

TREATMENT FOR DECOMPRESSION ILLNESS AT KAWASHIMA ORTHOPAEDIC HOSPITAL

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We have continued research and treatment about the dysbaric osteonecrosis and the decompression illness (DCI) of divers. In this presentation we report about these DCI cases and treatment results.

The circumstance of diving and DCI in Japan

The origin of diving in Japan, we can see description about it in the Japanese history book, “the gishi-wajinden”, written in 285. In the book, it was written that Ama divers caught fishes, shells, and coral. Our country is surround by the seas, diving is essential technology for us in many kinds of fields such as fishing, construction work, development of natural resources, construction of communication equipment, and so on.

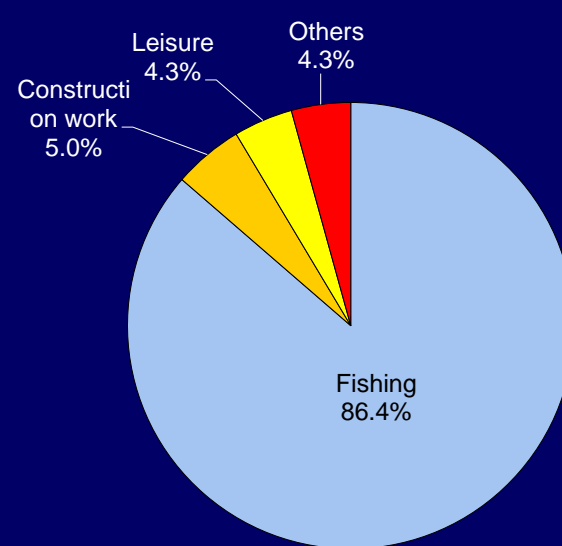
The standard of the Japanese Society of Hyperbaric and Undersea Medicine (JSHUM) indicates that DIC case should be treated with multiplace chamber. However, there are only 49 multiplace chambers are working, and there is bias depends on area in Japan. Moreover, all of them can not always cope with treatment of DCI. Therefore, Some cases may have to go long way from diving place to take recompression therapy.



The distribution of multiplace hyperbaric chamber in Japan.

Purpose of diving

Purpose of diving	Diving	Caisson
Fishing	443	
Construction work	26	2
Leisure diving	22	
Others (Investigation, Machine maintenance, etc)	22	
	513	2

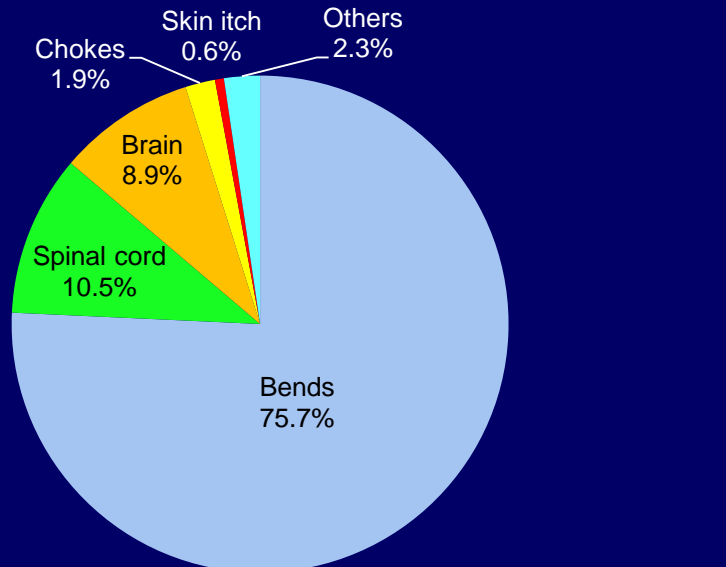
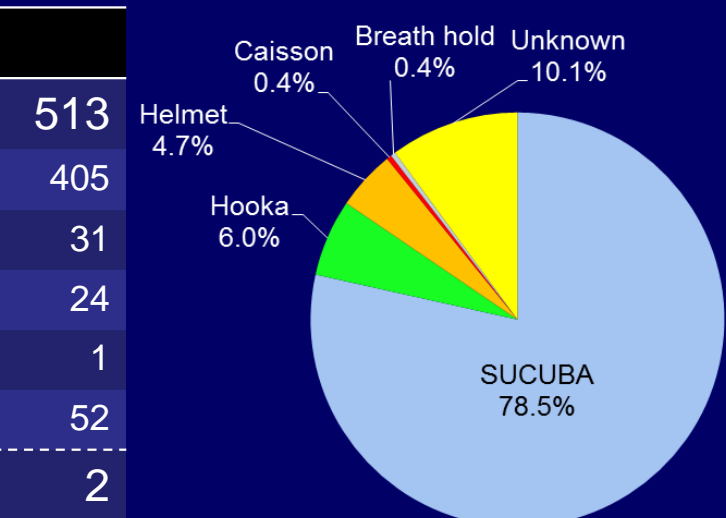


