

ANYTIME

ANYWHERE

ANYONE

ANYTHING

ADVANCED

PERFORMANCE

EXERCISE

BASIC

RECOVERY

LONGEVITY



EXERCISE



RECOVERY

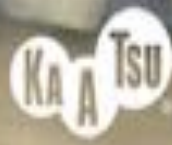


RECOVERY



ANYONE





TALK. TEXT. TRAIN

ANYWHERE

IN WATER AND AIR







REST, RELAX
RECOVER

ANYTIME





ANYONE





**ANYTHING
FROM BEAUTY
TO SKIN CARE**



DR. YOSHIAKI SATO

70-year old inventor of
KAATSU



1973
CYCLE
DISCOVERY





1980s
AND
1990s



1990s





2001



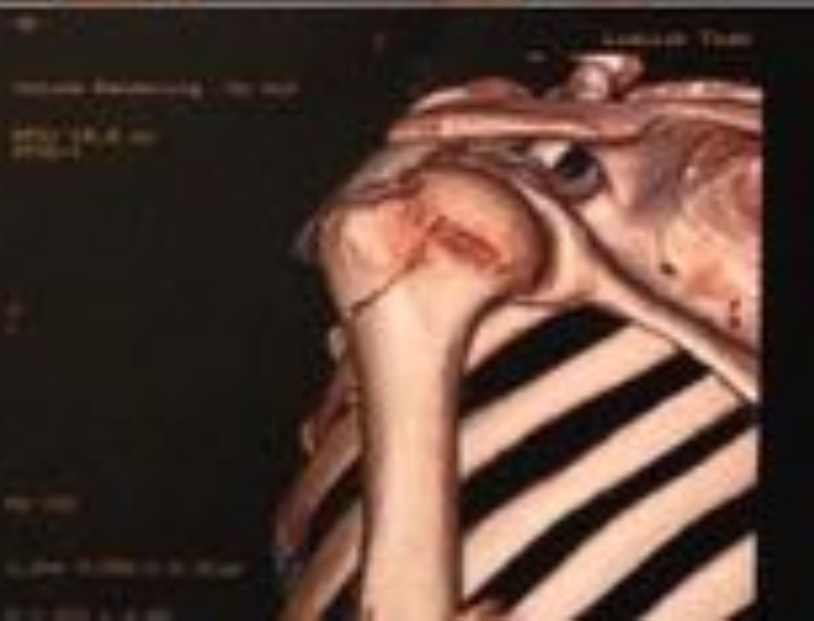
**2000 ON,
CLINICAL
TESTS
CONDUCTED**



**TESTING
ON
GOATS,
HORSES,
RATS
AND MICE**

HOW MUCH DOES A QUADRIPELGIC WANT TO






FEBRUARY 7TH – 4 WEEKS POST INJURY





40 DAYS
POST INJURY



Kaatsu training is blowing fitness researchers' minds

By: Jon R. Anderson, February 6, 2015 *(Photo Credit: Courtesy of Jim Stray-Gundersen)*

KAATSU MILITARY USAGE



HOW DOES IT WORK?



IMPROVED CIRCULATION



at 100 Optimal SKU pressure (21.8 mls/min)

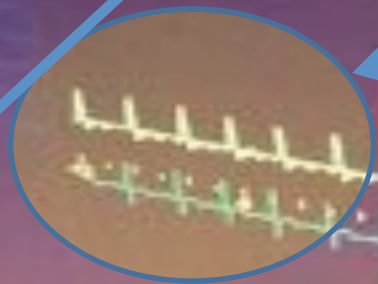
vein



This shows the pulse of arterial blood



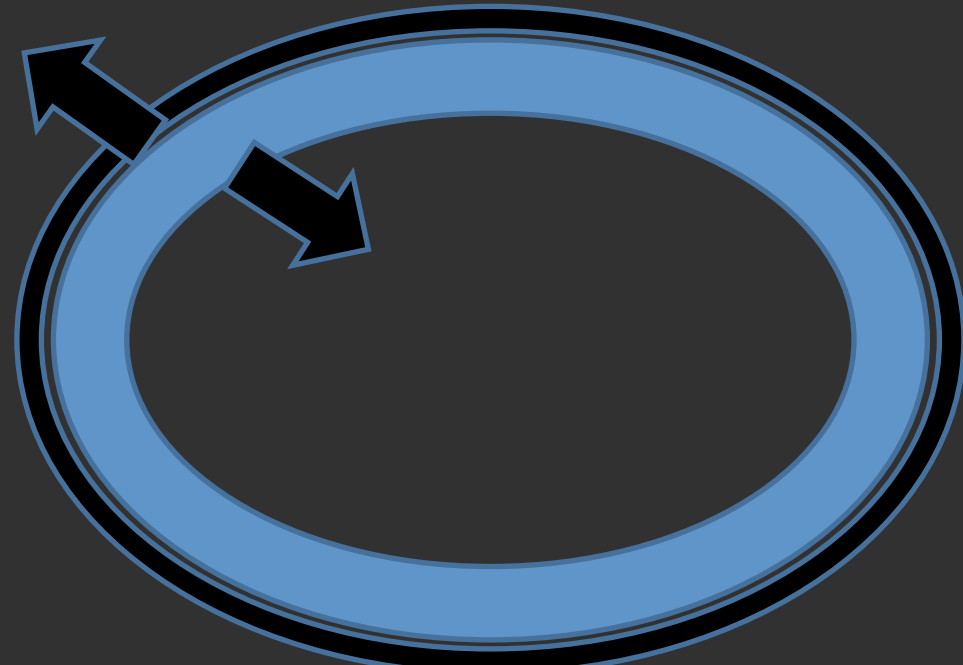
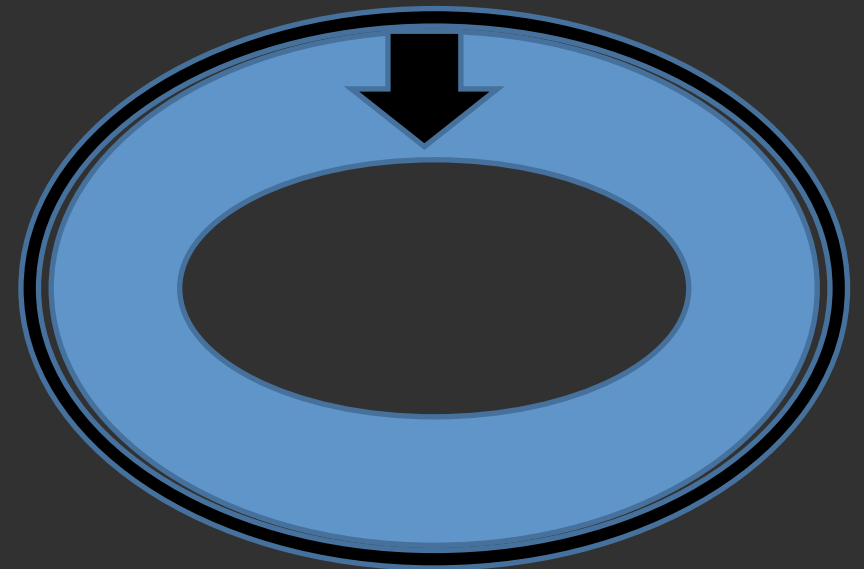
patent artery



