



Hyperbaric Oxygen Therapy and Closed Irrigation with Ozone Nano-Bubble Water for Bone and Joint Infection

Masayuki Kawashima, Mahito Kawashima, Hiroaki Tamura, Katsuhiko Takao, Takashi Yamaguchi, Kenji Miyata

Kawashima Orthopaedic Hospital, Nakatsu, Oita, Japan

INTRODUCTION

At present time, various antibiotics have been developed, but for bone and joint infection, suppurative osteomyelitis especially has still up to now been very difficult to cure. If not treated at the initial treatment for infectious arthritis or acute osteomyelitis, infection will spread throughout the bone, many patients are annoyed by the recurrence of chronic osteomyelitis. Moreover, an increase of multiple resistance bacteria, opportunistic infection and traumatic osteomyelitis make it very complex to treat. Since 1981, many patients with bone and/or joint infection were treated using hyperbaric oxygen therapy (HBO) and closed irrigation suction therapy. Recently we use “Ozone Nano-Bubble Water” in the irrigation resulting very favorably.

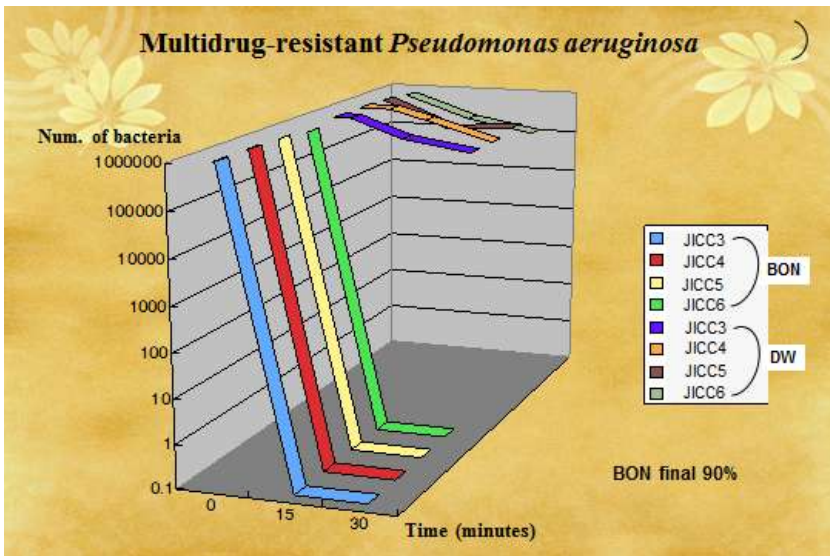
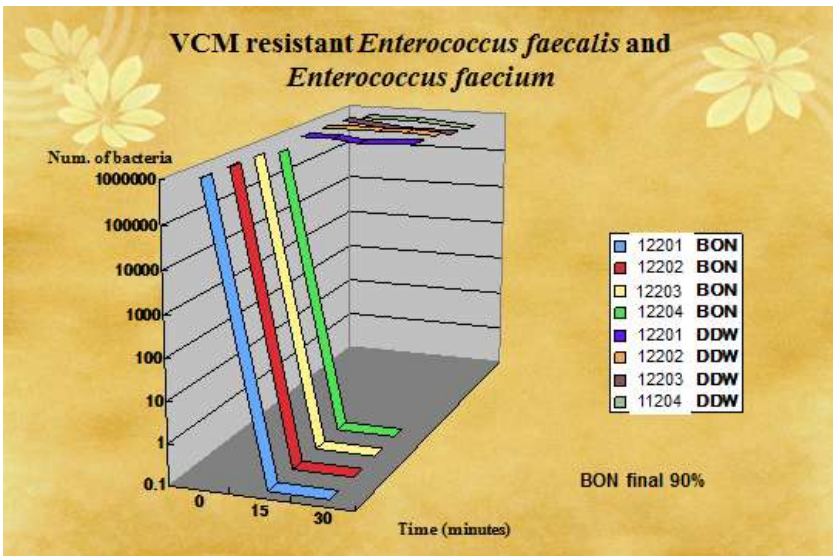
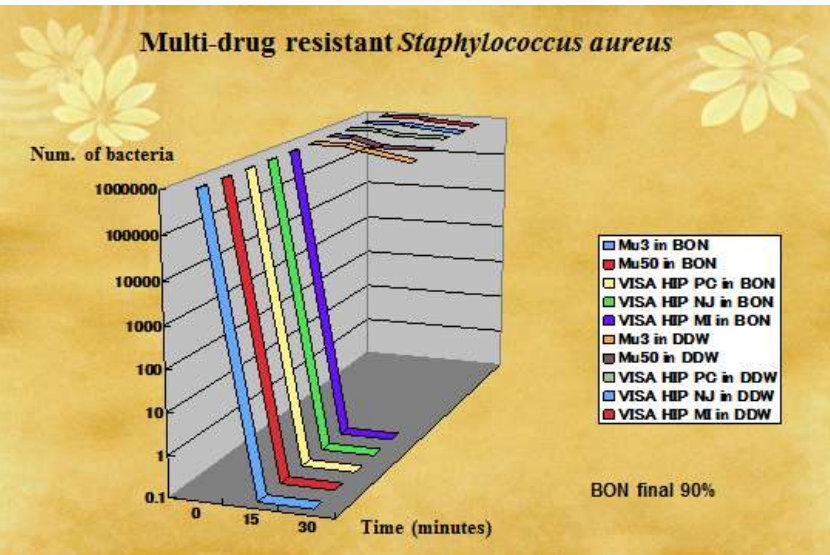
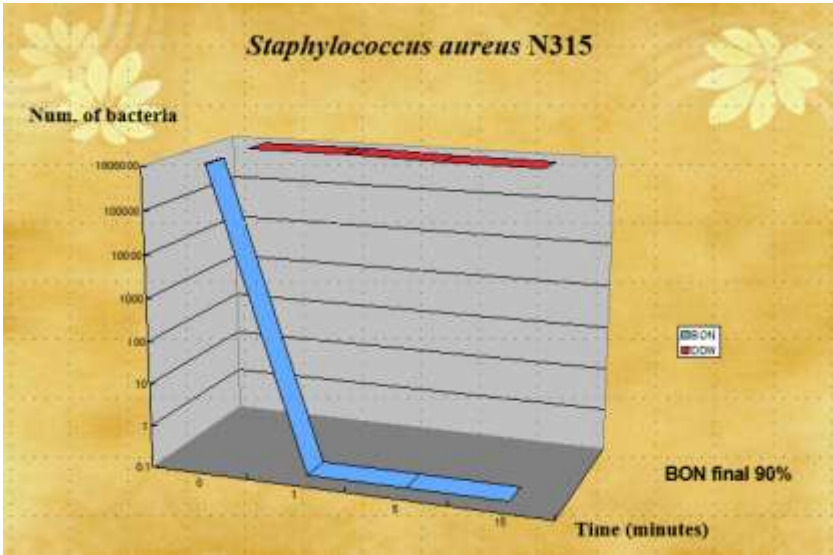
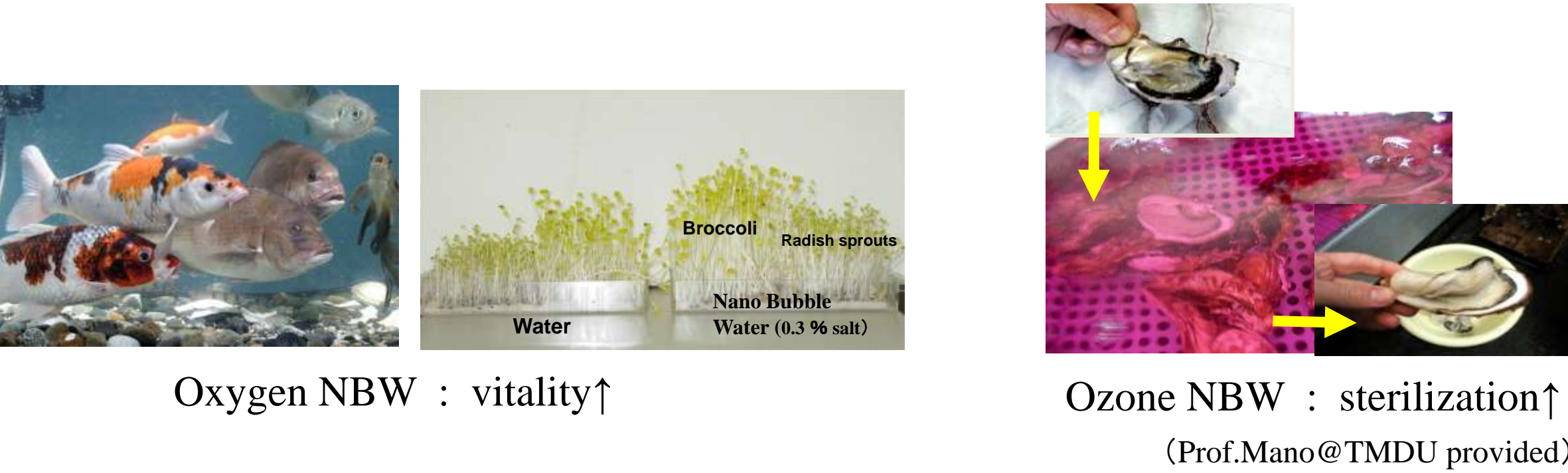
Nano-Bubble

