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Bubbles cause endothelial damage in a positive correlation manner

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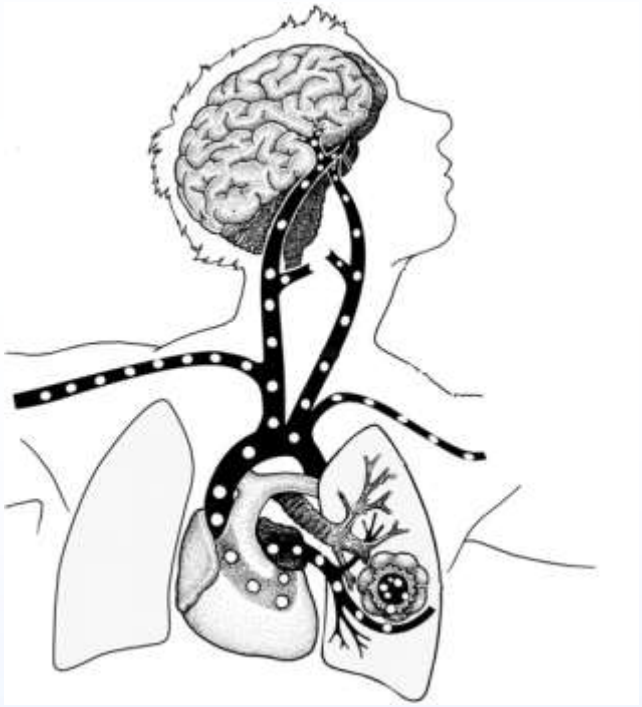
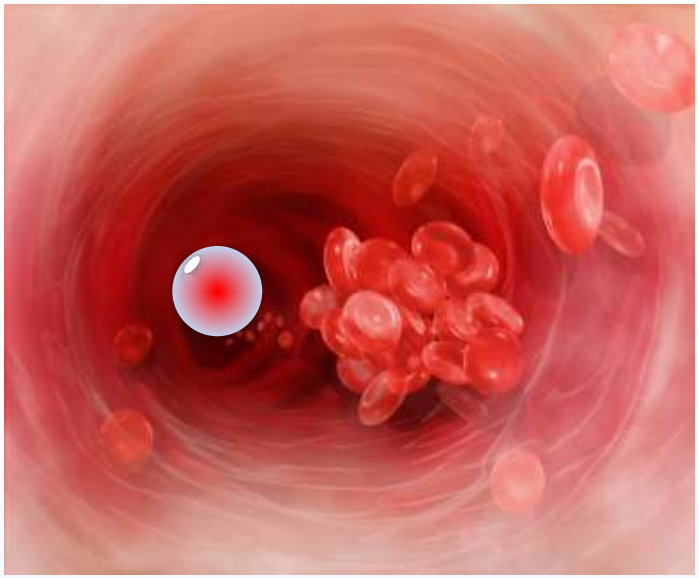
Decompression Sickness (DCS)



- A pivotal medical problem in underwater and hyperbaric interventions.
- Bubble formation is a direct etiology.

