



Preliminary trial to investigate  
the effect of myocardial maintenance of  
**AMETHYST BIOMAT** following  
Myocardial Infarct operation

Pilotstudie zur Untersuchung des Effekts von AMETHYST BIOMAT auf die  
Erhaltung des Herzmuskels nach einer Myokardinfarktoperation



Preliminary trial to investigate  
the effect of myocardial maintenance of  
**AMETHYST BIOMAT** following  
Myocardial Infarct operation

Pilotstudie zur Untersuchung des Effekts von AMETHYST BIOMAT auf die  
Erhaltung des Herzmuskels nach einer Myokardinfarktoperation

# Research background

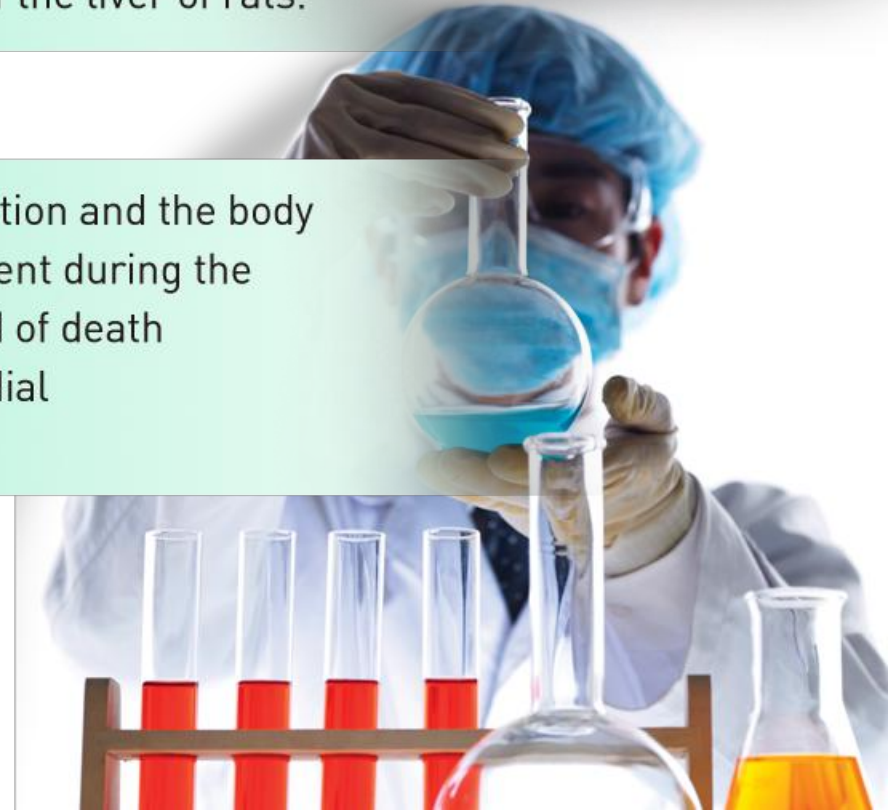


1

In Anatomy lecture 2 and Surgery lecture 2 of the department of surgery of Sapporo Medical School, cardiac regeneration was studied using Marrow stromal cells of the liver of rats.

2

It was thought that if the scaffold solution and the body temperature management is insufficient during the follow-up after surgery, the likelihood of death from acute cardiac failure or myocardial rupture is increased.



# The aim and significance of this study

3

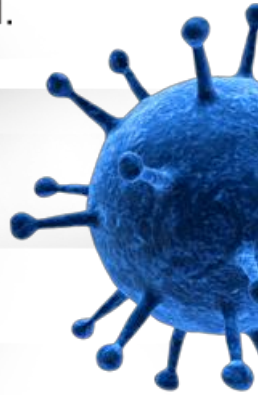
To date, the experiments were conducted using rat myocardial infarct (MI) models but because the subject animal was small, the accuracy of the MI model was unclear. This means that cardiac disease progresses to cardiac failure in the end.