Diving methods

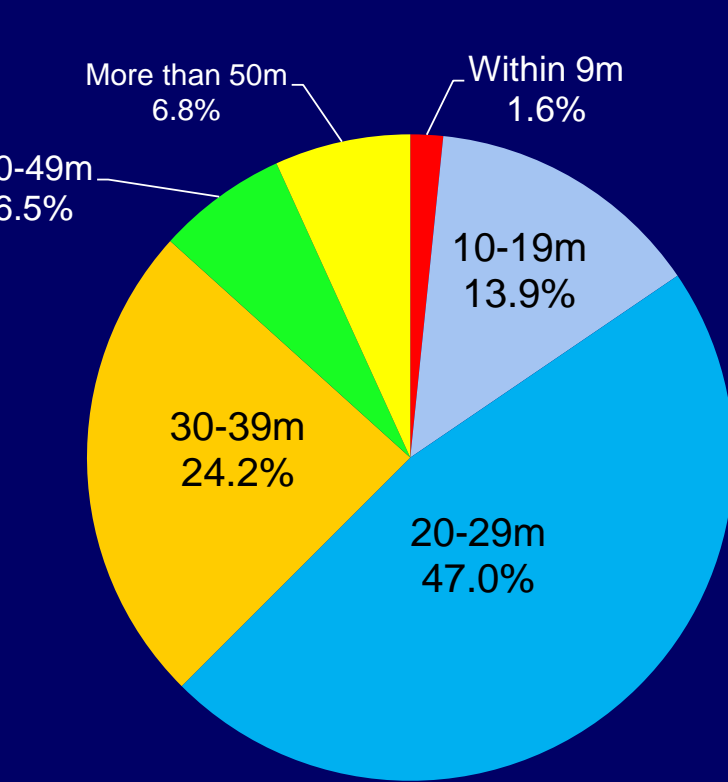
Diving methods	
Diving	513
SUCUBA	405
Hooka	31
Helmet	24
Breath hold	1
Unknown	52
Caisson	2