BANDS vs. CUFFS



KAATSU Bands and Blood Pressure Cuff Elasticity Difference



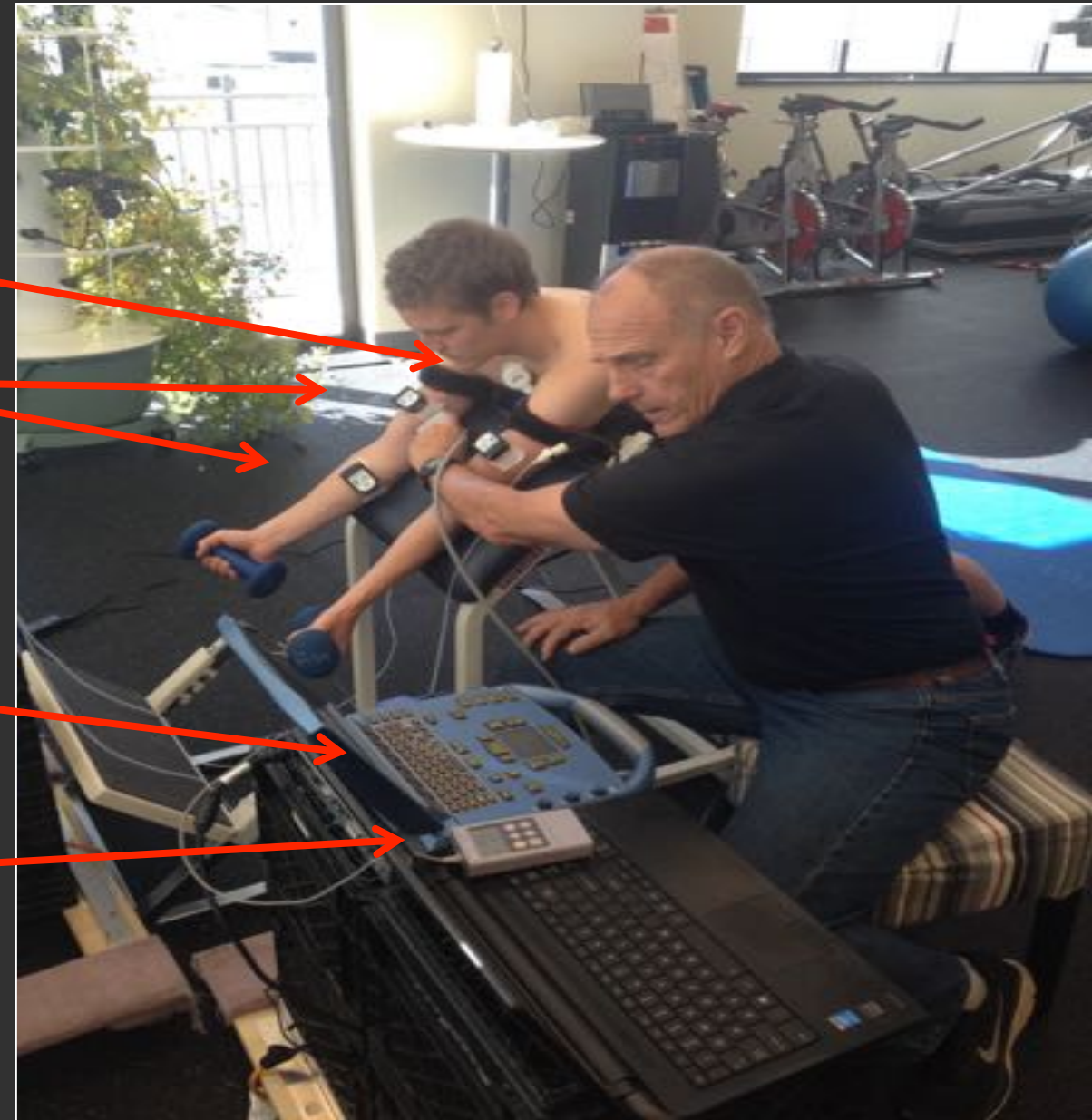
MONITORING SETUP

First Beat Body Guard
Heart Rate Monitor
Accelerometer

MOXY
Near Infra Red Spectroscopy
SmO₂
Muscle Oxygen Saturation

Sonosite MicroMaxx
Doppler Ultrasound
Arterial and Venous blood flow

Nelcor
Pulse Oximeter
SpO₂
Arterial Oxygen Saturation





Before
pressure
application



Capillaries



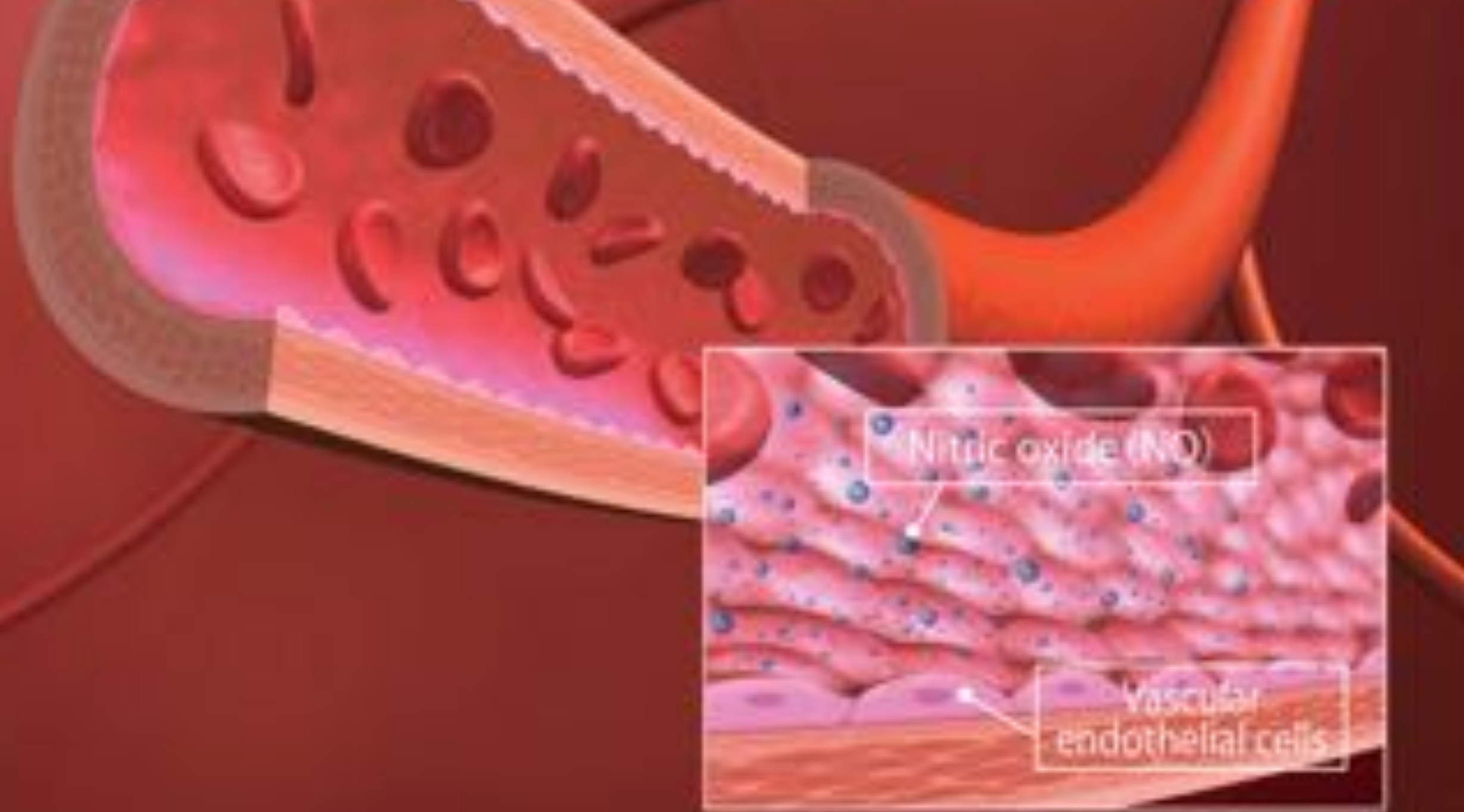
During
pressure
application



Capillaries

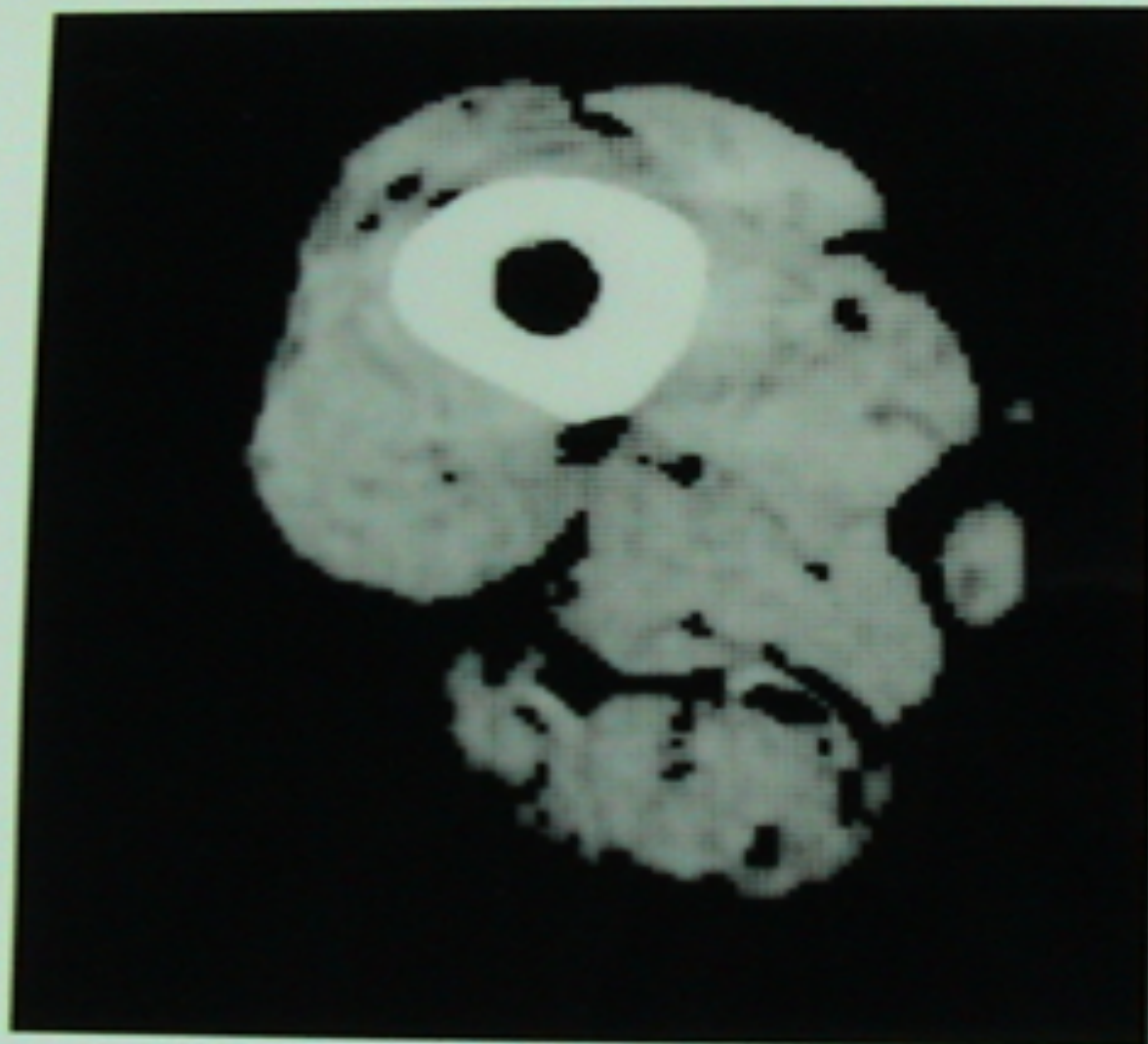
Fast muscle

Slow muscle

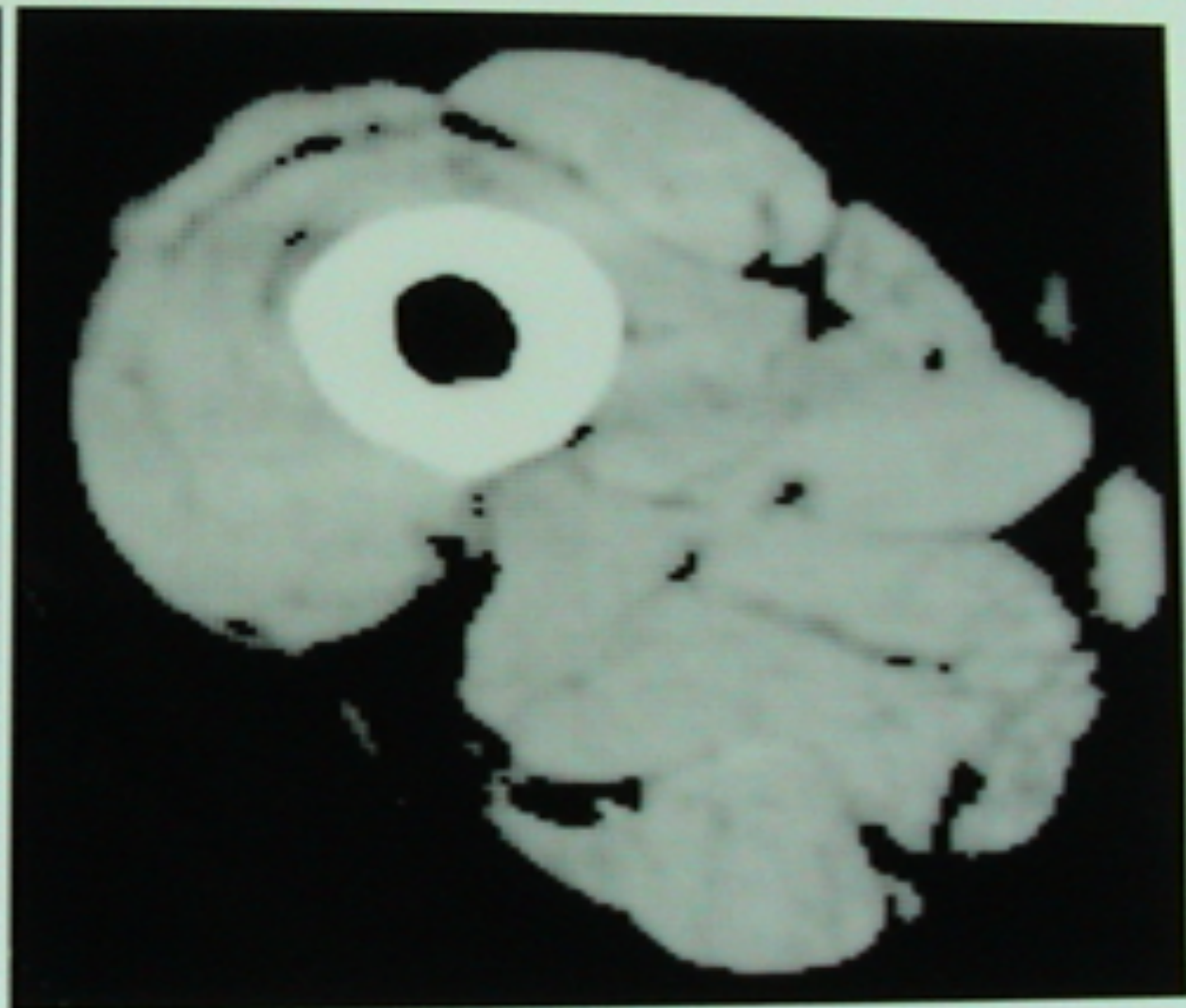




大腿部横断像 (らせんCT)



リハビリ前



リハビリ3ヶ月後

JOSH SAUNDERS, MLS GOALIE



- January 2014: Left ACL reconstruction with right hamstring graft
- 8 weeks: Leg girth equal
- 12 weeks: Gait, girth, strength of quadriceps normal and symmetric to contra-lateral side.
- 18 weeks: Return to practice
- 23 weeks: First game post op
- March 2015: MLS Player of the Month

100%
REHABILITATED
POST LEFT
ACL REPAIR



CASE STUDIES CONCLUSION