4

Therefore it was not confirmed whether the results of transplanting marrow stromal cells to the heart could be applied to the human body. using marrow stromal cells to treat the underlying cause of cardiac disease for safe cardiac surgery and to review the likelihood

5

There is a need for a more accurate animal model of MI for experiments to investigate the mechanism of cardiac regeneration and promotion of treatment strategies.



# The aim and significance of this study



Cardiovascular  
disease **100**



Concentrated Medical  
treatment **10**



Application  
of surgical treatment **1**



# Study design -1

At the surgical department of Sapporo University Medical School, rats is the amethyst bio mat provided by Richway Japan Co. will be used from the stage of stromal cell transplant to regulate the body operation and temperature of the subjects during the surgery. weeks post-op, the cardiac function will be checked using ultrasonography and the structure of the Following surgery, the results of the group who continue to use studied. bio mat and those who do not continue to use bio met will be compared.

## Control group 1

The aim of this study will be to determine whether there is a significant difference between these two groups.

(Surgical treatment)

10 rats with MI will have surgery on the biomat, and the other 10 rats will have surgery on normal surgical table.

## Control group 2

(Scaffold A)

10 rats with MI will have surgery on the biomat, and the other 10 rats will have surgery on normal surgical table.

## Control group 3

(Scaffold A and B, transplant of stromal cells)

10 rats with MI will have surgery on the biomat, and the other 10 rats will have surgery on normal surgical table. A total of 60 rats were used for this experiment.

# Outline of the experimental methods

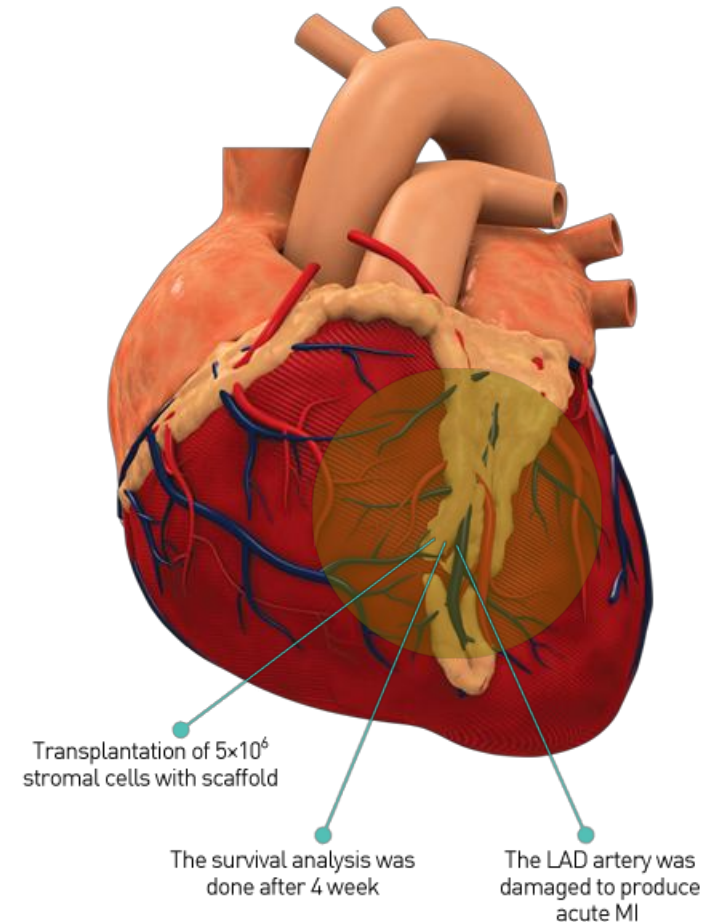
	RECIPIENT	Donor-MSC cell collection
Type of animal	Rat	Rat
Gender	Male	*
Breed	S-D	S-D

## Transplant method

- **Time of transplant** : Immediately after MI
- **Method of transplantation** : The scaffolding solution (solution A) containing the stromal cells will be transplanted to the area of MI using  $200\mu\ell$  forceps and  $100\mu\ell$  of scaffold solution B will be injected.

