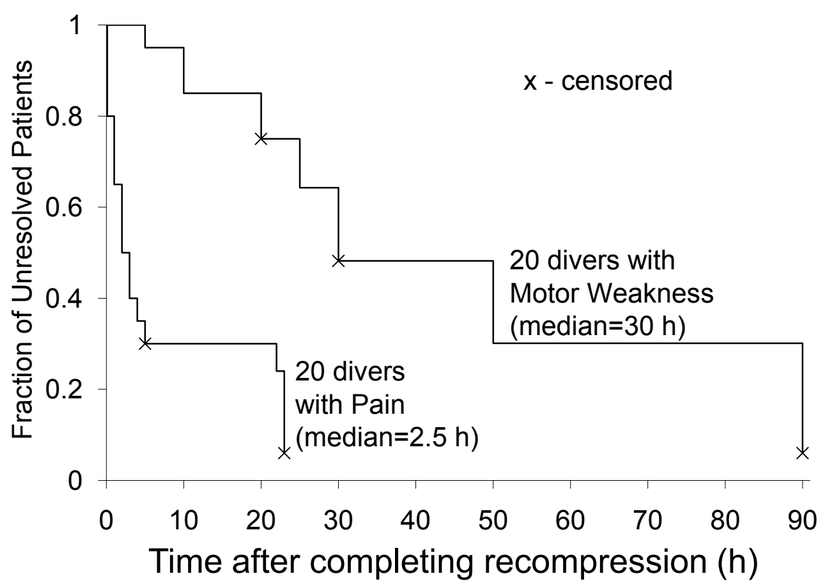


Figure 2. K-M curves for pain and motor weakness based on fictitious data.



DISCUSSION

- Survival analysis is used when 'time to event' is the outcome of interest such as in clinical trials comparing time to patient death for a drug versus placebo (Fig. 1).
- Survival analysis can use information for censored patients (lost to follow-up) whereas logistic regression cannot.
- For DCI, the variable of interest is the time to resolution of a particular manifestation (Fig. 2). (Figure 2 uses fictitious data as resolution times were unavailable.)
- Survival analysis is a general term for regression models (e.g., proportional hazards, time dependent covariates, exponential, normal, log-normal). These methods are applicable for investigating how recovery time is influenced by age, sex, body mass index, first aid oxygen, time to recompression, or multiple recompressions.
- Application of survival analysis to DCI data will require follow-up of cases until manifestations resolve.

REFERENCES

1. Vann RD. ASEM 2009; 80:466.
2. Golding. Br J Ind Med 1960; 17:167.
3. Francis. 42nd UHMS Workshop 1990.
4. Dick. Neurol 1985; 35:667.
5. Ball. UHM 1993; 20:133.
6. Kelleher. ASEM 1996; 67:654.