

Intravascular bubbles and diving patterns in Japanese Ama divers

Kiyotaka Kohshi¹), Frédéric Lemaître²), Hideki Tamaki^{1,3}), Kazuo Nakayasu⁴), Masanori Harada⁵), Masanobu Okayama⁵), Yuka Satou¹), Michiko Hoshiko¹), Tatsuya Ishitake¹), Robert M Wong⁶)

1: Department of Environmental Medicine, Kurume University School of Medicine; Japan (kohshi33@gmail.com)

2: CETAPS EA 3832, Faculty of Sports Sciences, University of Rouen, France (Frederic.Lemaitre@univ-rouen.fr)

3: Division of Emergency and General Medicine, Tamaki Hospital, Hagi; Japan

4: Hagi City Ooshima Clinic

5: Division of Community and Family Medicine, Center for Community Medicine, Jichi Medical College, Japan

6: Department of Diving and Hyperbaric Medicine, Fremantle Hospital, Western Australia

Introduction

✓ Reports on DCI in Ama

Mt Sinai J Med '98

J Neurol Sci '00

J Occup Health '01

Undersea-Hyperb-Med '05

Undersea-Hyperb-Med '10 (a)

✓ A survey of DCI in Ama

Undersea-Hyperb-Med '10 (b)

✓ Detection of “*intravascular bubbles*” in Ama?

In this study

Methods

12 male Funado Ama (partially assisted)

Age: 56 yr (44-61yr)

Careers of Ama: 28.5 yrs (9-40 yrs)

Using Weight: 20kg (18-24kg)

Cardiac Doppler (AQUALAB system)

Within 5 min after continuous 3-4 hours'
repetitive breath-hold dives

Cardiac Doppler



Before diving



After diving

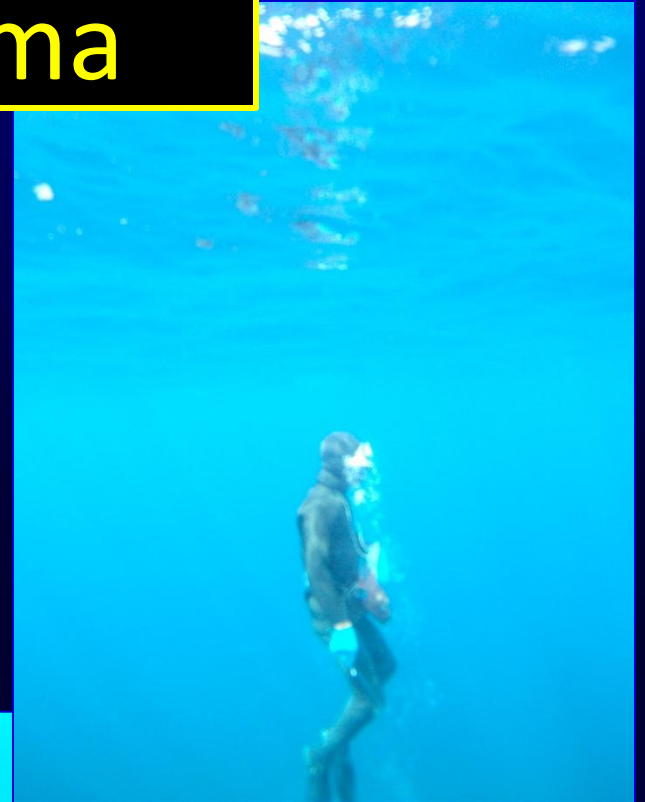
Descending Ama



Ama on the bottom



Ascending Ama



Diving profiles in Ama (*n*=12)

Number of descents: 75-131 times

Diving depths: 10-20m

Descending time: 5-15sec

Bottom time: 40-60sec

Ascending time : 7-20sec

Surface interval: 40-60sec

Diving & medical histories of Ama

No. /age(yr)	careers of Ama/Funado (yrs)	weight bar /belt (kg)	cigarette	BP	Neuro-DCI
1/58	24/23	23/7	-	120/80	-
2/49*	17/12	20/5	20/day	110/66	-
3/44	21/14	24/6	20/day	122/74	-
4/48	30/9	20/4	-	□	speech disturbance, hemiparesis
5/59	27/27	18/1	10/day	130/72	-
6/56	21/21	20/4	-	122/64	-
7/61	38/34	20/4	-	138/74	sensory numbness
8/61	36/34	20/4	-	162/74	-
9/54	30/30	20/6	-	132/80	-
10/56	40/40	20/6	-	□	-
11/58	40/40	20/6	40/day	154/82	hemiparesis
12/55	34/31	20/7	20/day	112/70	sensory numbness

*: Ama with bubble detection

Diving profiles in Ama with bubble detection (Spencer's grade I)