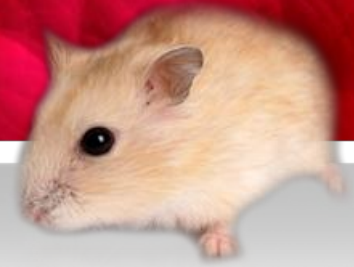
## Assessment

- Ultrasounds will be done before surgery, after surgery, and at days 7, 14, 21, 28 post-op.
- 4 weeks after the transplant autopsies will be done for histological studies (myocardial cells and the left ventricular wall in the area of the MI)



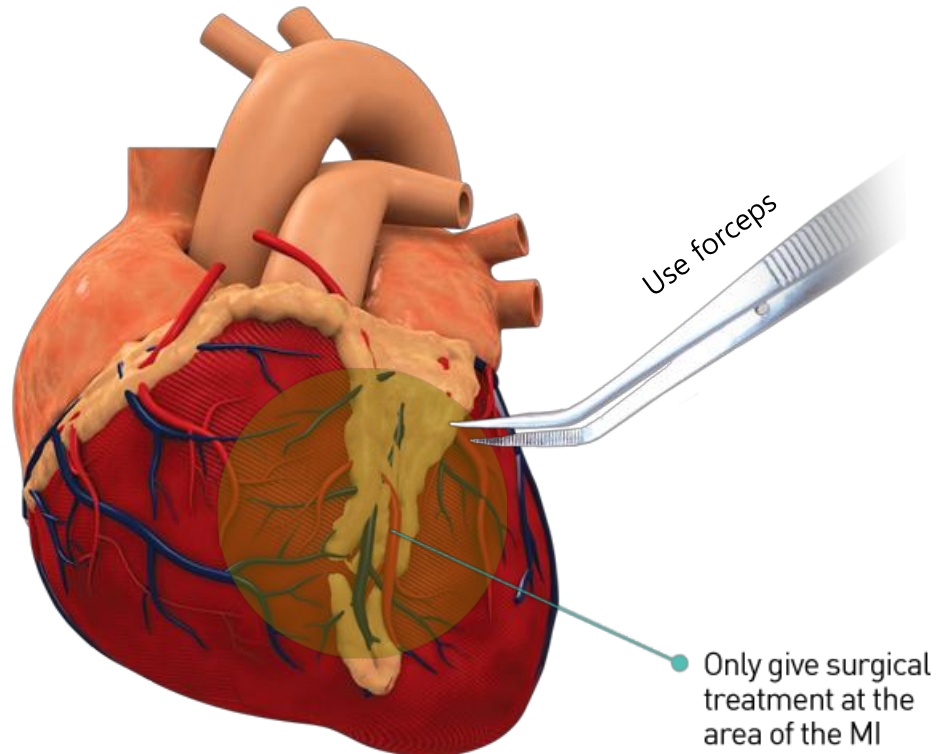
Experimental methods

# Only surgical treatment – Group 1



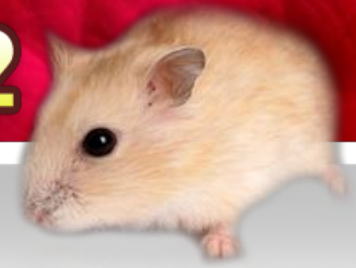
## >> Eeneral surgical group

- Only surgical treatment was given without scaffolding at the area of the MI.
  - 10 rats with MI had the surgery on BIO MAT
  - 10 rats with MI had the surgery on ordinary surgical table