- KAATSU was the primary and critical rehabilitation tool in the return of these elite athletes to their sport.
- The athletes competed much earlier than expected.
- The whole athlete was re-conditioned for the demands of their sport with minimal loss of fitness.



KAATSU
MOTIVATION



CHECKING BASE SKU...SETTING OPTIMAL SKU



KAATSU AQUA ON THE LEGS



OLYMPIC NORDIC COMBINED SKIERS



ENGORGEMENT



KAATSU CYCLE AT WORK



KAATSU WITH BABY BOOMERS





University of Missouri

U.S. AIR FORCE
ACADEMY



UNITED STATES MILITARY ACADEMY
WEST POINT



facebook



THE UNIVERSITY OF
ALABAMA



KAATSU CYCLE



“You’re my
great success
story...”

**DR. LEE CARTER,
CARDIOLOGIST**



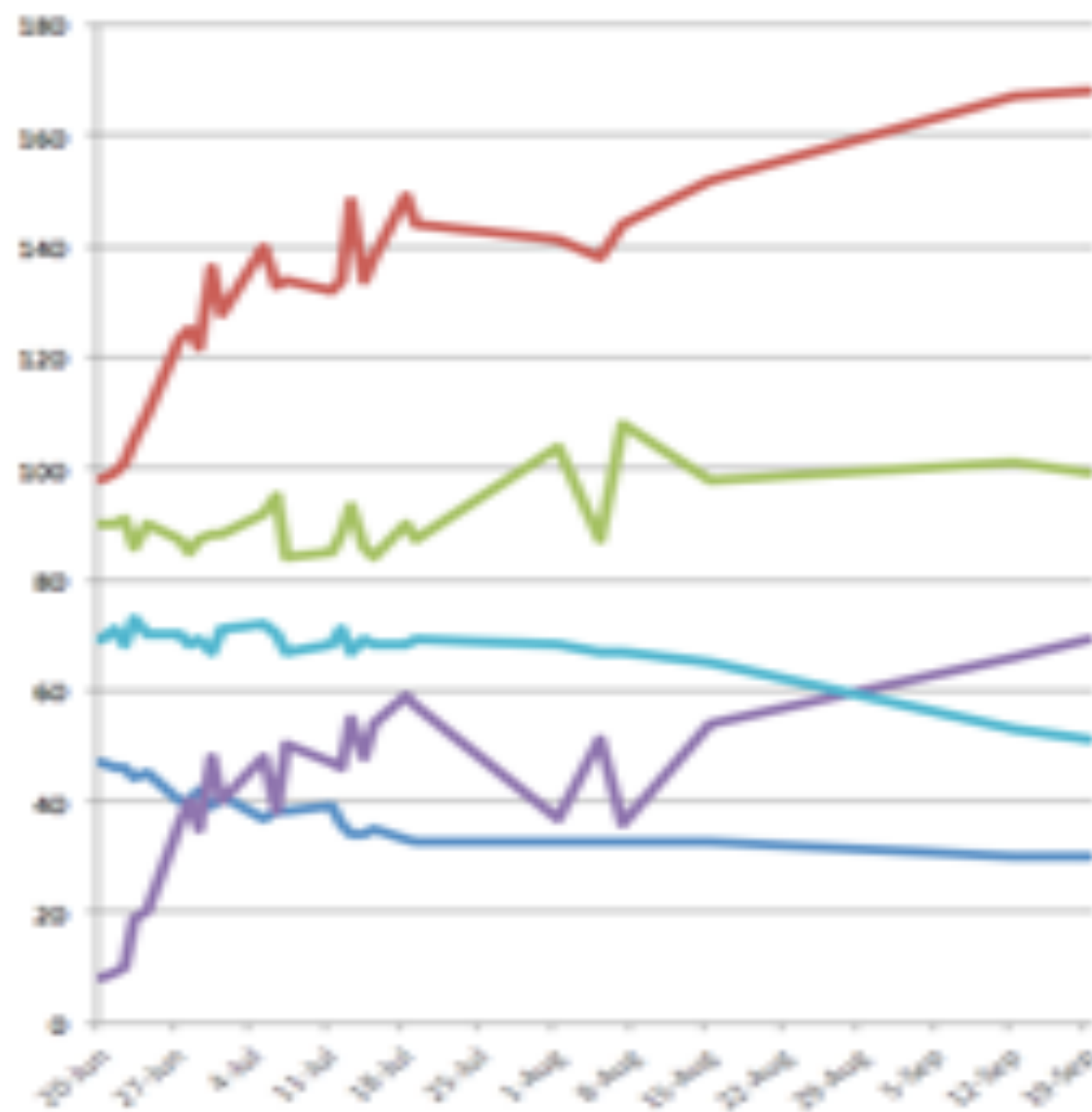


“You were
dead when
we got to
you... no
heart beat, no
breath”

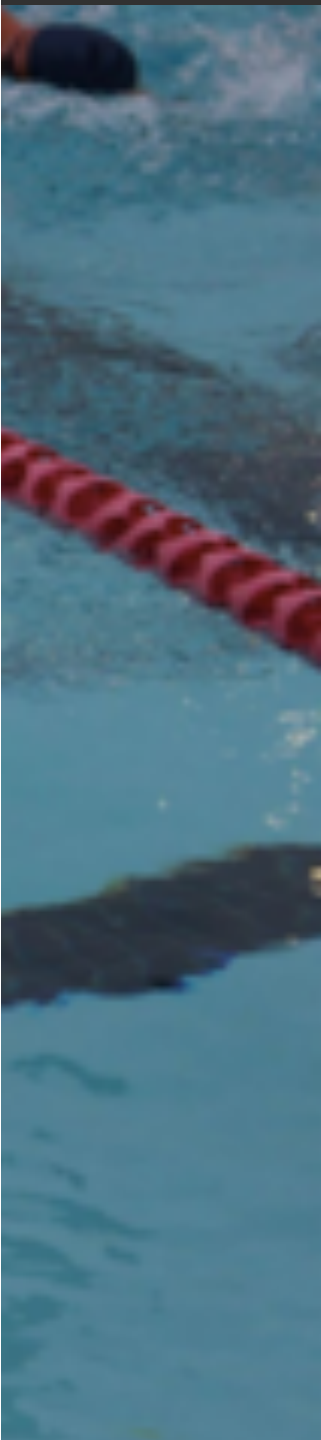
PARAMEDICS



Swimming Rehab



- Fastest Swimming Pace per 50 yards (in seconds)
- Maximum heart rate taken within 25 seconds of finish (bpm)
- Heart rate taken after 60 seconds of rest (bpm)
- Heart rate difference between max bpm and bpm after 60-sec rest
- Heart rate before swimming (bpm)