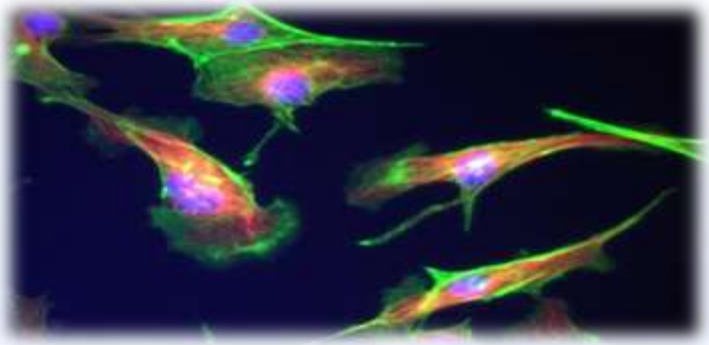
Intravascular bubbles

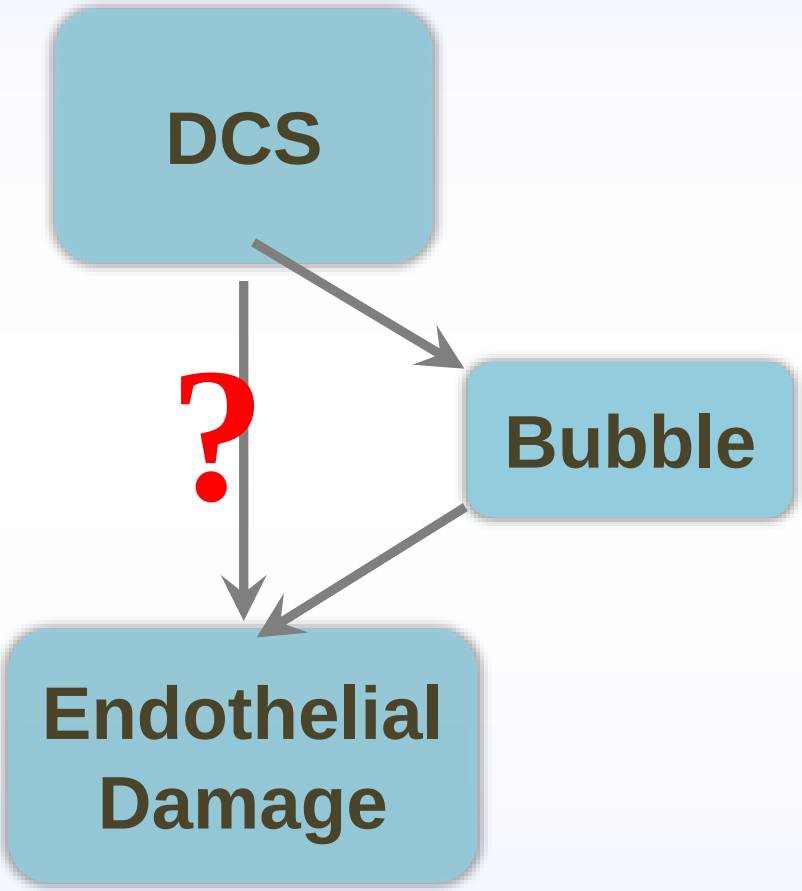


- Circulating or embolising vessels.
- Initiating a biochemical cascade including thrombotic events, inflammatory.

Endothelial cells (EC)

- A multifunctional transducing organ that mediate a plethora of cardiovascular process.
- Damaged through I/R, physical contact or by an increase in shear stress.