Type of DCI

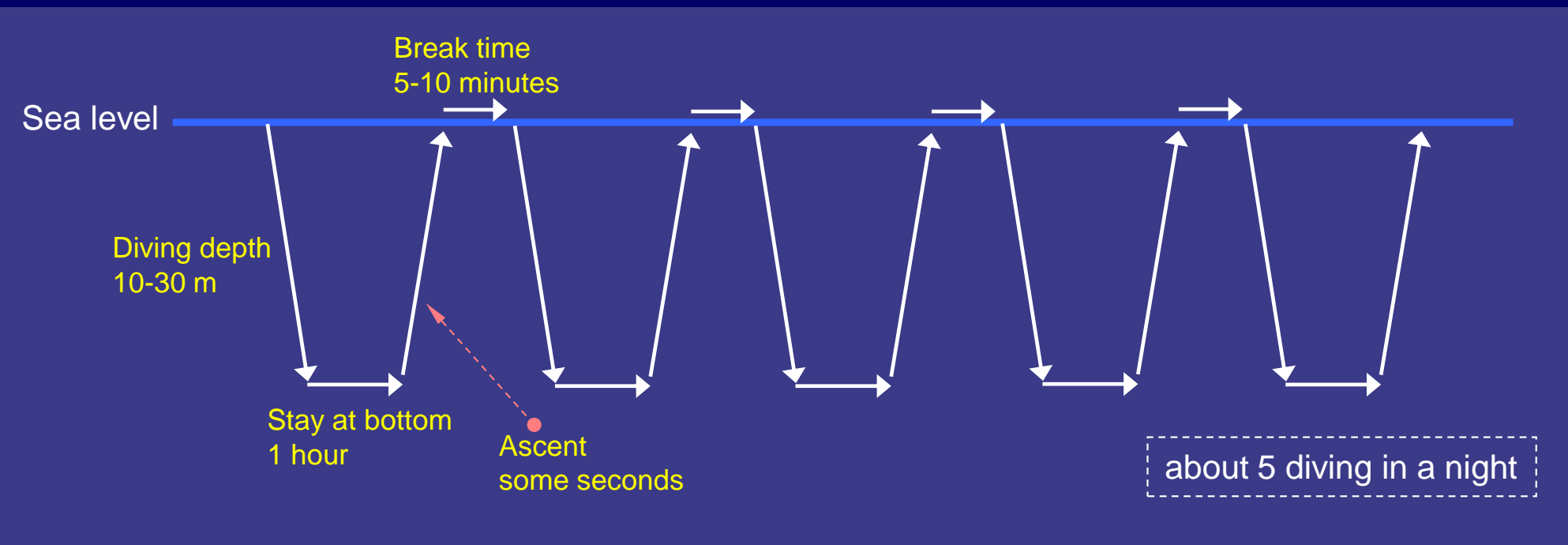
Type of DCI	
Limb Bends	390
Spinal cord	54
Brain	46
Chokes	10
Skin itch	3