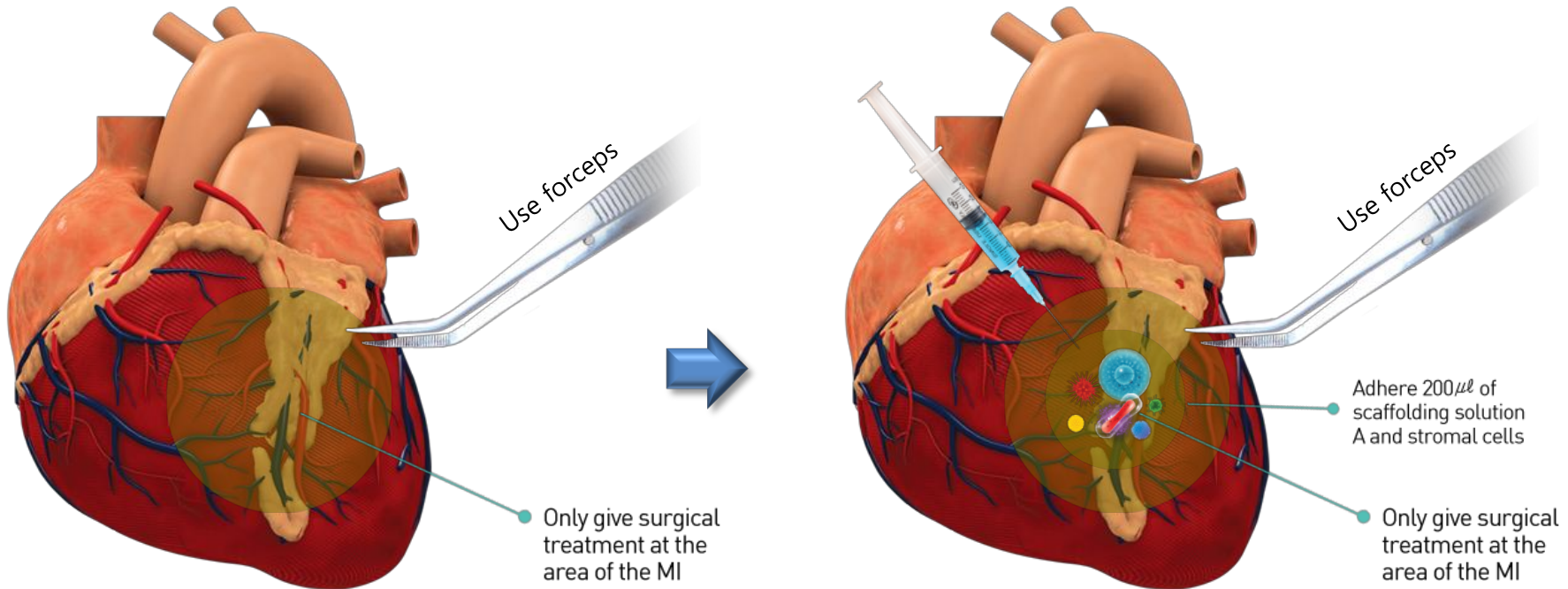


# MSC cell transplantation – Group 2

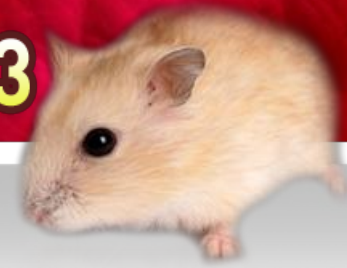


## >> Group with scaffolding

- 200  $\mu\text{l}$  of the fibers of scaffold solution A and stromal cells were adhered to the area of MI.
- 10 rats with MI had the surgery on BIO MAT
- 10 rats with MI had the surgery on ordinary surgical table