加圧: **EXERCISE FROM THE INSIDE OUT**

Improve Vascular Elasticity

WITH THE KAATSU CYCLE

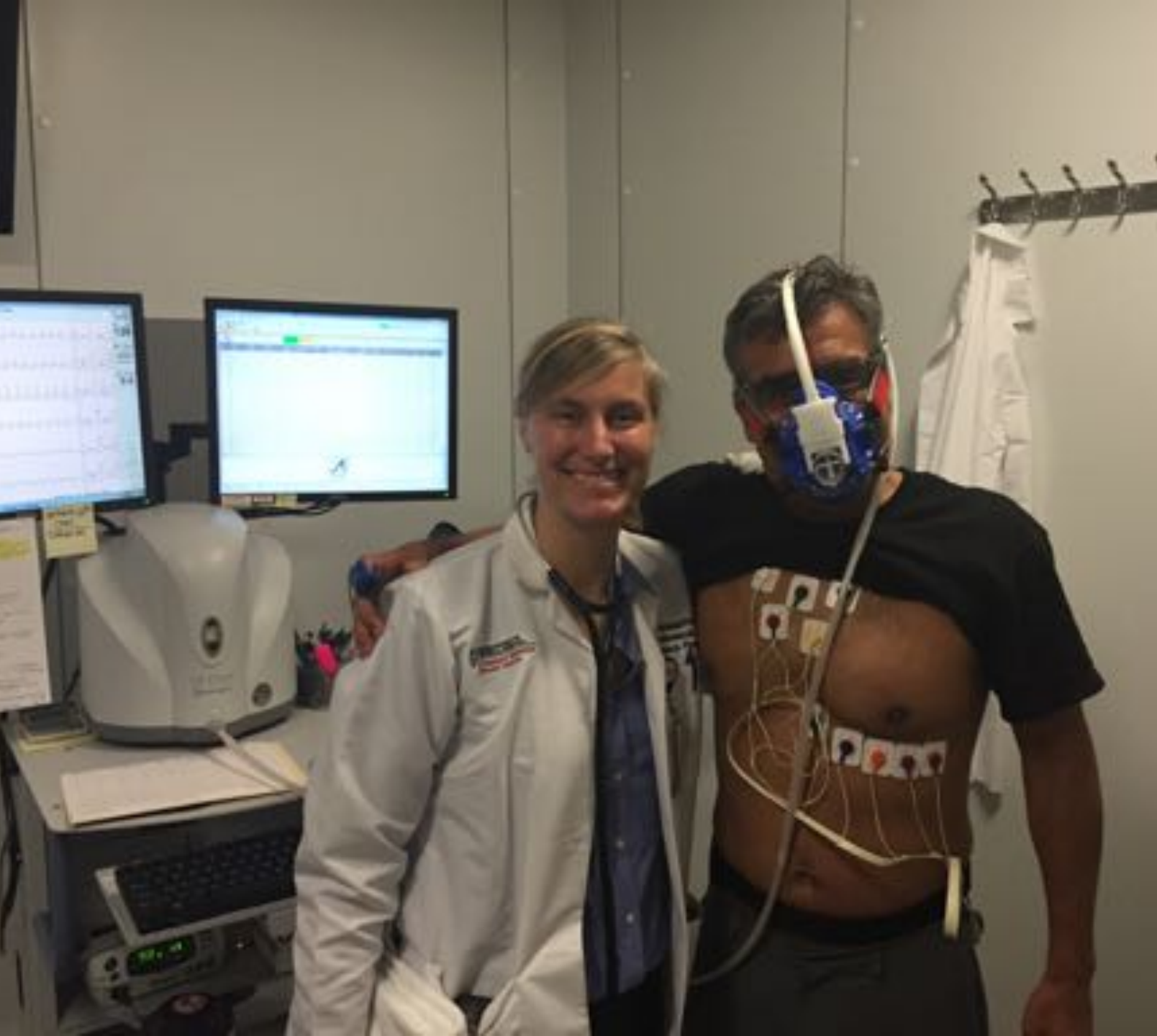
Strengthen Muscle

WITH KAATSU 3-POINT EXERCISES

Increase Aerobic Capacity

WITH SWIMMING, WALKING AND SIMPLE SQUATS





CEDARS-SINAI®



HARVARD
MEDICAL SCHOOL

HOW DOES **KAATSU** WORK?

- By impeding – but not occluding – blood flow, simple easy exercises become unsustainable.
- This disturbance of homeostasis is transmitted to the brain, which in turn, releases an anabolic/healing neuro-humoral cascade.
- Since little damage was actually done, improvement in musculo-skeletal structure and function ensues rapidly.

KAATSU EFFECTS

- KAATSU simply tricks the brain into thinking a workout has occurred and it must repair the damage.
- But in reality, little damage has been done and rebuilding just makes structure and function better rapidly.
- KAATSU allows significant maximal intensity training while injured joints, bones, and muscles heal quickly.

KAATSU PRESSURE IS NOT ARTERIAL BLOOD PRESSURE

- KAATSU pressure is applied to the veins and moderates venous outflow.
- Moderating venous outflow eventually modifies arterial inflow.
- Blood flow into an extremity must soon match blood flow out of the extremity.
- However, there is some capacitance for holding extra blood in the extremity, but once that capacitance is reached, blood flow in must match blood flow out.

BLOOD FLOW WITH KAATSU

- When a muscle contracts, pressures in that muscle can reach high levels.
- They squeeze any blood in the muscle or vessels in the muscle, back into the major arteries and veins.
- Veins have valves, which causes blood to flow only in one direction, back to the heart.
- With KAATSU, the veins are holding lots of blood and with muscle contraction that blood is squeezed past the pressure blockage of the band.

DISTURBANCE OF HOMEOSTASIS IN THE MUSCLE

- When light, easy exercises are added to impeded circulation, exercise quickly becomes unsustainable.
- pO_2 , pH, drop to critical levels with even mild exercise (e.g. unweighted arm curls)
- High levels of lactate are generated
- ATP levels drop, as ADP and P_i levels rise
- ATP dependant Electrolyte pumps (e.g. Ca^{++}) can not maintain proper electrolyte gradients

KAATSU MECHANISM

- **LOCAL VASCULAR MECHANISM:** There is alternating distension and emptying of the venous/capillary vascular space.
- **LOCAL MUSCLE MECHANISM:** There is disturbance of homeostasis in the muscle. These disturbances are communicated to the CNS.
- **SYSTEMIC MECHANISM:** The CNS reflex stimulates cardiovascular responses and releases an anabolic neuro-humoral cascade.

CNS REACTS

- There is a reflex initiation of a neuro-humoral-immuno anabolic/healing/adaptation cascade.
- All vascular tissues that have had this distension/emptying flow characteristics stimulate an angiogenic response.
- All muscular-tendon-bone units that have been exercising enjoy an anabolic growth response.
- Any current injuries are augmented/aided/accelerated by the healing, anabolic milieu.

TOOLS TO EXPLAIN **KAATSU MECHANISM**

- DOPPLER ULTRASOUND to document the arterial and venous blood flow changes
- NEAR INFRARED SPECTROSCOPY to document the profound disturbance of homeostasis in the exercising muscle from proper KAATSU
- HEART RATE MONITORING to document the changes in autonomic function from KAATSU
- HIGH PRESSURE LIQUID CHROMATOGRAPHY to document changes in the Metabolome to KAATSU