Micro bubbles are bubbles smaller than one millimeter in diameter, but larger than one micrometer. By applying very strong adiabatic compression, micro bubbles are nanoized (10-200nm). Micro bubbles change to nano bubbles when extra-high pressure is applied.

Usually, bubbles in water get bigger and go up and burst on the surface, but micro bubbles burst and disappear in the water, and nano bubbles stay without bursting for more than three months.

It doesn't have characteristics of gas, but it has the characteristic form of the source gas, such as oxygen and ozone.

Nano-Bubble Water (NBW) : Nano bubbles are dissolved in 0.9% saline water.



In Ozone NBW (BON), staphylococcus aureus disappeared in 1 minute and the multidrug-resistant bacteria disappeared in 15 minutes. (2009 Arakawa)

SUBJECTS

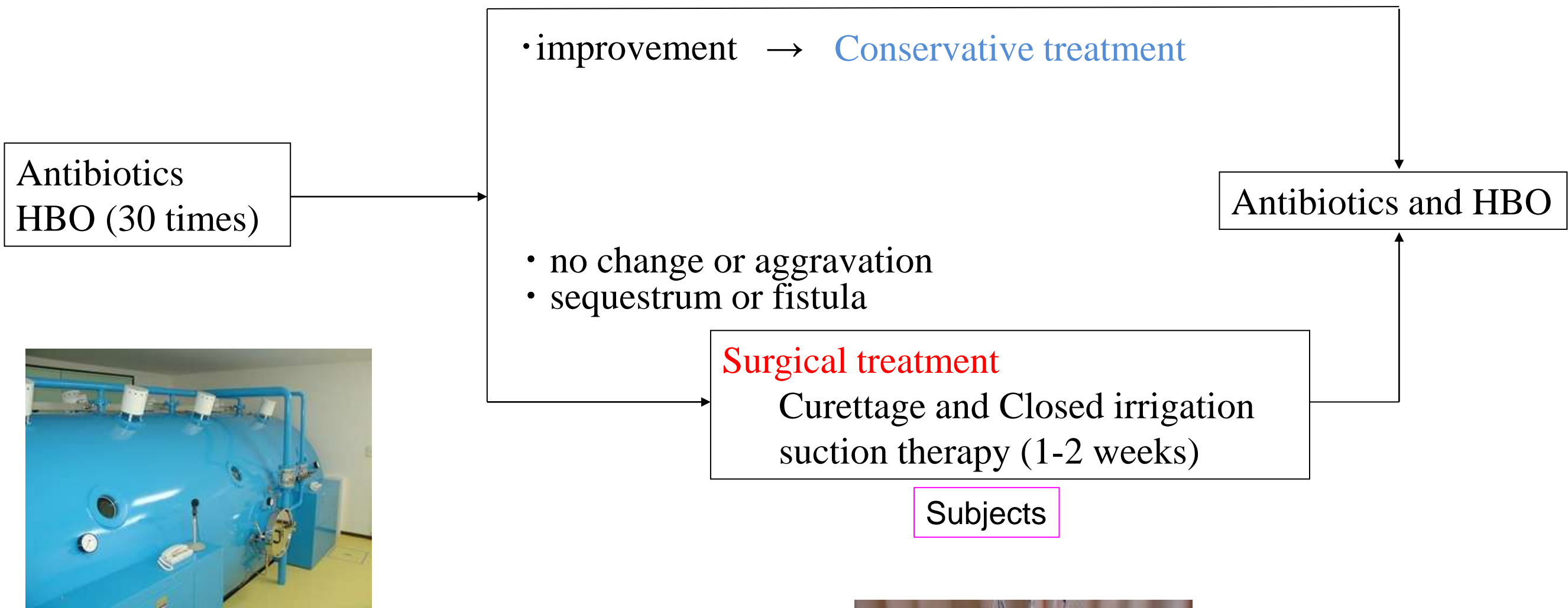
The cases which were not healed by conservative treatment of antibiotics and HBO.