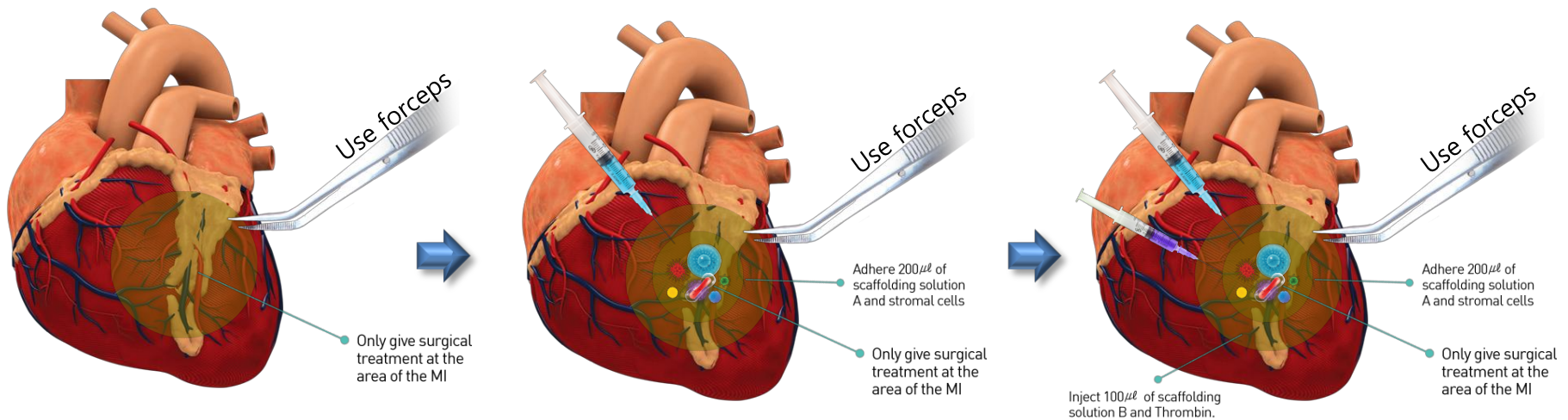


# MSC cell transplantation method - Group 3



## >> Group with stromal Cell transplant with scaffolding

- Following the adherence of  $200\mu\text{l}$  of stromal cells and scaffolding solution A,  $100\mu\text{l}$  of scaffolding solution B was injected with 50,000,000 stromal cells
  - 10 rats with MI had the surgery on BIO MAT
  - 10 rats with MI had the surgery on ordinary surgical table