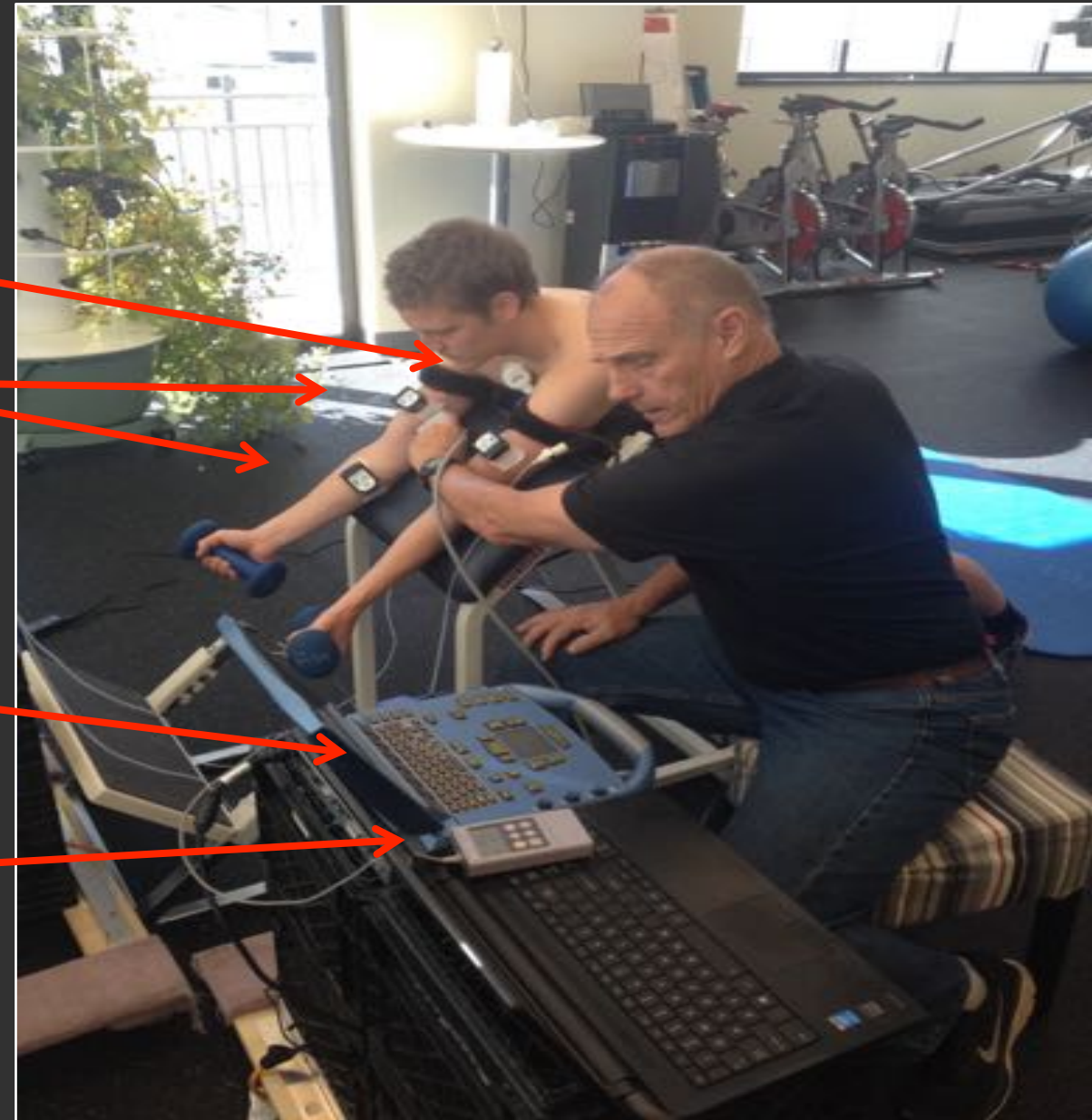
MONITORING SETUP

First Beat Body Guard
Heart Rate Monitor
Accelerometer

MOXY
Near Infra Red Spectroscopy
SmO₂
Muscle Oxygen Saturation

Sonosite MicroMaxx
Doppler Ultrasound
Arterial and Venous blood flow

Nelcor
Pulse Oximeter
SpO₂
Arterial Oxygen Saturation



WITH **DOPPLER ULTRASOUND**, WE PROVE

- Impede, but *do not occlude* arterial inflow.
- Vasodilate all blood vessels distal to the KAATSU air band.
- Impede and distend the capillary and venous space.
- Change the venous outflow pattern to pulsatile flow in the deep, major veins when the muscle contracts.

VASCULAR MECHANICS OF KAATSU

- When the KAATSU Air Bands are applied, the venous and capillary space distend.
- As they maximally distend, any additional arterial inflow is accompanied by venous outflow. However, this is done when the muscle contracts.
- The effect is that the circulation is impeded or slowed so the working muscle does not get the oxygen and fuel it needs to continue to work.
- Metabolic waste products are also not cleared, causing disturbance of homeostasis in the muscle.



DISTURBANCE OF HOMEOSTASIS IN THE

MUSCLE PROTOCOL

Relaxed Rest
Base Pressure (50 SKU)
25 arm curls
KAATSU 100 SKU
25 arm curls
Release
KAATSU 200 SKU
25 arm curls
Release
KAATSU 300 SKU
25 arm curls
Release
KAATSU 400 SKU
Arm curls to failure
Release



Muscle proximal (blood flow not limited) to the air band
Not very active in arm curls

No KAATSU
No Exercise

MOXY

- Total Hb in muscle
- SmO₂

Proximal to cuff— R Deltoid
(not exercising, no KAATSU)

Distal to cuff—R Biceps
(Exercising, KAATSU)

Cuff at Fitting Pressure—L Biceps
(Exercising, but no KAATSU)



Air band not inflated (blood flow not limited)
Same exercise as right arm

No KAATSU
Exercise

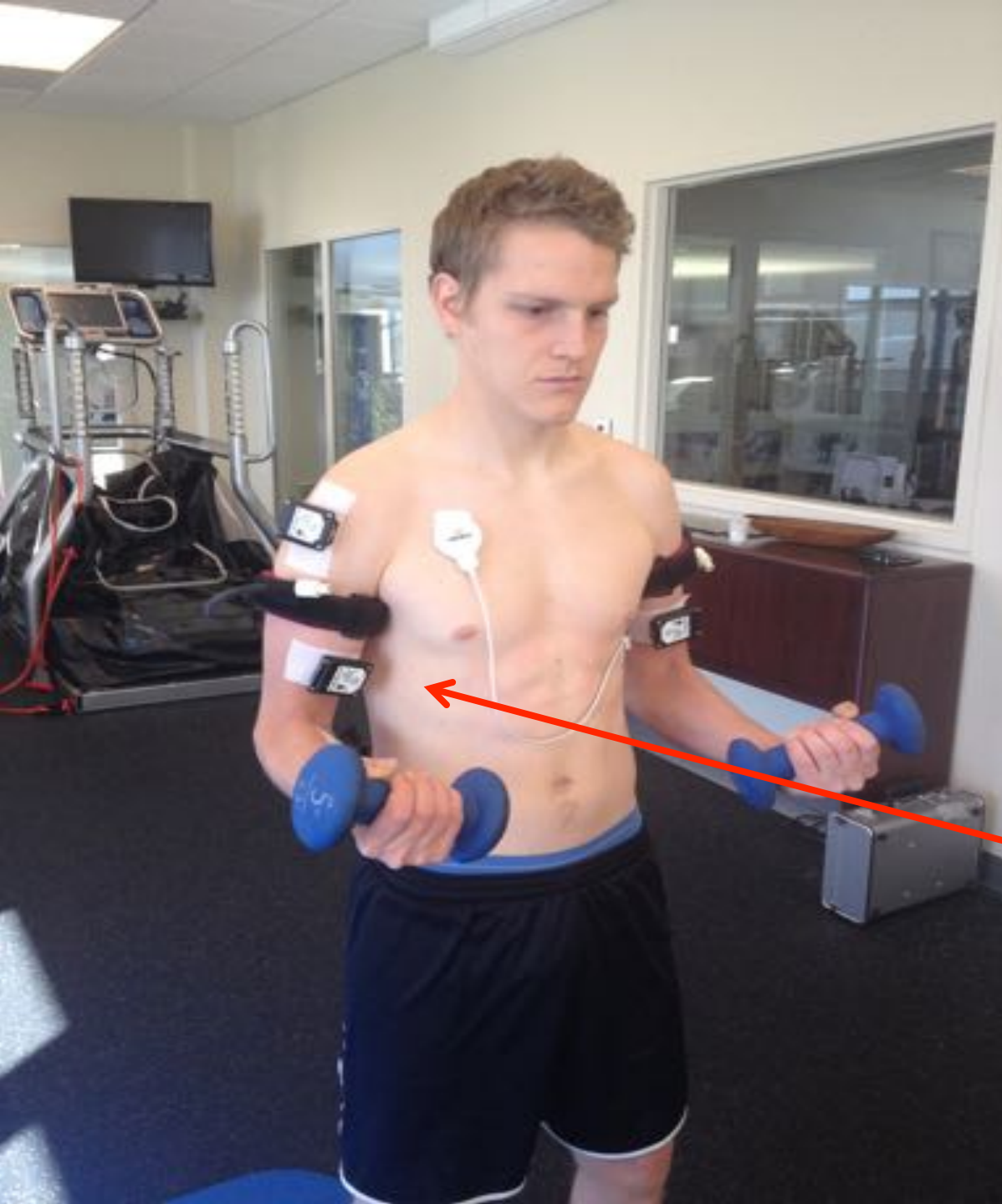
MOXY

- Total Hb in muscle
- SmO₂

Proximal to cuff— R Deltoid
(not exercising, no KAATSU)

Distal to cuff—R Biceps
(Exercising, KAATSU)

Cuff at Fitting Pressure—L Biceps
(Exercising, but no KAATSU)



Muscle distal (blood flow limited) to the air band. Very active in arm curls

KAATSU
Exercise

MOXY

- Total Hb in muscle
- SmO₂

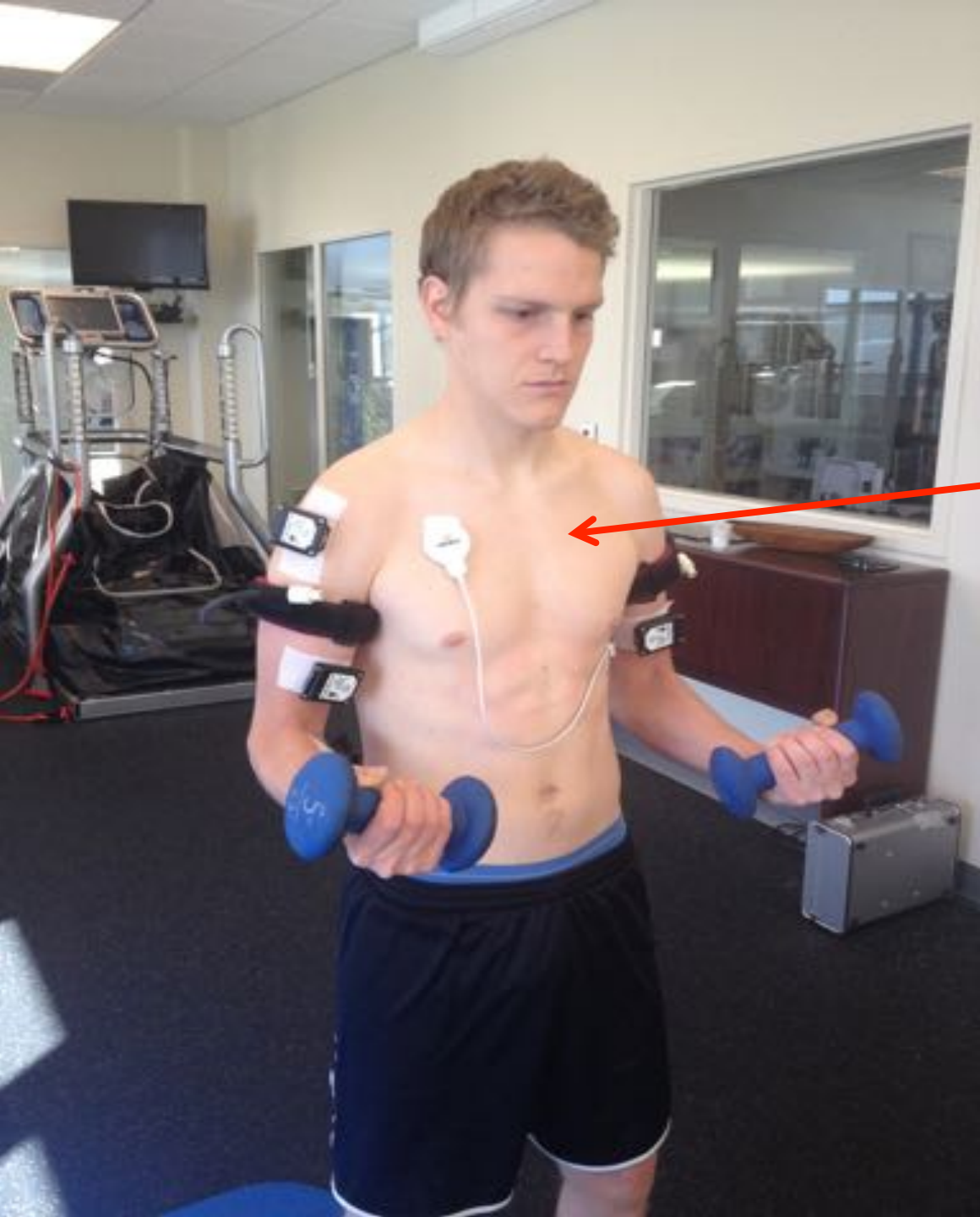
Proximal to cuff— R Deltoid
(not exercising, no KAATSU)