Number of repetitive dives: 101 times

Diving time (total): 2hr 50min

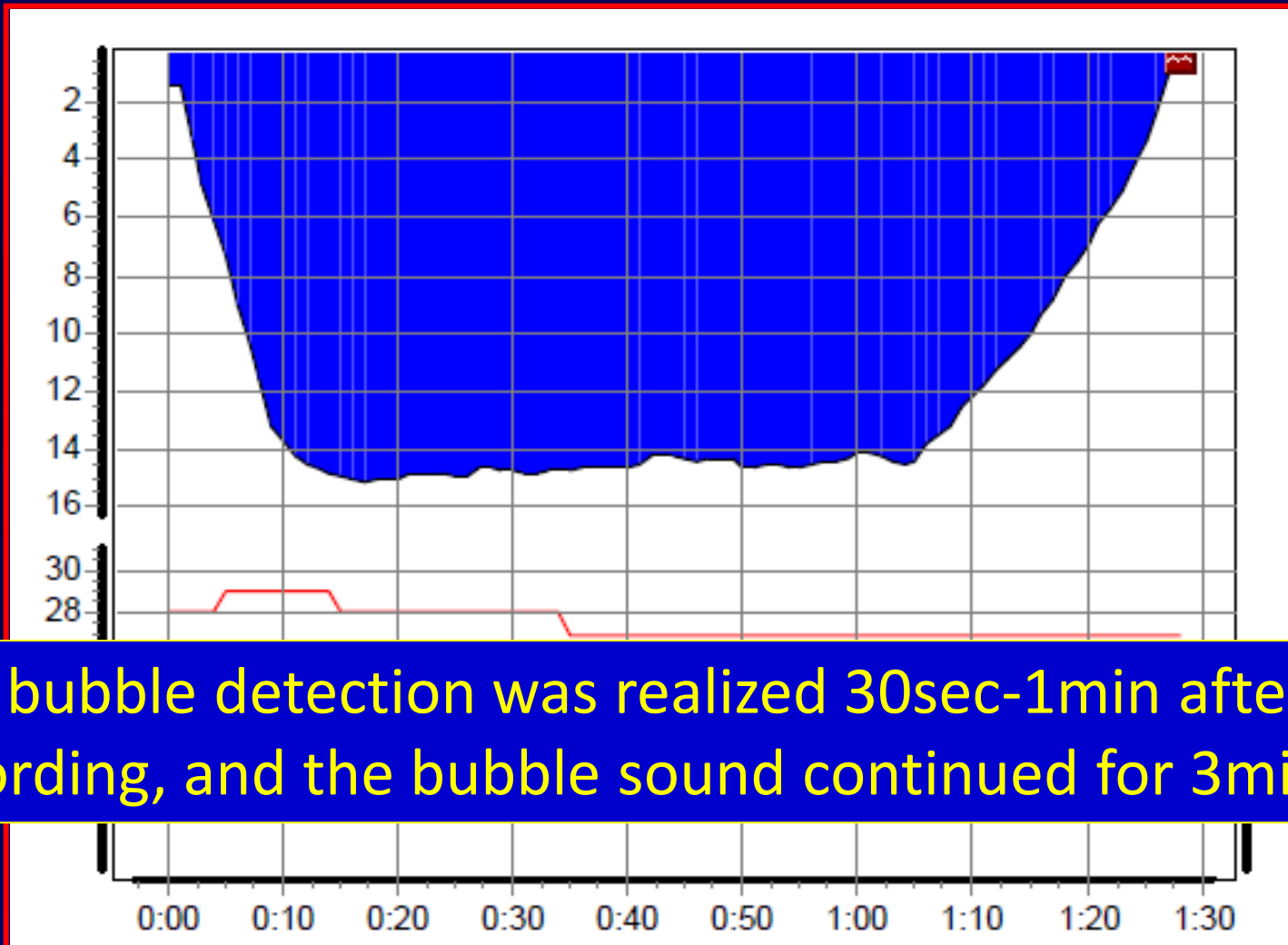
Diving time (in water): 1hr 51min

Diving depth (mean; min.-max.): 12.3m; 10m-19m)

Apnea time (max.): 1min 23sec

Surface interval (mean; shortest - longest): 35sec; 30sec–1min 5sec

Single dive in Ama with bubble detection (Spencer's grade I)



The bubble detection was realized 30sec-1min after recording, and the bubble sound continued for 3min.

Summary

- ✓ In one Ama with short surface intervals, “intravascular bubbles” were detected for a few minutes after repetitive dives
- ✓ Nitrogen is accumulated by repetitive dives to 15m for a duration of 3-4 hours
- ✓ “Venous bubbles” are probably a cause of neurological DCI in Ama