Duration	2009 December ~ 2013 February
Number of Cases	21
Average Age	62.4 (11-98)

METHOD

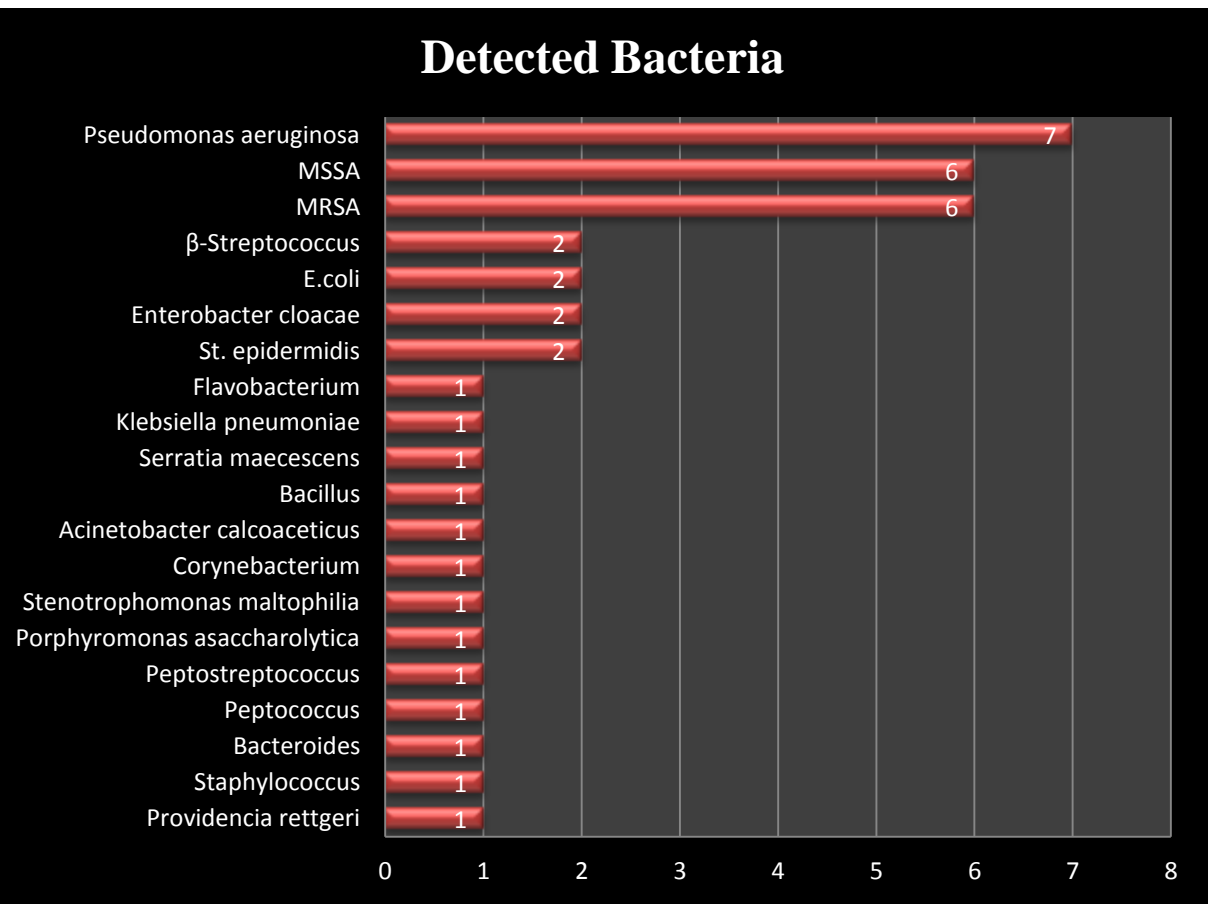
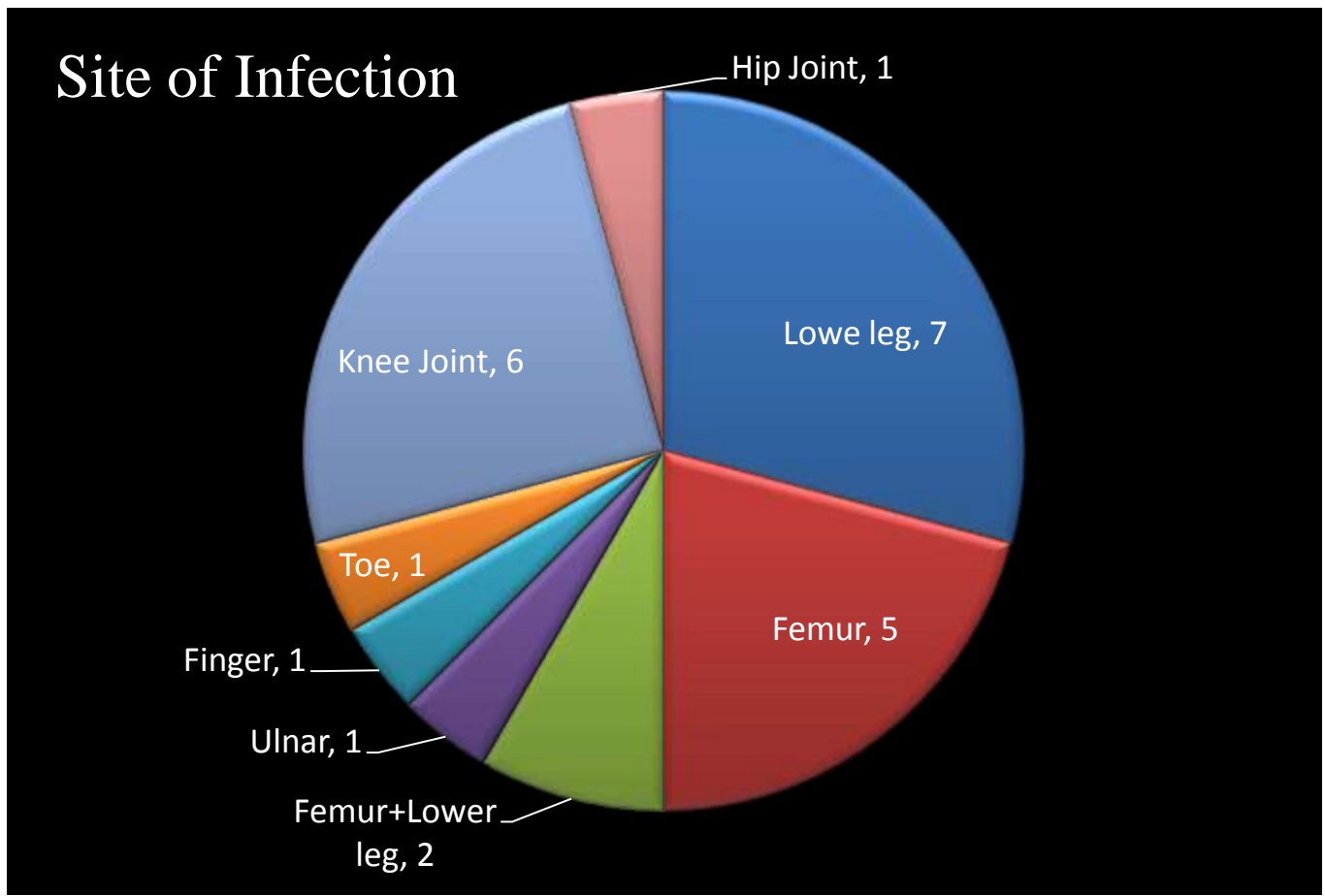
All cases had both antibiotics and HBO. Debridement of synovium, curation of sequestrum, and closed irrigation suction therapy is carried out, if the case does not change or untoward badly. After the irrigation therapy, HBO is again carried out. Ozone nano-bubble water and HBO were used together in 21 cases of bone and joint infections.