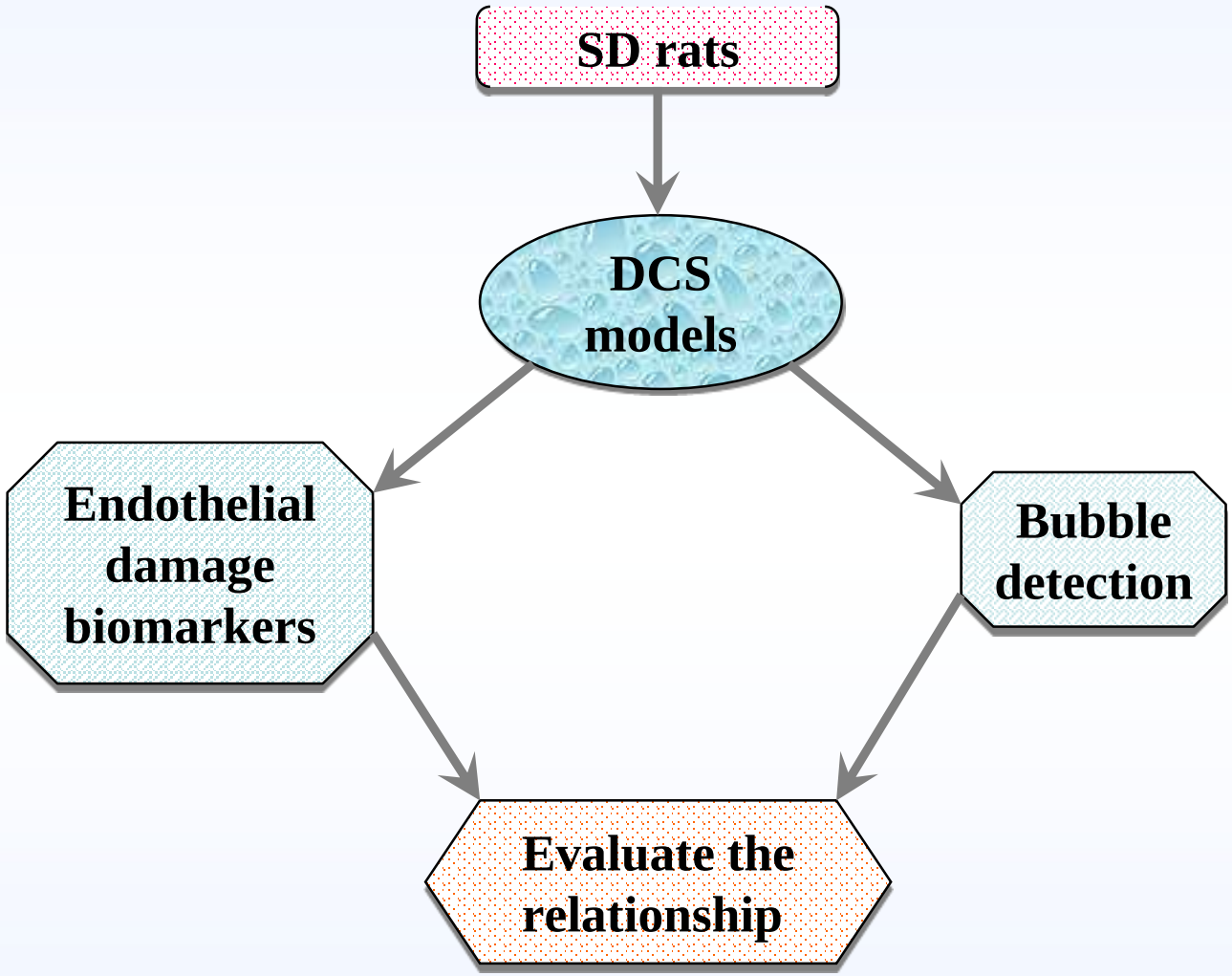

DCS
?
Bubble
Endothelial
Damage


Bubble Amounts
?
Endothelial Damage

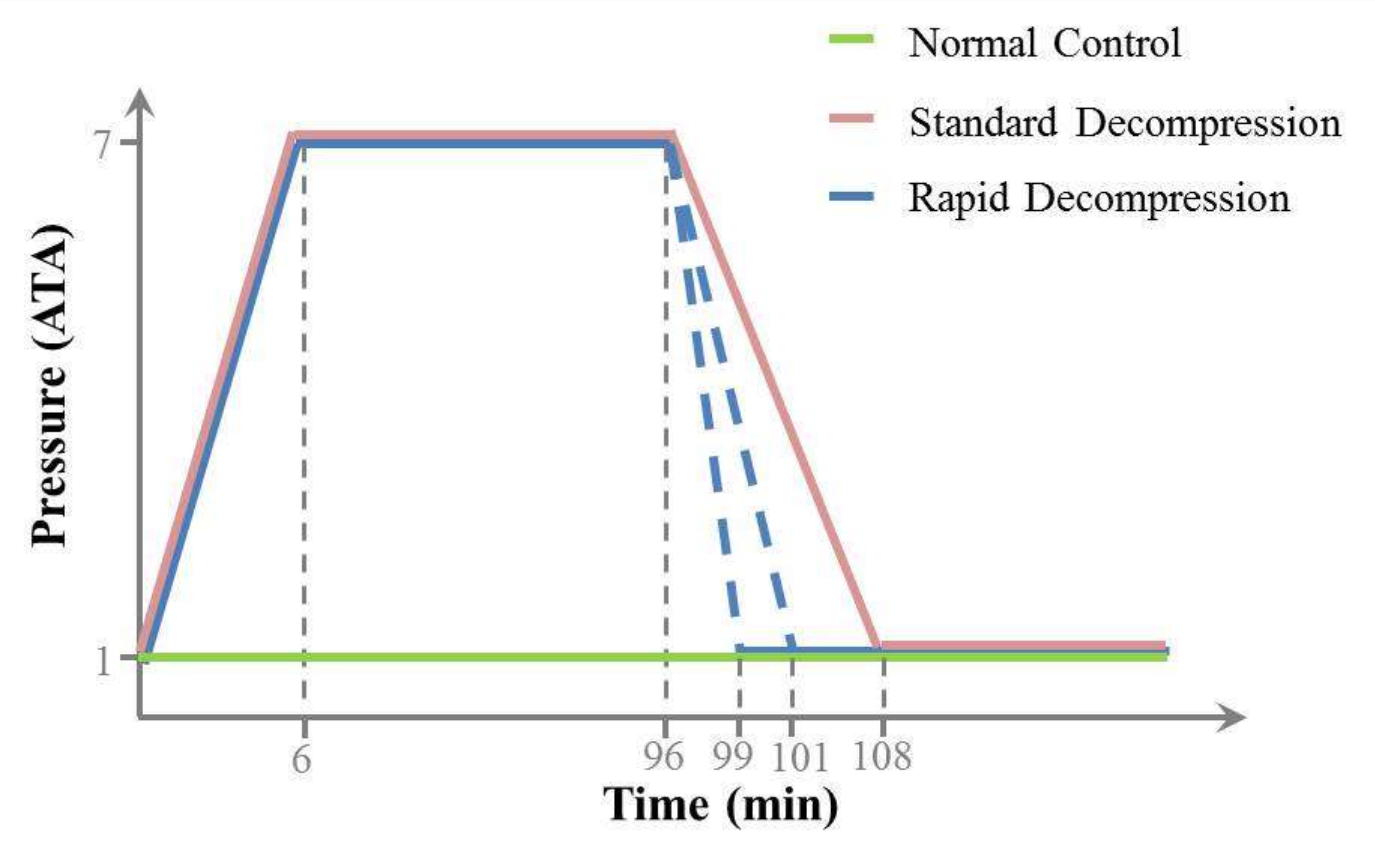
Purpose of the study：

- Investigate potential changes in biomarkers of endothelial damage.
- Evaluate the relationship between bubble score and the degree of endothelial injury.