Others	12



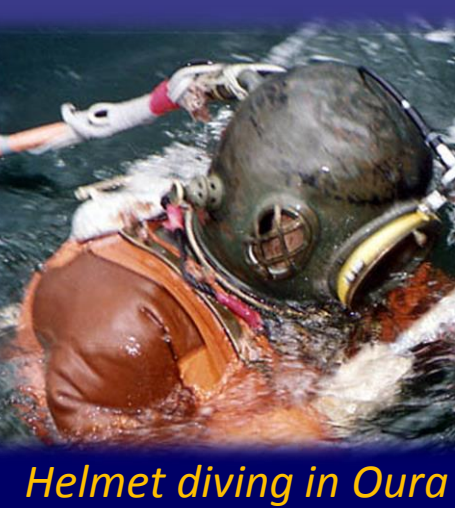
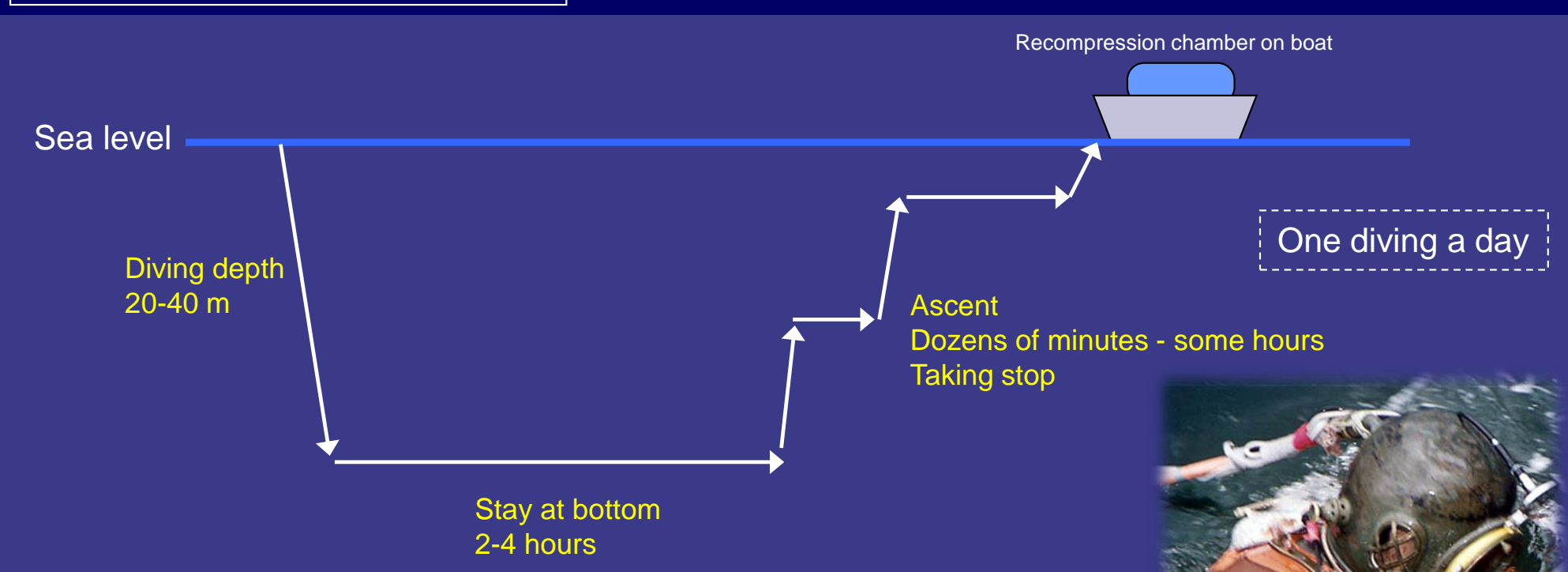
The maximum diving depth