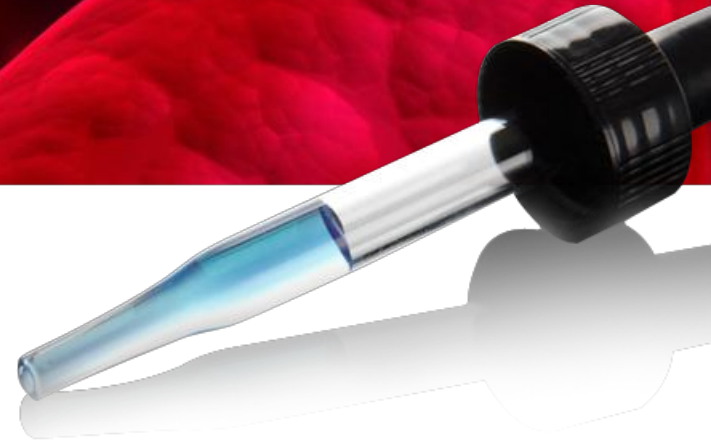
Experimental methods

# Rat MI model

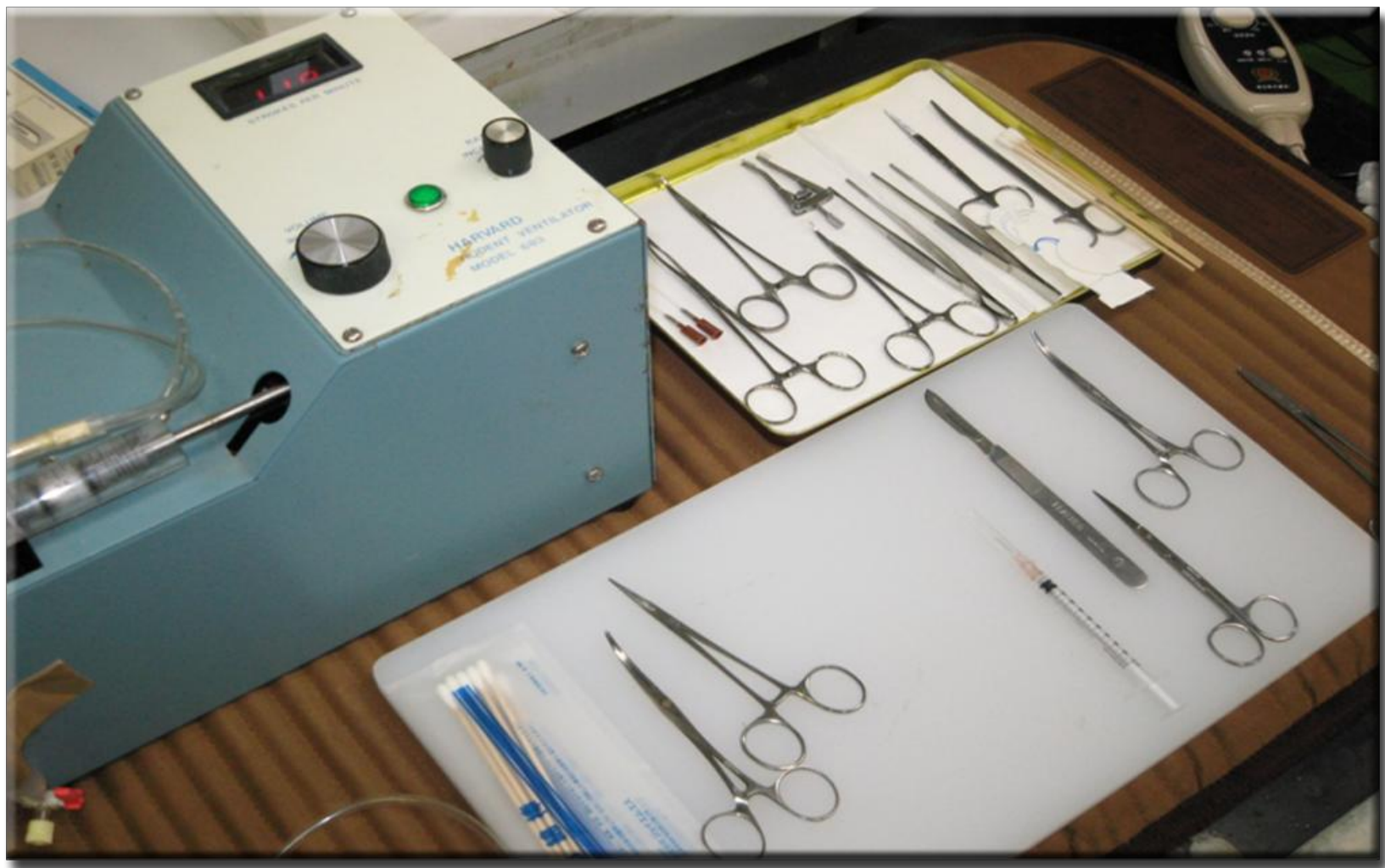
Type of animal :  
Experimental Rat (S.D.: Sprague-Dawley)

## Surgical methods

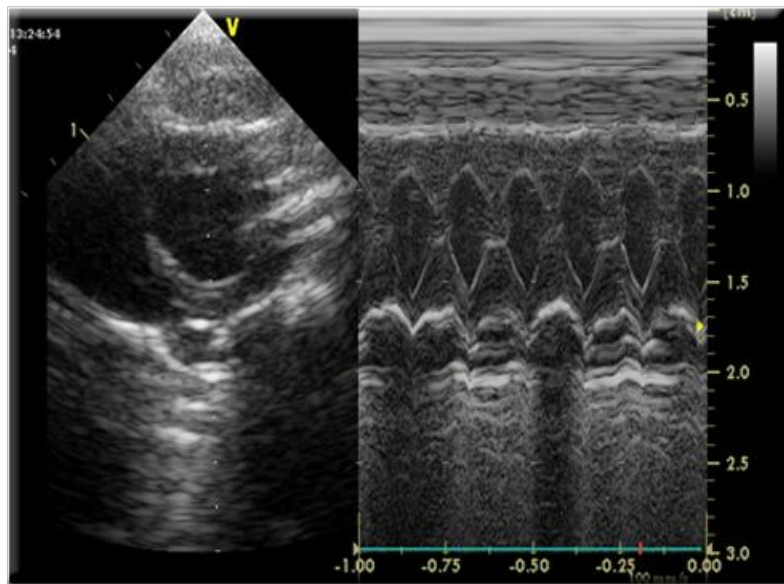
1. Pentobarbital Na is injected intra-abdominally. 2. Rat is shaved and disinfected, and fixed using tweezers.
3. Set up cardiac ultrasound to monitor the cardiac function
4. Insert tubes.
5. For open thoracic surgery, place the oxygen mask and maintain oxygen supply.
6. Open the left thoracic cavity.
7. Under the microscope, open the pericardium and move the myocardium into good visual field.
8. Close the left lower part using 4-0 thread.
9. Attach scaffold
10. Close the thoracic wall and suture the skin