Distal to cuff—R Biceps
(Exercising, KAATSU)

Cuff at Fitting Pressure—L Biceps
(Exercising, but no KAATSU)

PROPER KAATSU

- Profound Desaturation in Exercising Muscle
 - Hemoglobin in the working muscle 0 – 15% saturated with Oxygen
- Profound Reactive Hyperemia post Exercise
- Unable to continue (Muscle Failure)



FIRST BEAT BODY GUARD

Autonomic Function

Heart Rate Variability

Heart Rate

Ventilation

Energy Expenditure



NO BANDS

Arm Curls: 25-25-25

Hand Grip: 25-25-25

Push Ups: 25-25-25

Double Leg Squats: 25-25-25

Heel/Toe: 25-25-25

R & L Single Leg Squats: 25-25-25

“REAL” KAATSU

410 SKU arms bands

Arm Curls: 50-30-20

Hand Grip: 50-40-30

Push Ups: 50-30-10

460 SKU leg bands

Double Leg Squats: 50-30-25

Heel/Toe: 25-25-25

R & L Single Leg Squats: 30-25-20

All exercises to muscle failure

“INADEQUATE” KAATSU (100 SKU)

Arm Curls: 25-25-25

Hand Grip: 25-25-25

Push Ups: 25-25-25

Double Leg Squats: 25-25-25

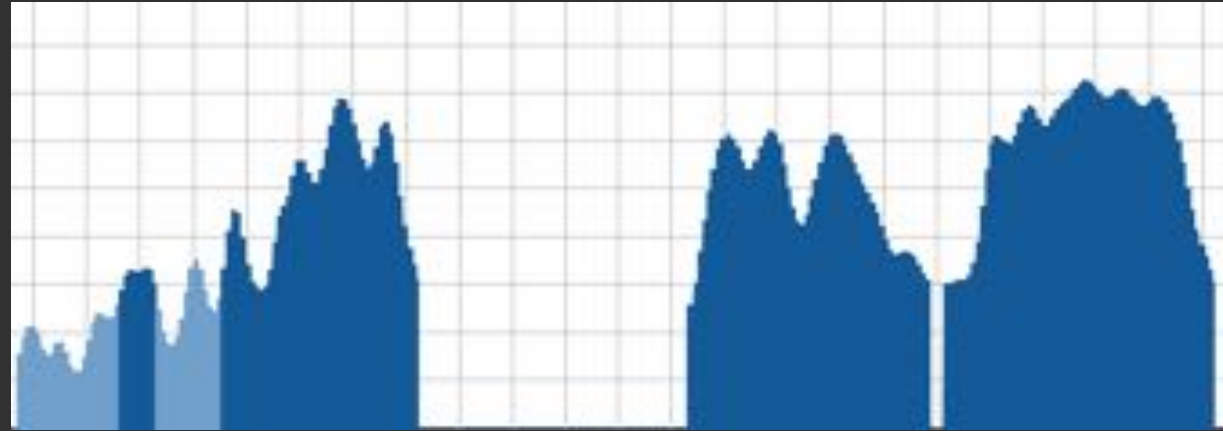
Heel/Toe: 25-25-25

R & L Single Leg Squats: 25-25-25

SYMPATHETIC ACTIVATION

Real KAATSU

Arms 410 SKU
Legs 460 SKU
All exercises to failure



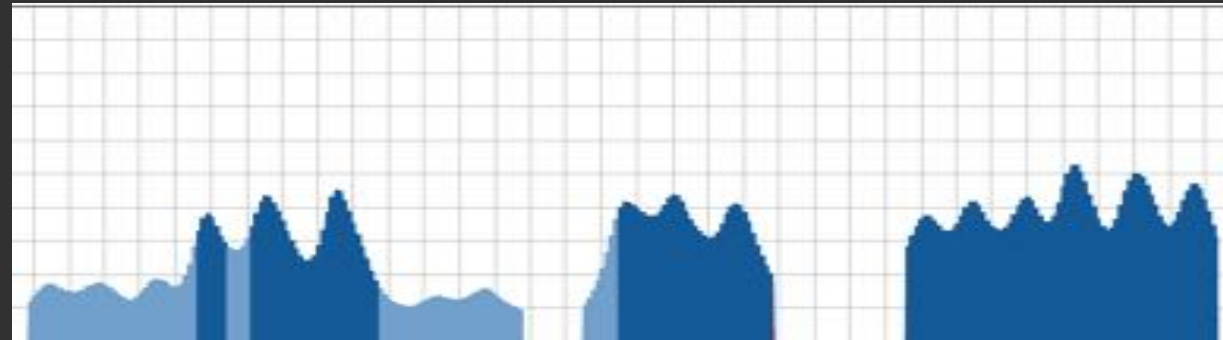
Inadequate KAATSU

Arms 100 SKU
Legs 100 SKU
No exercise to failure



No KAATSU

Just exercises



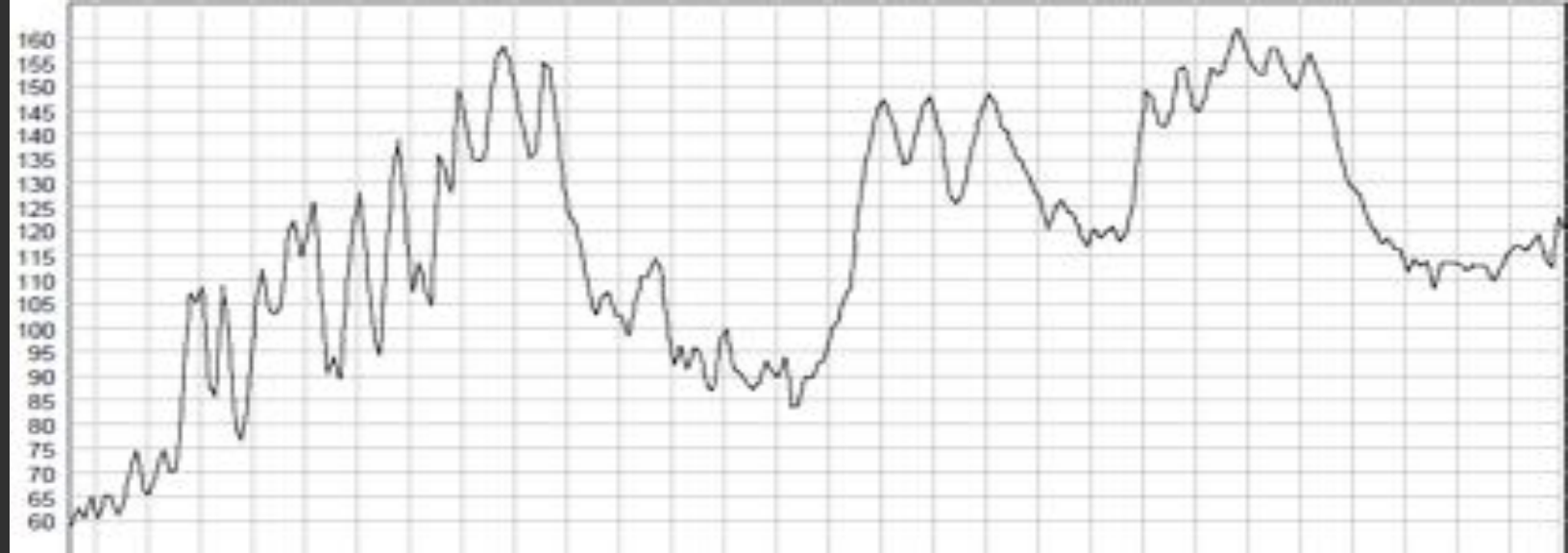
Heart Rate (bpm)

