Modification of Individual Diving Practices After PFO Diagnosis or PFO Closure

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Background

- Patent foramen ovale (PFO) is associated with an increased incidence of DCS[1]
- Relative risk of divers with a large PFO is 4-6x greater than the overall risk of DCS in recreational scuba divers, which is 2 in 10,000 dives or 0.02% [2,3]

Background

- Risk lowering strategies include:
  - No diving
  - More conservative diving
    - Less frequent diving, limiting depth and/or bottom time, or utilizing oxygen enriched breathing mixtures (i.e. Nitrox)
  - Surgical closure of PFO
    - Complication risk of 1-2%
      - Complications include palpitations, bleeding, thrombosis, infection, perforation/erosion, and device embolization[4]

Background

- Diving practices after diagnosis of a PFO in those who undergo closure and those who opt for non-surgical management has yet to clearly be defined

http://emedicine.medscape.com/article/156863-overview

Aim

- To elucidate changes in diving practice by divers who are diagnosed with a PFO and choose to undergo closure and those divers diagnosed with PFO who choose non-surgical management

Methods

- In 2010, Divers Alert Network (DAN) initiated study to assess risk-benefits of PFO closure in divers
  - Inclusion criteria
    - 18 years old or greater
    - Certified Diver
    - Diagnosis of PFO with medical clearance to dive
- In 2012, we administered a follow-up survey to the enrolled 58 patients

Methods

- 2012 Survey Inquired
  - Numbe of dives
  - Dive depths
  - Breathing gases
  - Possible complications of PFO closure
  - DCS Symptoms
  - General health status

Methods

58 Enrolled Divers

37 Follow-up Surveys

12 PFO

24 Closure

1 Excluded

Methods

- Mean number of annual dives before PFO diagnosis and before closure were compared to diving practices after diagnosis (PFO group) or after closure (Closure group)
- Difference in mean annual number of dives between the two groups was tested for statistical significance with an unpaired t-test

Results

- Frequency of Diving

Table 1: Mean (St. Dev) annual number of dives before diagnosis and after diagnosis (PFO group) and before closure and after closure (Closure group)

Group	Before Dx or Closure	After Dx or Closure	T-test	P-Value
PFO	46(36)	33(30)	0.95	0.35
Closure	43(33)	33(43)	0.88	0.38

Results

- Frequency of Diving

Table 2: Number of divers who changed their frequency of diving

Group	No diving	Less Dives	More Dives
PFO	3	6	3
Closure	8	10	6

Results

- Complications of Closure

  Table 3: Mean (St. Dev.) annual number of dives before and after PFO closure in divers with and without complications

Outcome of Closure	Mean (St Dev.) Before	Mean (St. Dev) After
Complications* (n = 3)	8(4)	0(0)
No complications (n = 21)	48(32)	38(44)

* Two PFO were not fully closed. One diver reports recurrent visual symptoms.

Results

- Decompression Sickness
  - Transient skin rash c/w Type I DCS
    - PFO Group: 1 diver
    - Closure Group: 2 divers
  - Transient bilateral LE paraesthesias c/w neurological or Type II DCS
    - PFO group: 0 divers
    - Closure group : 1 diver

Conclusions

- No statistical difference between the mean annual dives of the PFO group and the Closure group following diagnosis and closure, respectively, was detected
- Divers with uncomplicated closures did more dives afterwards, while those with closure complications, recurrent symptoms, or requiring medical clearance did less dives

Conclusions

- Divers with PFO, who chose non-surgical management and did more dives than before diagnosis, used more oxygen-enriched breathing mixtures and limited their depth and time

Limitations

- Number of enrolled divers
  - May fail to reveal differences in diving practices between those undergoing closure and those choosing non-surgical management
- Lack of long-term follow-up
  - May mask long-term improvements in diving symptomatology in those who are currently experiencing acute and sub-acute complications from closure, not diving secondary to health concerns other than PFO, and lacking post-surgical medical clearance for diving secondary to health care access or time conflicts at the time of this analysis

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