Protocol of Treatment for Osteomyelitis



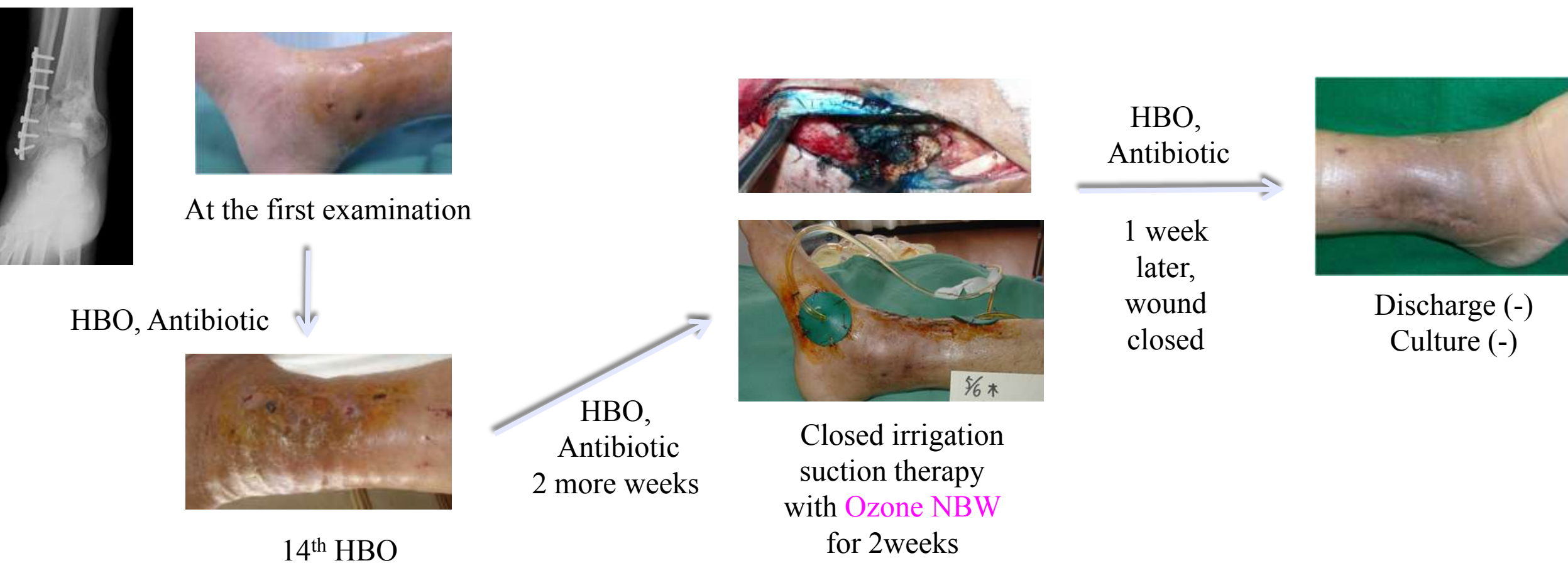
Ozone Nano-Bubble Water

Closed irrigation suction therapy



Case. 71 year old man, Rt. Osteomyelitis of Lower Leg (MRSA / DM+)

He broke his lower tibia and fibula one year before. After the surgery, he suffered from MRSA infection. He had HBO therapy and surgery, but he did not recovery. Then he visited our hospital.



RESULT and CONCLUSION

20 out of 21 cases were successfully treated except for an old woman's case with diabetes and MRSA osteomyelitis of femur and tibia after total knee arthroplasty.

The main feature of the “ozone nano-bubble” is that it has an excellent antiseptic capability against bacteria and is harmless to the human body. The ozone nano-bubble water may replace antibiotics to kill off bacteria in irrigation therapy.