Typical diving pattern in Genkai-nada sea SCUBA diving



Typical diving pattern in Ariake sea Helmet diving

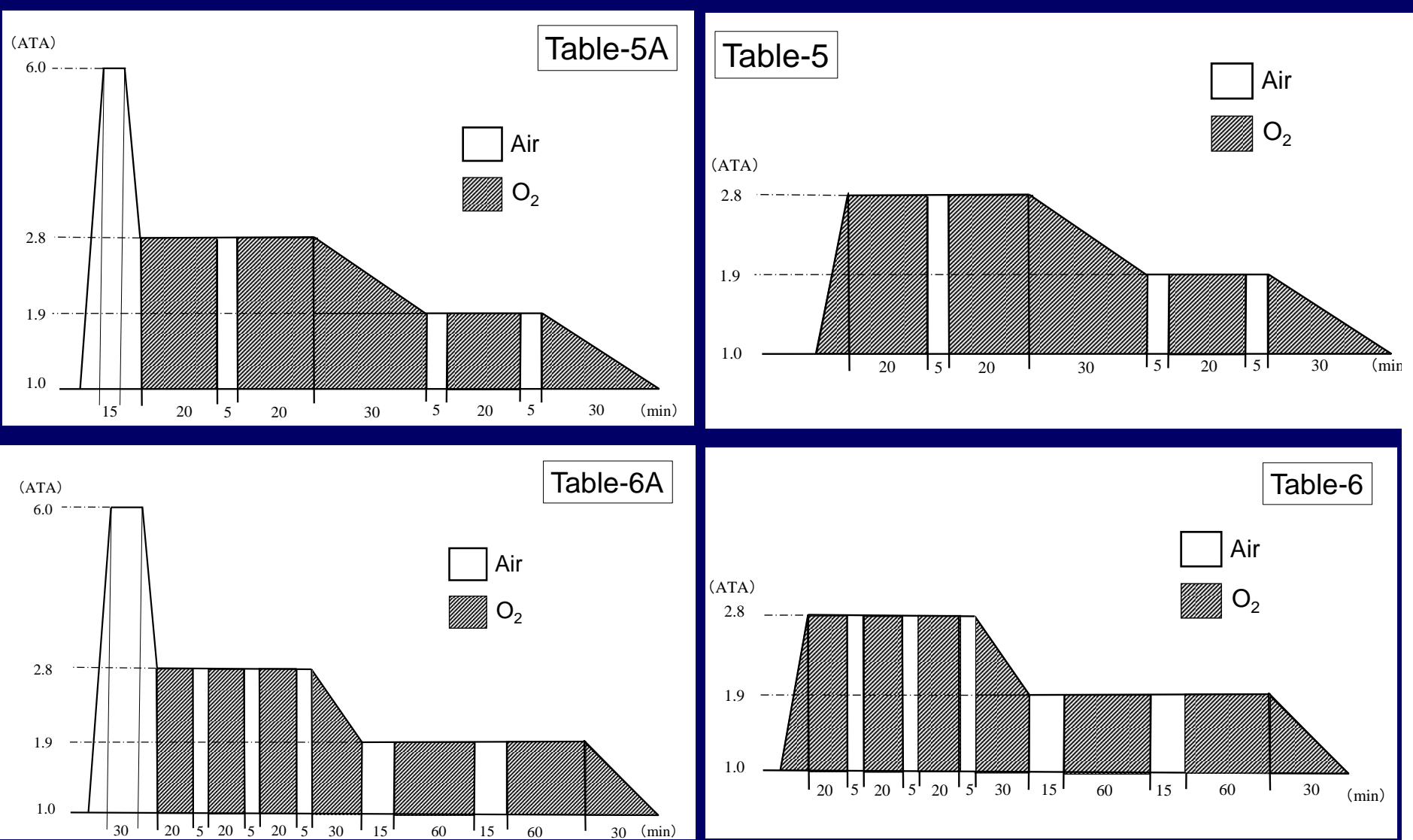


Helmet diving in Oura

Selection of the recompression therapy table

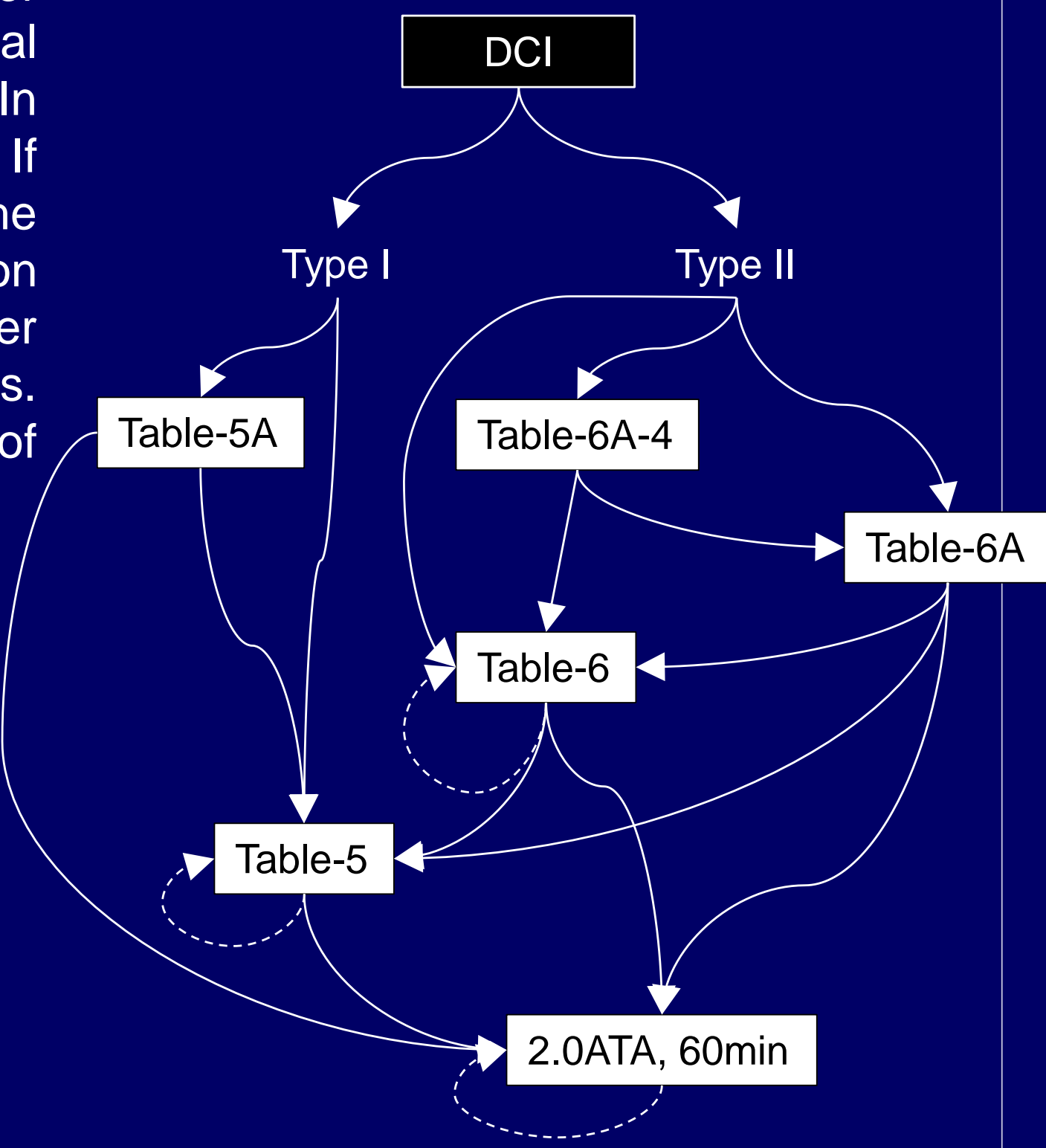
We use the U.S. Navy’s table 5A for initial treatment of type I DCI. After the first recompression treatment, we give anticoagulant and adrenal cortical hormone to them for the purpose of circulation improvement. In many cases, symptoms improved after the first recompression therapy. If symptoms are eliminated at the second day, they go home after the second recompression (2ATA, 60 minutes). If symptoms remain even after the second recompression with table 5, table 5 is repeated 2 or 3 times. Then, they are treated with 2.0ATA 60 minutes HBO till improvement of symptoms.