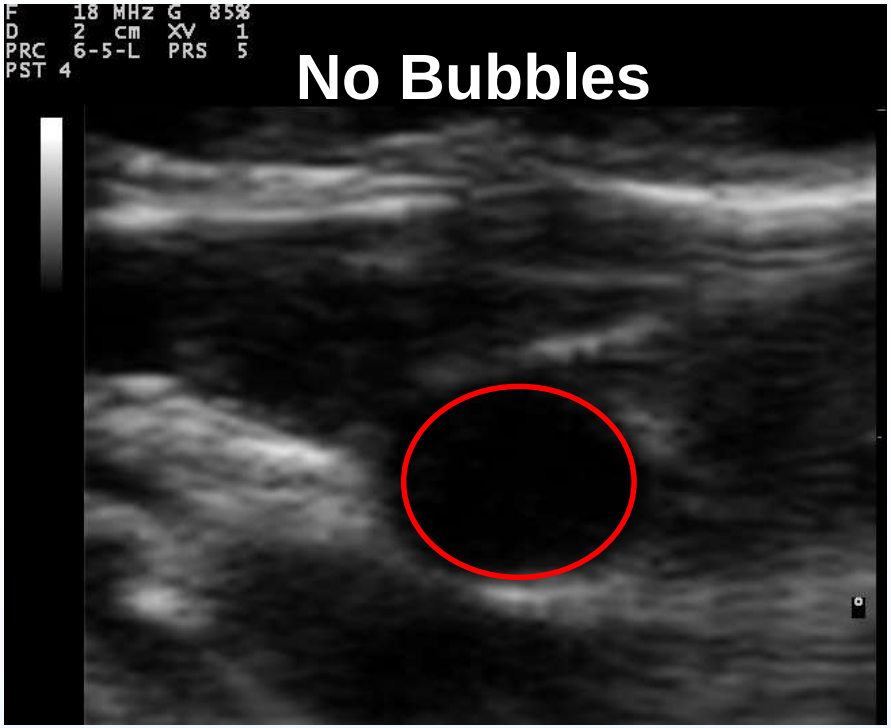
Material & Methods

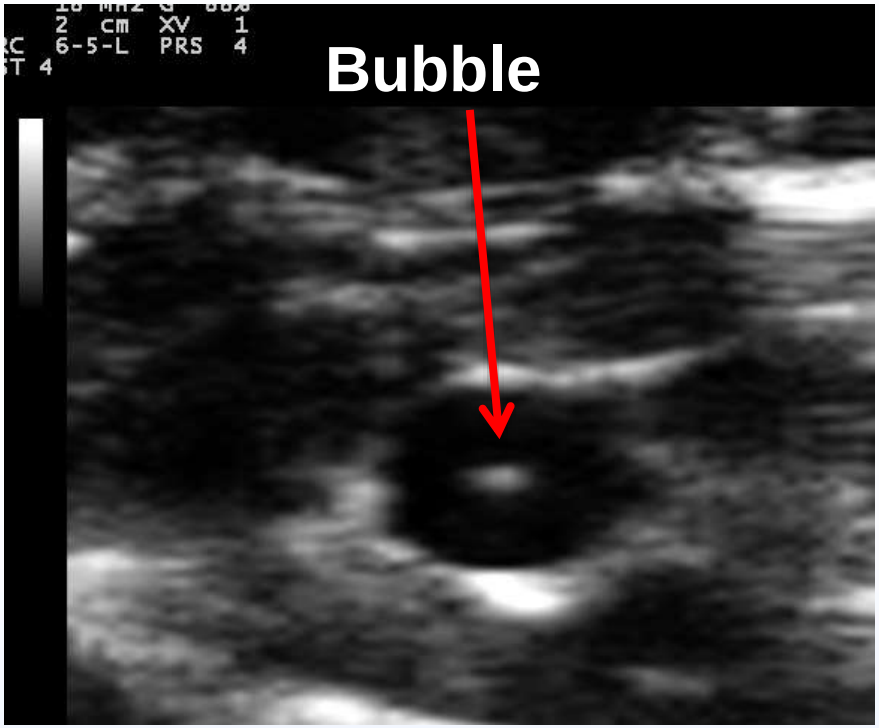


Simulated dive protocol ：



Bubble detection ：

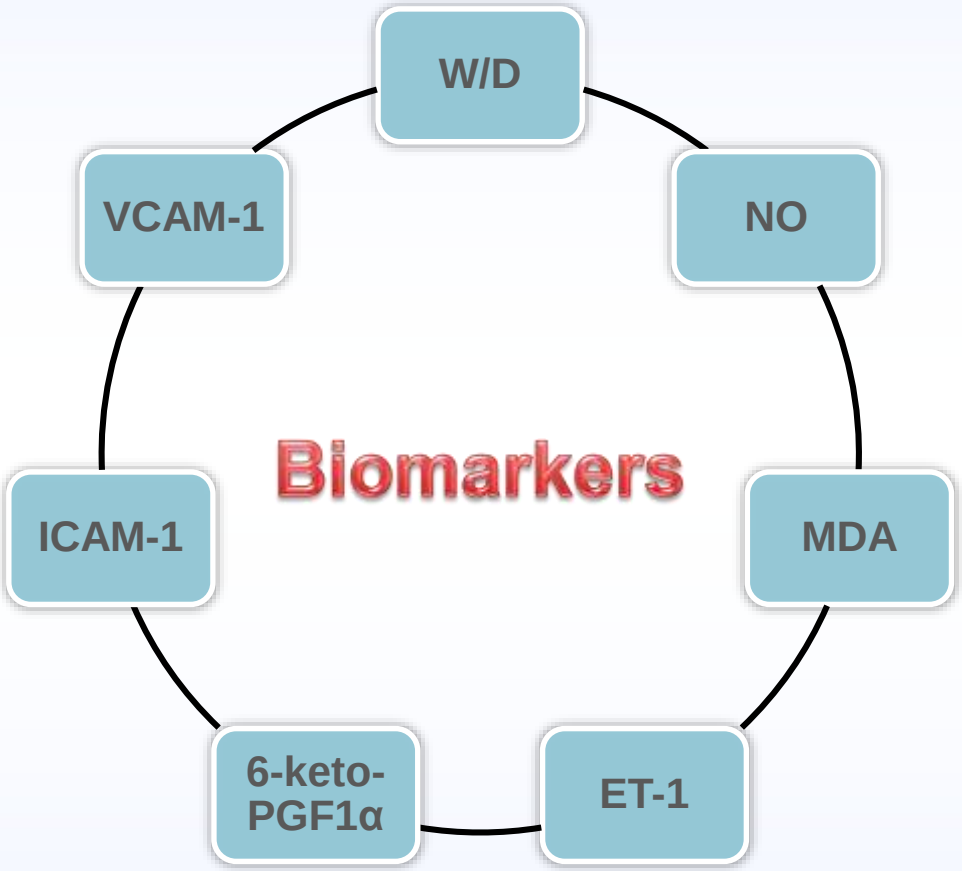




Grading of the ultrasonic images of DCS bubbles

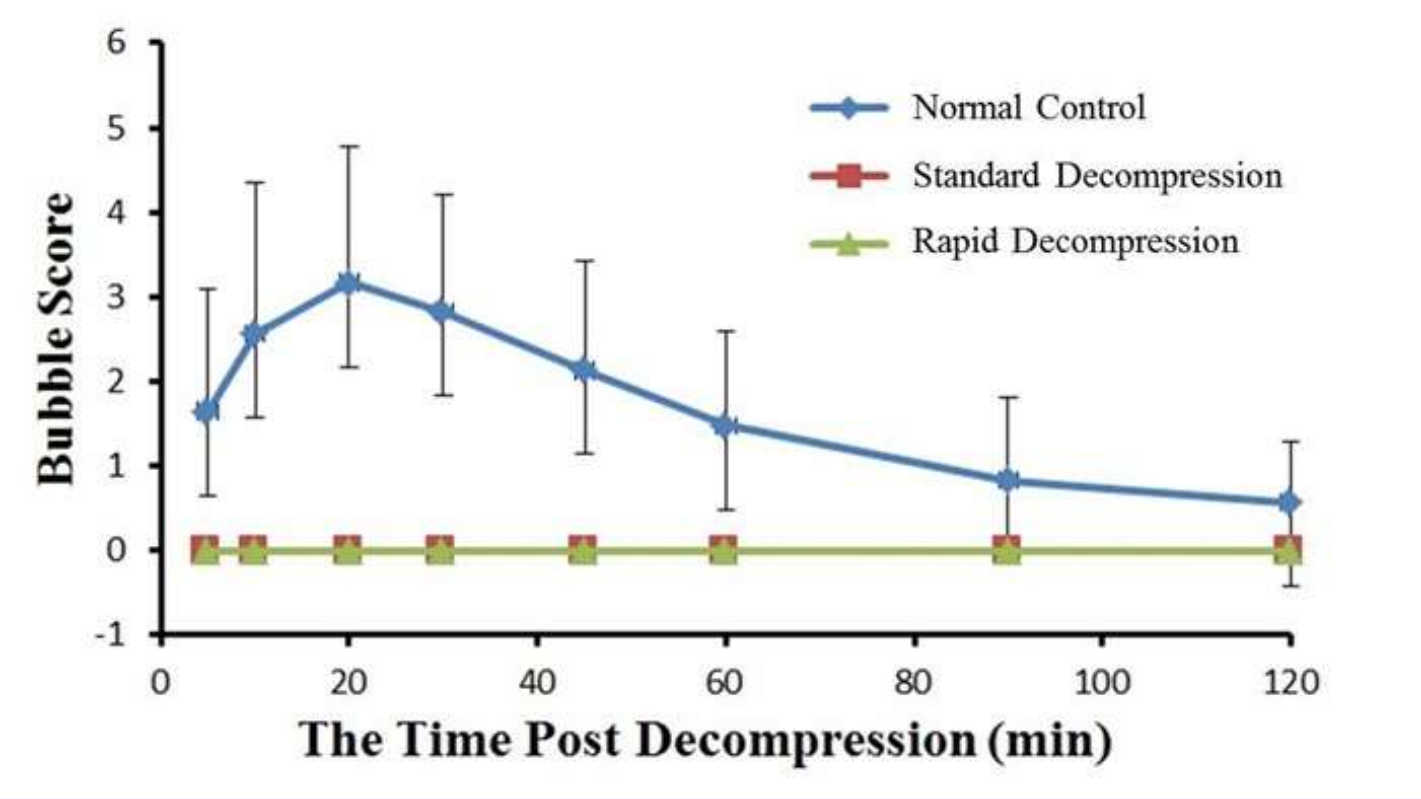
Grade	Definition
0	No observable bubbles
1	Occasional bubbles
2	At least 1 bubble every 4 heart cycles
3	At least 1 bubble every heart cycle
4	At least 1 bubble per cm^2 in every image
5	At least 80% of visible lumen obscured by bubble cloud; single bubbles cannot be discriminated