Real KAATSU

Arms 410 SKU

Legs 460 SKU

All exercises to failure

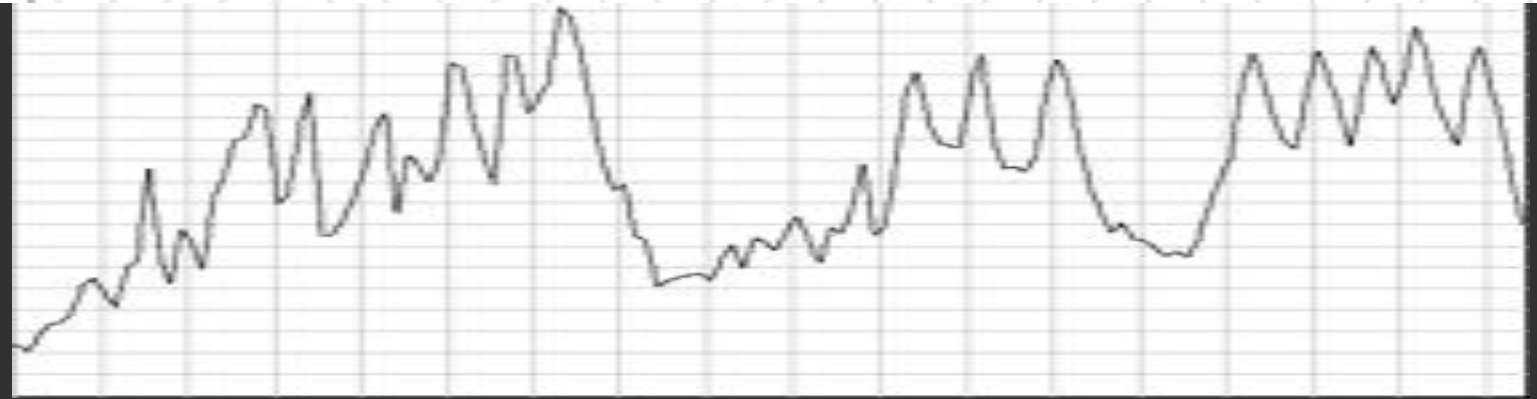


Inadequate KAATSU

Arms 100 SKU

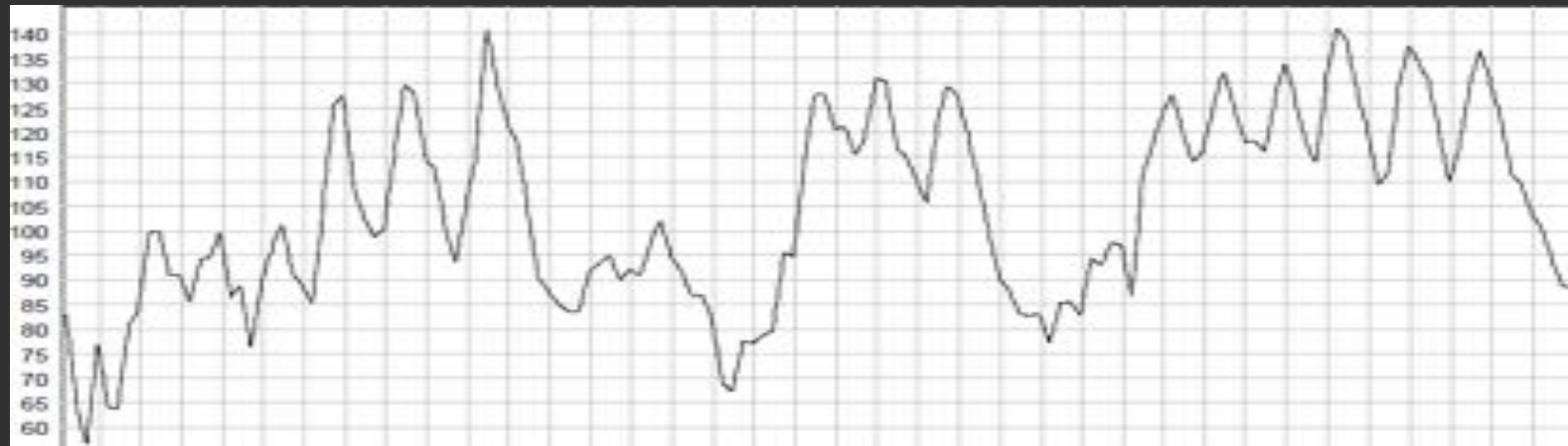
Legs 100 SKU

No exercise to failure



No KAATSU

Just exercises



Ventilation

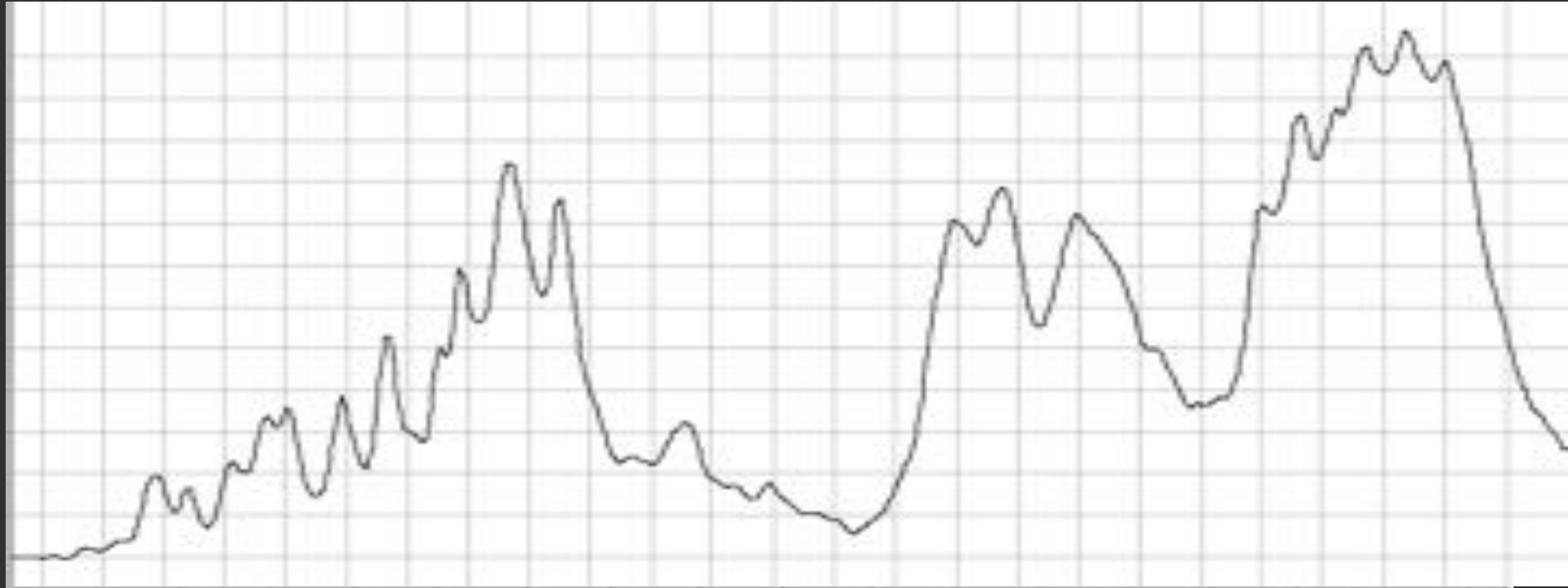
L/min

Real KAATSU

Arms 410 SKU

Legs 460 SKU

All exercises to failure



Inadequate KAATSU

KAATSU

Arms 100 SKU

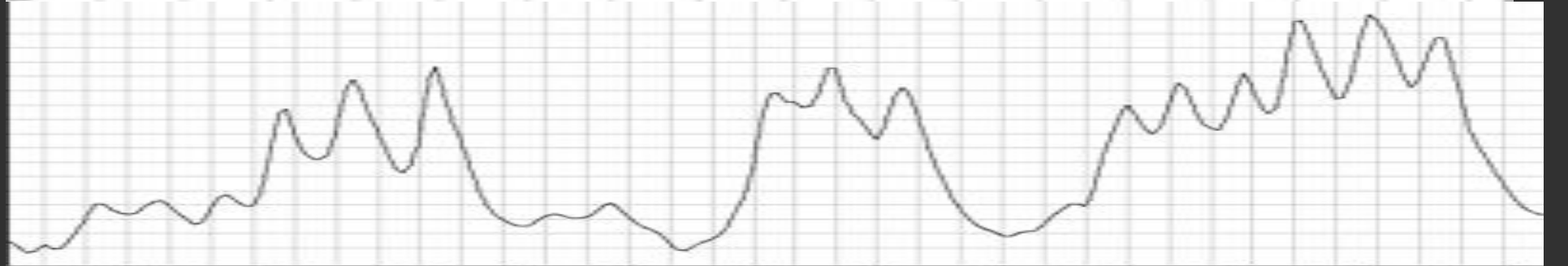
Legs 100 SKU

No exercise to failure



No KAATSU

Just exercises



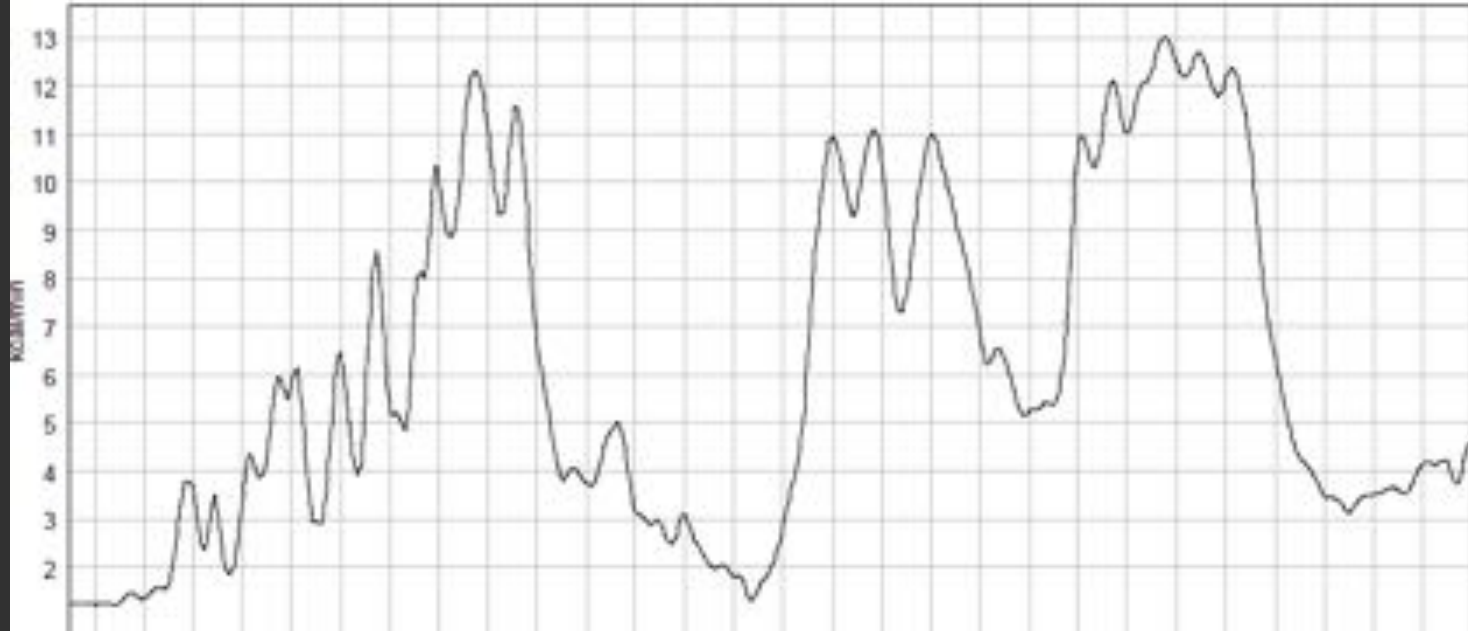
Energy Expenditure (Kcals/min)