In case of type II DCI, we treat them with table 6A. If the case is very serious such as there are bladder and rectal disorder, disturbance of consciousness, or walking difficulty, they are treated with table 6A-4. The table 6A-4 is what the U.S. Navy’s table 6A was modified by the Tokyo Medical and Dental University. It is rare that type II DCI recovers completely in only one recompression therapy. After the first recompression therapy, treatment table is chosen depending on symptoms.



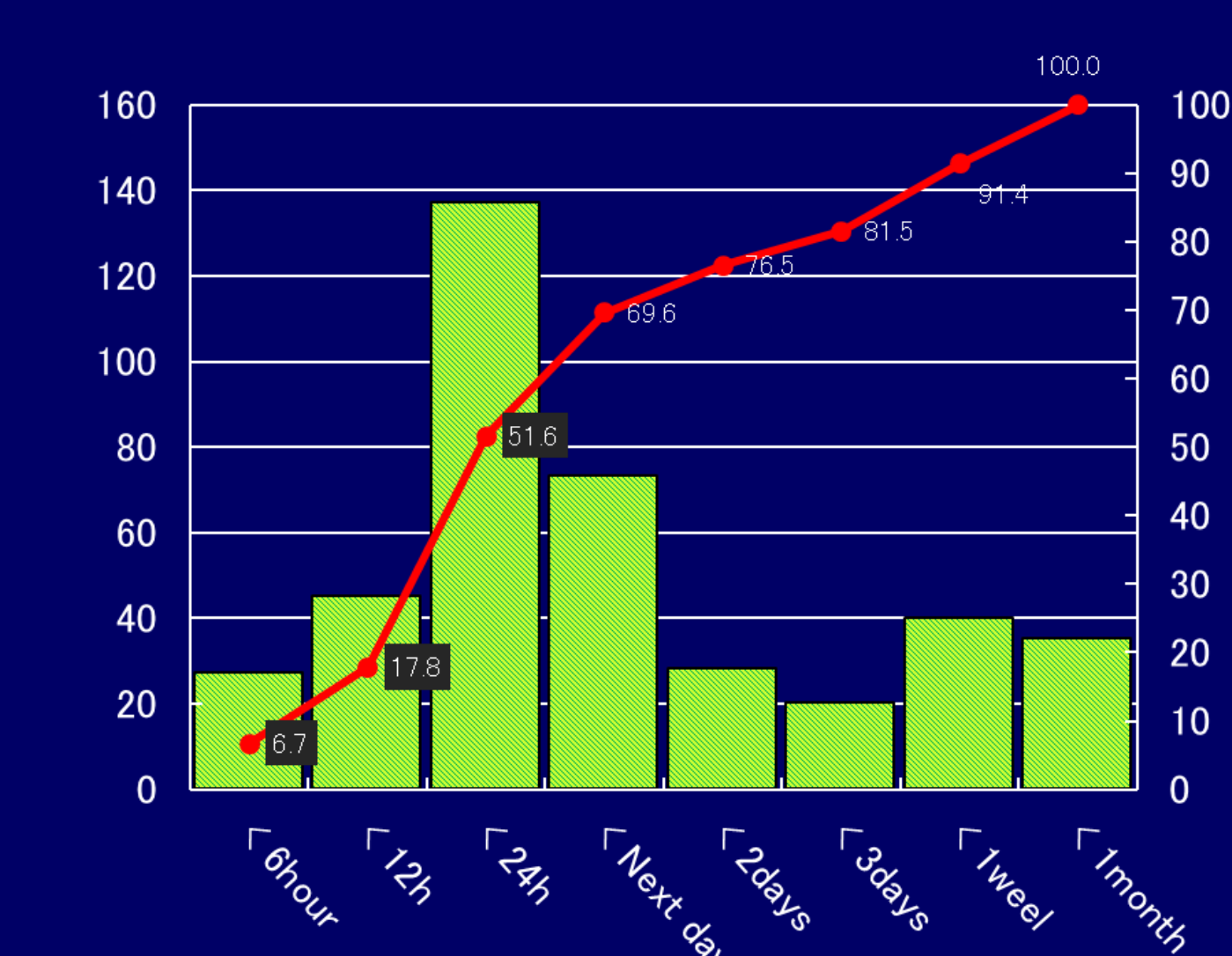
DCI patients were many which came from especially 3 areas, Genkai-nada sea, Ariake sea, and Saiki city. Those are rich in sea resource, there are several fishermen’s village and many divers. The character of diving pattern were seen according to the area. Around Genkai-nada sea, they dive about 1 hour to 10-30m depth at one diving. Then, after put their catches on the boat, they go to under water again in 5-10 minutes. They repeat it about 5-7 times in a day. DCI symptom often appears after the ascent, but sometimes they continue diving with patient the pain.