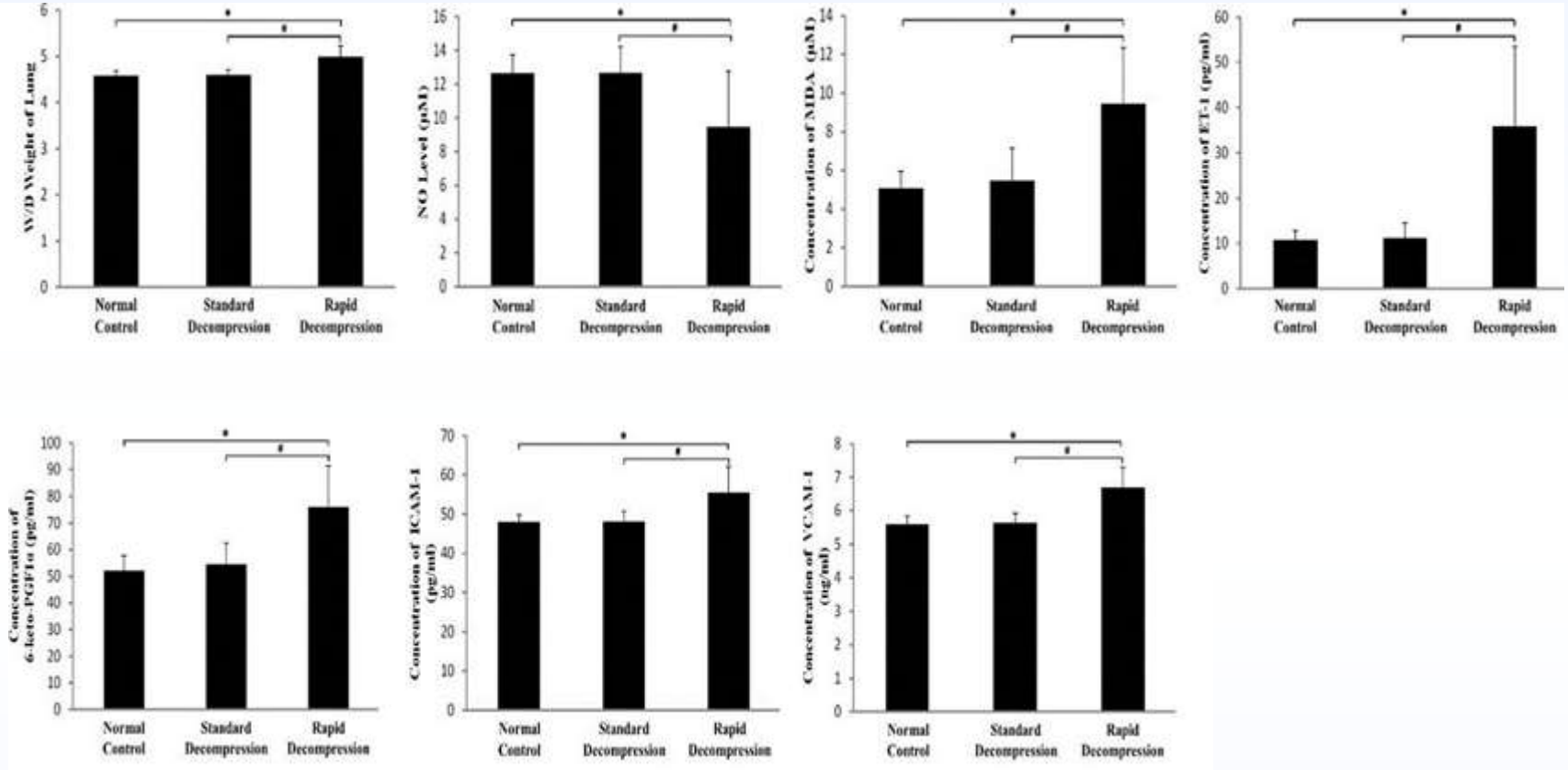
Eftedal, O. S. (2007). Ultrasonic detection of decompression induced vascular microbubbles. Det medisinske fakultet.