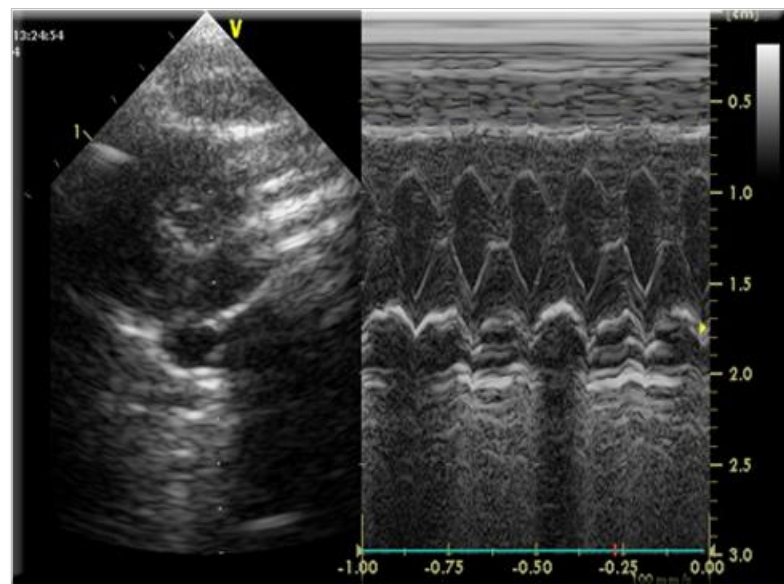
# Preperation for surgery- 1



# Ultrasound to assess the cardiac function

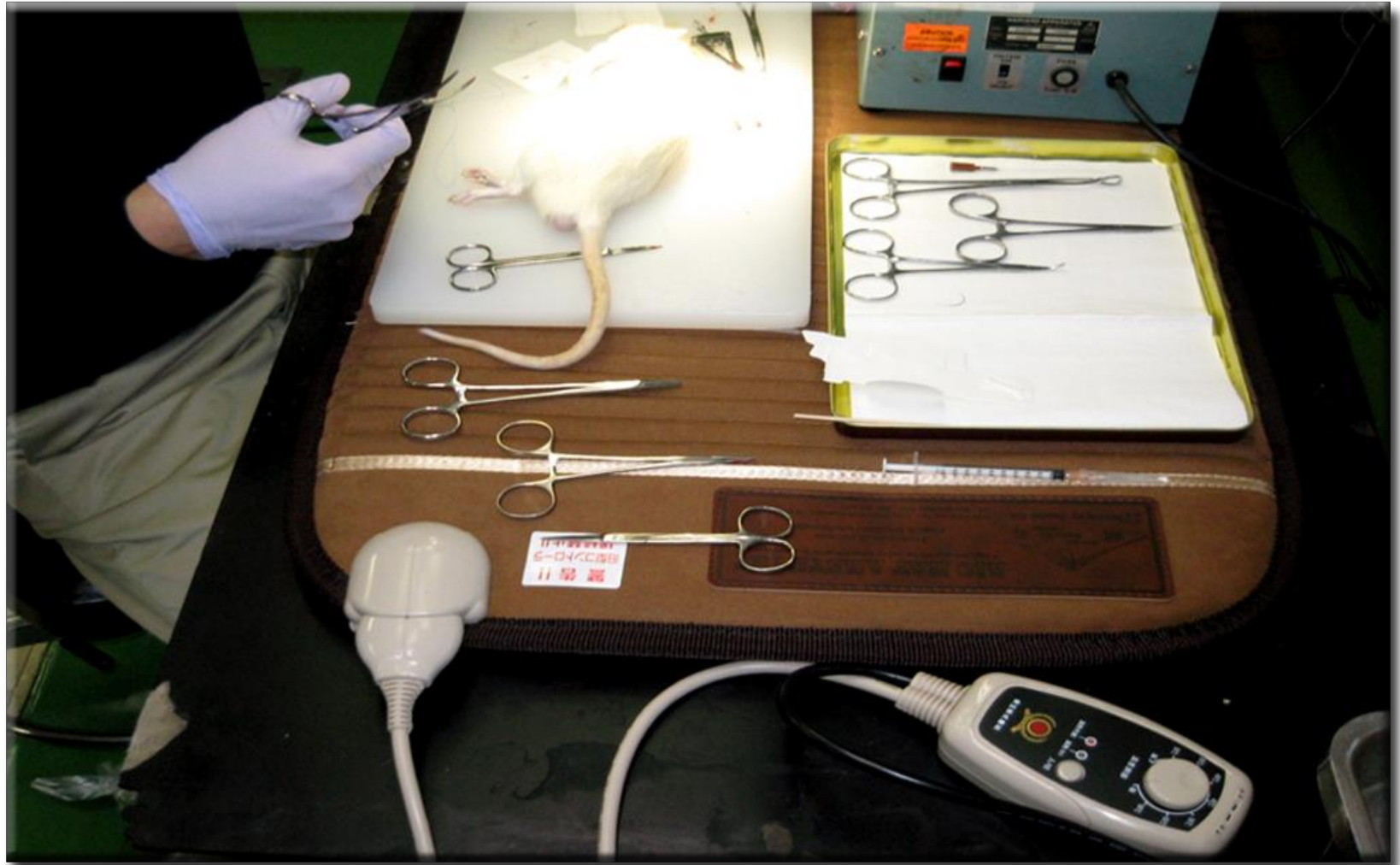


Diastole



Systole

# Surgical procedure--12



# Results (Survival rate after 4 weeks)

General surgical group		Group with scaffolding		scaffolding+stromal cells	
on ordinary surgical table	surgery on BIO MAT	on ordinary surgical table	surgery on BIO MAT	on ordinary surgical table	surgery on BIO MAT
survival 4	<b>survival 10</b>	survival 7	<b>survival 9</b>	survival 9	<b>survival 10</b>

- surgery on BIO MAT
- on ordinary surgical table



General surgical group



Group with scaffolding



scaffolding+stromal cells



# Discussion

1

In the case of the MI rats which did not receive scaffold intervention, the death rate within 4 weeks after the surgery was 100% in the experiment to date.

2

The remarkable feature in the surgical experiment performed on Biomat was that the survival rate after 4 weeks following the surgery was 100% even in the case of the MI rats which did not receive scaffold intervention.

3

With these results, the far-infrared thermal effect of Biomat provided by Richway Japan Co. can be said to have a potential to delay or improve myocardial degeneration and fibrosis

4

We sincerely hope the effect of the thermal effect of Biomat on cardiac surgery can be clearly demonstrated from further clinical trials based on this clinical result.



# Acknowledgements

We would like to appreciate Higashi Takahiko, the chairman of Richway Japan Co., for providing 2 Biomat products to Anatomy lecture 2 and Surgery lecture 2 of Department of Surgery of Sapporo Medical School.

In this clinical experiment, the medical effectiveness of the management of body temperature by physical energy during the surgery or during the recovery period post surgery was proven. I wish your product becomes widespread and be applied in many fields in the future.

*Dr Suganuma*