In Ariake sea, they dive to 20-40m depth 2-4 hours in one diving with helmet equipment. After the working at the bottom, they ascent taking some hours stop. If the DCI symptom was seen, a diver goes into a recompression chamber on a boat, and they come to our hospital keep the chamber compressing on a track.



Treatment results

The elapsed time of the onset of symptom to recompression therapy

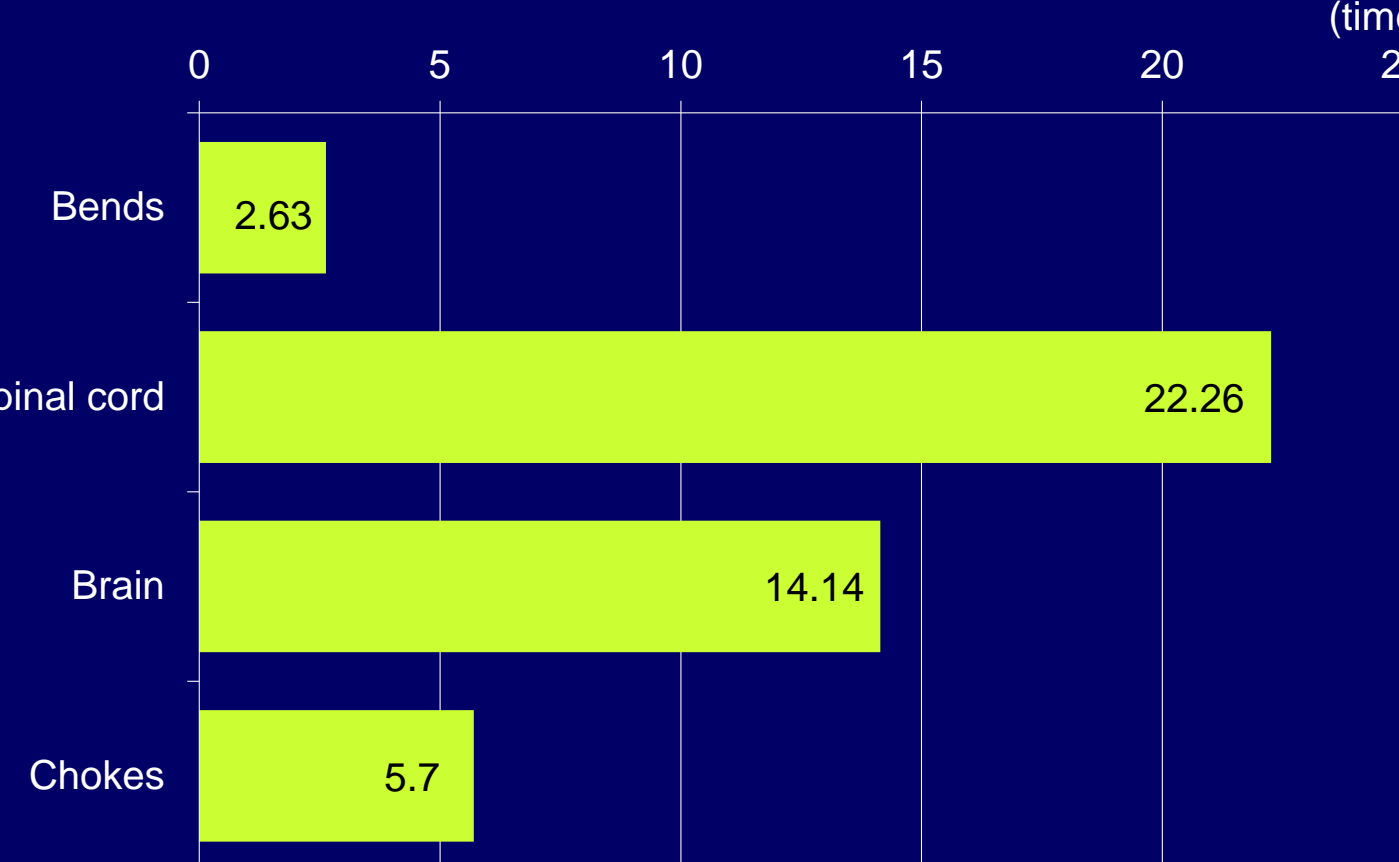


Approximate half of all DCI cases were started recompression therapy within 24 hours from onset. The treatment results according to symptom, 99.2% of bends cases, 75.9% of spinal cord cases, and 76.9% of brain cases were good. About the numbers of times of recompression therapy, the bends is really least than the others, the average of recompression therapy was 2.63 times. In the cases of spinal cord and brain, the average recompression therapy were 22.26 and 14.14 times. We experienced many times the symptoms disappeared during the first recompression of the Table-5A. But several spinal cord and brain cases remained symptom even after treatments.

The treatment results according to DCI type



The average treatment number of times of recompression therapy



The problems about DCI treatment and diving circumstance in Japan

1. Many diving fishermen think lightly of DCI

Most diving fishermen are independent business, and ascend according to their own experience without suitable ascent procedure such as diving computer or prescribed decompression table. Moreover, many of them continued diving after onset of the DCI symptom. There are many dives which came to our hospital many times as DCI. The most frequent patient coming to our hospital was 16 times. Understanding their diving is high risk of DCI, they don’t change their diving methods. Although, incidence of DCI decreased than before, we have to educate them about DCI more.

2. The expense of DCI treatment in Japan is too low, and it is fixed amount regardless of treatment time.

The Japanese Ministry of Health, Labour and Welfare defines the DCI treatment fee as ¥60,000(approx. \$590). It is regardless of treatment time. Recompression therapy requires long time, it is 3 hours in the shortest, the amount is not suitable. Due to the unsuitable treatment fee, unsuitable recompression therapy may be carried out. The Japanese government should renew the treatment fee against DCI.

3. The number of multiplace chamber is not enough, and there is deflection depends on area.

There are only 49 multiplace chambers in Japan. But, all of them may not be able to treat DCI. DCI patients may be forced to high altitude movement and long distance travel in some cases to receive recompression therapy. Several hospitals abolished recompression therapy by the multiplace chamber, in these years. I conjecture that they abolished having multiplace chambers because of economical reason.

Conclusions

- We treated 515 DCI cases from 1981 to March 2013. The most of them were fishermen from the Kyushu Island. The most common DCI type was bends.
- We treated them by the U.S. Navy table and the Tokyo Medical & Dental University table.
- The treatment results were “Good” in 94%, “Improved” in 5.6%, and “Failed” in 0.4%.