W/D
NO
MDA
ET-1
6-keto-PGF1α
ICAM-1
VCAM-1
Biomarkers

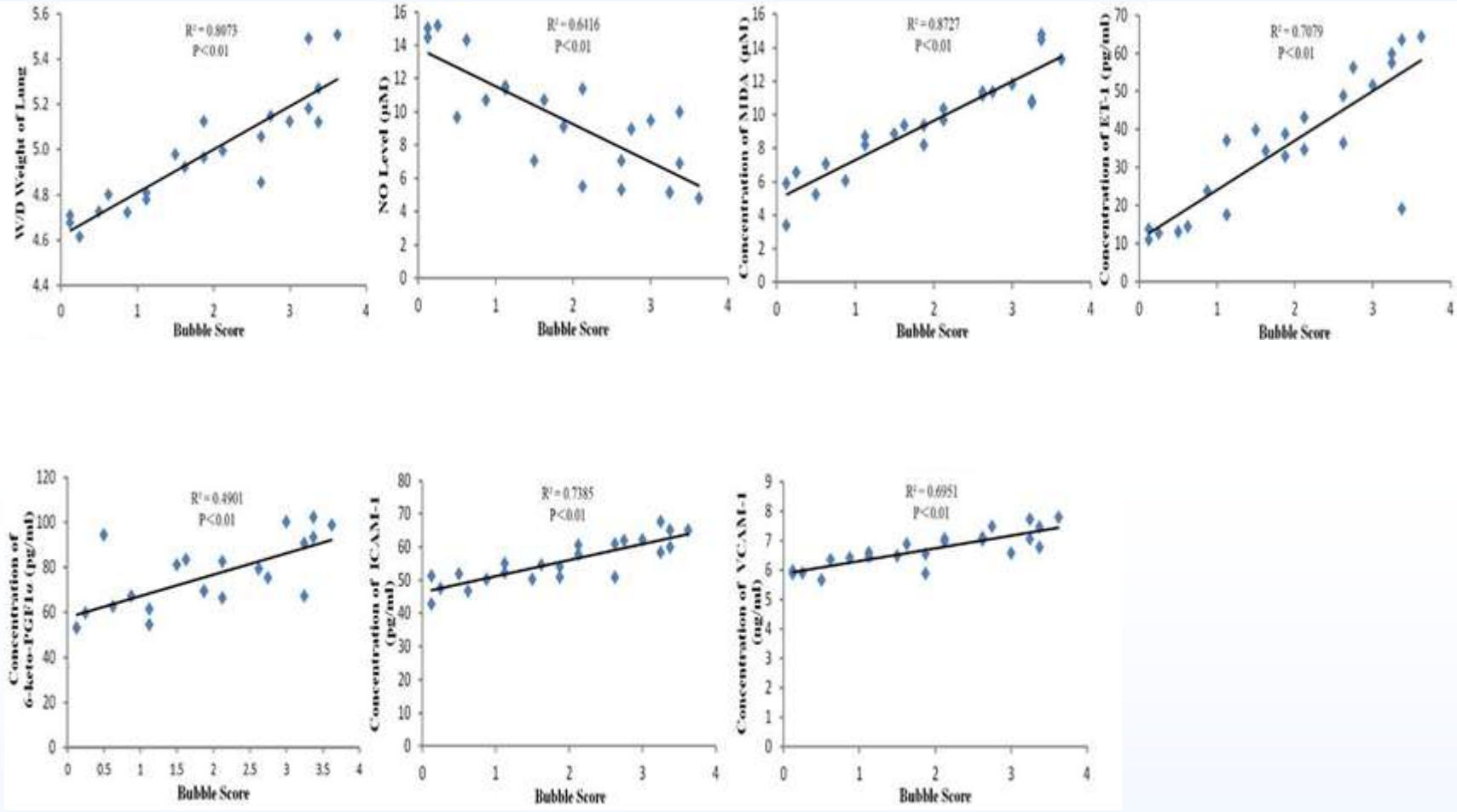
Results

Bubble scores in rat models with different decompression profile

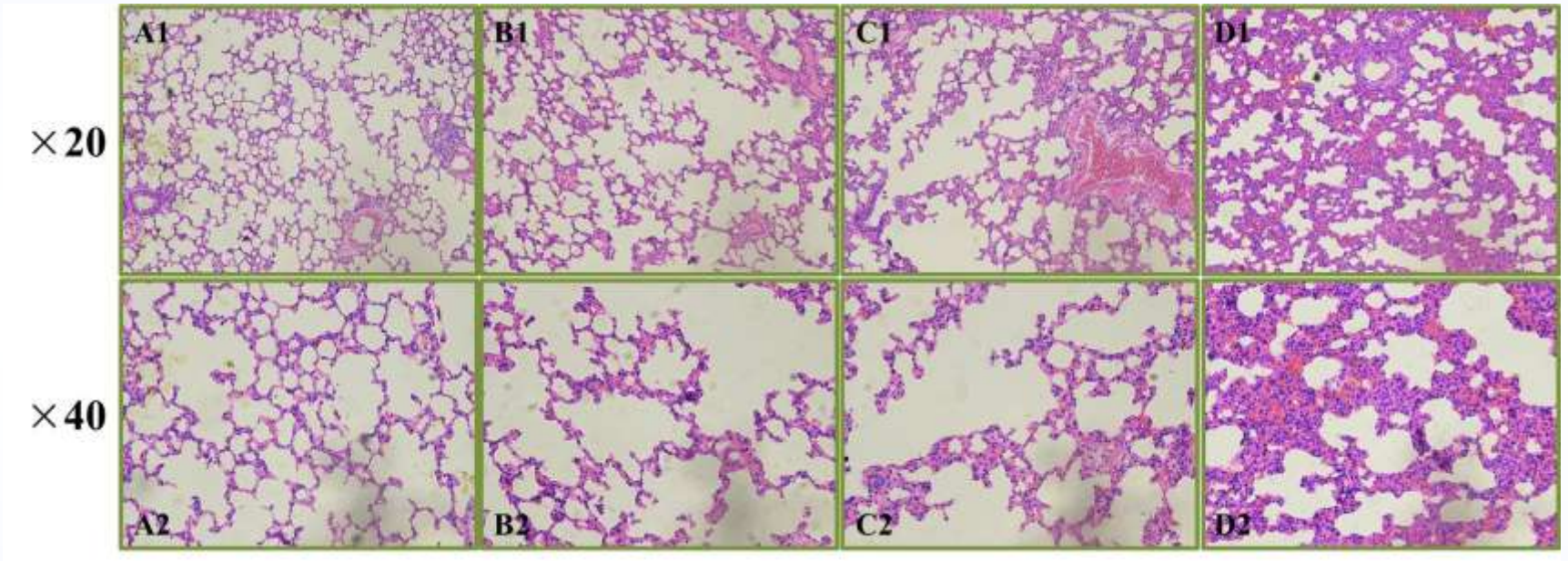




* P<0.01 vs Normal Control group, # P<0.01 vs Normal Control group.


W/D Weight of Lung
R² = 0.8073
P<0.01
Bubble Score
NO Level (μM)
R² = 0.6416
P<0.01
Bubble Score
Concentration of MDA (μM)
R² = 0.8727
P<0.01
Bubble Score
Concentration of ET-1 (pg/ml)
R² = 0.7079
P<0.01
Bubble Score
Concentration of 6-keto-PGF1α (pg/ml)
R² = 0.4901
P<0.01
Bubble Score
Concentration of ICAM-1 (pg/ml)
R² = 0.7385
P<0.01
Bubble Score
Concentration of VCAM-1 (ng/ml)
R² = 0.6951
P<0.01
Bubble Score

Representative photomicrographs of the lungs



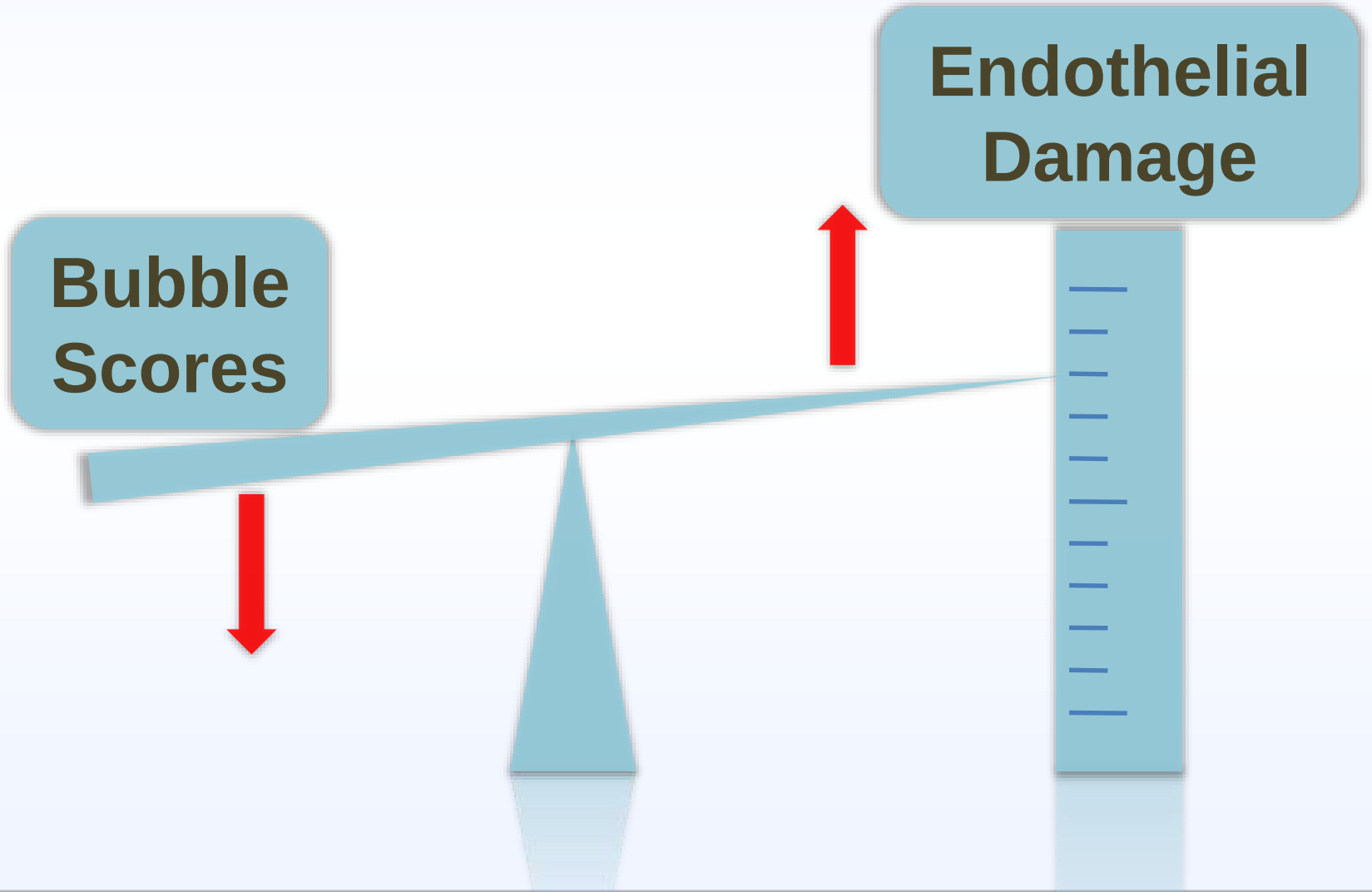
A) Normal Control, B) Standard Decompression, C) Rapid Decompression with low bubble Score
D) Rapid Decompression with high bubble Score

Discussions

Endothelial damage


Bubble

Bubbles cause endothelial damage in a dose dependent manner



Conclusions

- Intravascular bubbles cause endothelial damage after rapid decompression.

- Bubbles cause endothelial damage in a positive correlation manner.

THANK YOU!