Real KAATSU

Arms 410 SKU

Legs 460 SKU

All exercises to failure

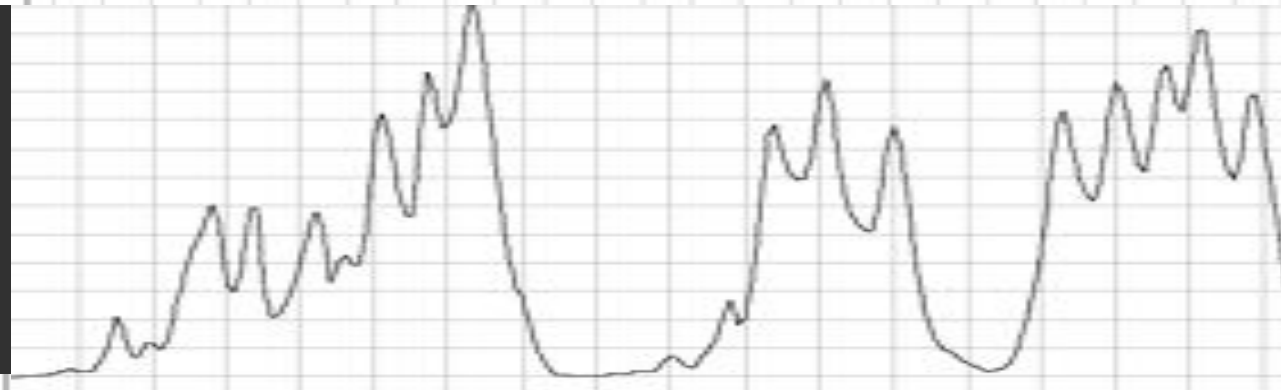


Inadequate KAATSU

Arms 100 SKU

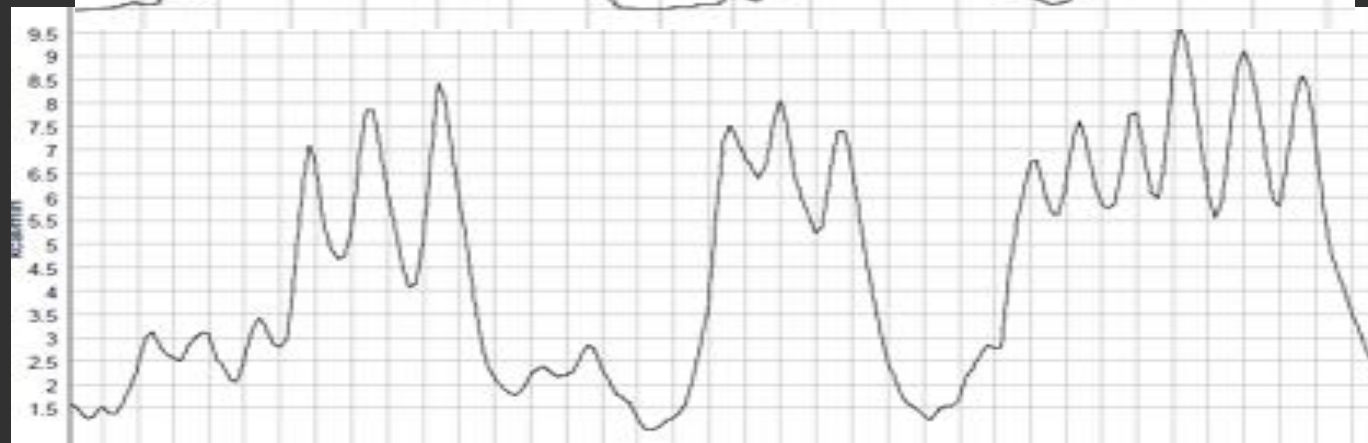
Legs 100 SKU

No exercise to
failure



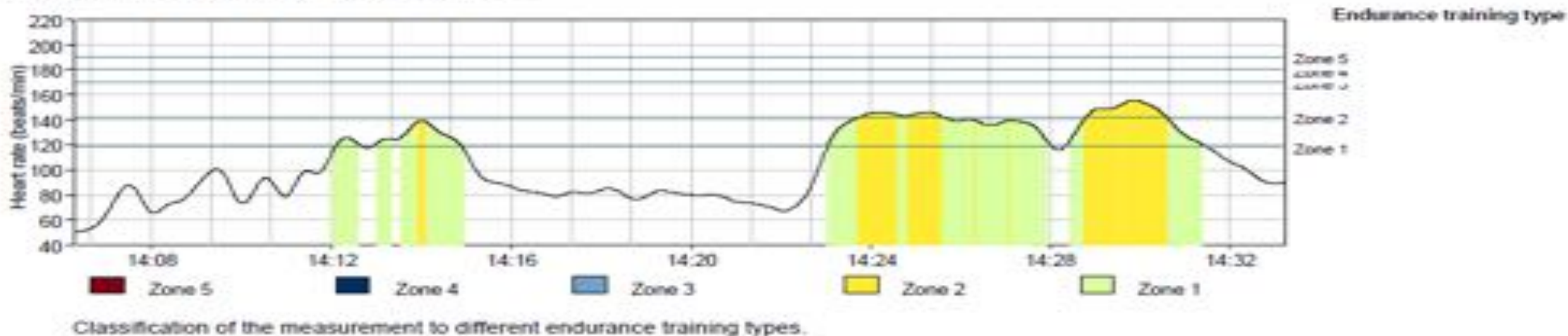
No KAATSU

Just exercises



KAATSU: Training Effect Score 1.6

Endurance Training Classification



Sham KAATSU: Training Effect Score 1.8

Endurance Training Classification



KAATSU CONCLUSIONS

- Incorrect KAATSU is similar to exercise without KAATSU.
- Correct KAATSU has a much greater sympathetic activation than either incorrect KAATSU or exercise without KAATSU.
- Correct KAATSU has a greater increase in heart rate and ventilation than incorrect KAATSU or exercise without KAATSU.
- Correct KAATSU has higher energy expenditure than incorrect KAATSU or exercise without KAATSU.
- Correct KAATSU stimulates a robust autonomic response.

KAATSU IS...

A safe, effective, efficient method for improving specific strength in sport, leading to improved performance on the pitch.

A safe, effective, efficient method to return an injured player back to the pitch quickly.

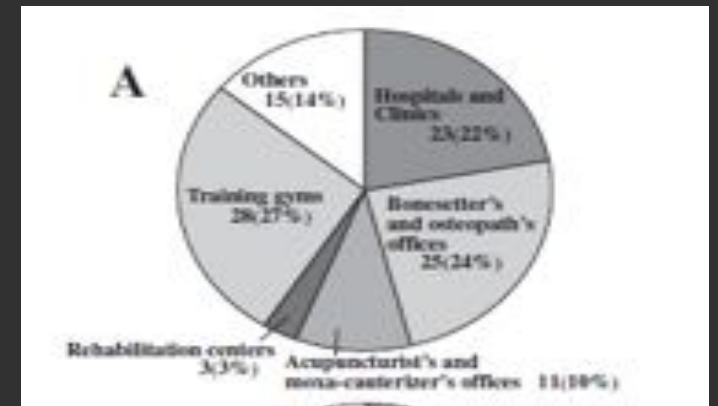
A safe, effective, efficient method for stimulating recovery.

HOW DOES KAATSU WORK?

- By impeding (but not occluding) blood flow, simple easy exercises become unsustainable. This disturbance of homeostasis is transmitted to the brain, which in turn, releases an anabolic/healing neuro-humoral cascade. Since little damage was actually done, improvement in musculo-skeletal structure and function ensues rapidly.

IS KAATSU SAFE?

1. Approximately, 300,000 KAATSU sessions per day for years in Japan. No reports of complications.
2. National Survey
 - a. 6 cases of DVT in 12,642 people undergoing ~32,000 KAATSU sessions.
 - i. 1/100,000 in general population
 - ii. 1/100 in hospitalized population
 - b. 1 case of rhabdomyolysis in ~32,000 KAATSU sessions.



COAGULATION STUDIES

Effects of low-intensity resistance exercise with blood flow restriction on coagulation system in healthy subjects.

[Madarame H¹](#), [Kurano M](#), [Takano H](#), [Iida H](#), [Sato Y](#), [Ohshima H](#), [Abe T](#), [Ishii N](#), [Morita T](#), [Nakajima T](#).

[Clin Physiol Funct Imaging](#). 2010 May;30(3):210-3.

Effects of KAATSU training on haemostasis in healthy subjects

T. Nakajima, H. Takano, M. Kurano, H. Iida, N. Kubota, T. Yasuda, M. Kato, K. Meguro, Y. Sato, Y. Yamazaki, S. Kawashima, H. Ohshima, S. Tachibana, T. Nagata, T. Abe, N. Ishii, T. Morita

IS KAATSU EFFICACIOUS?

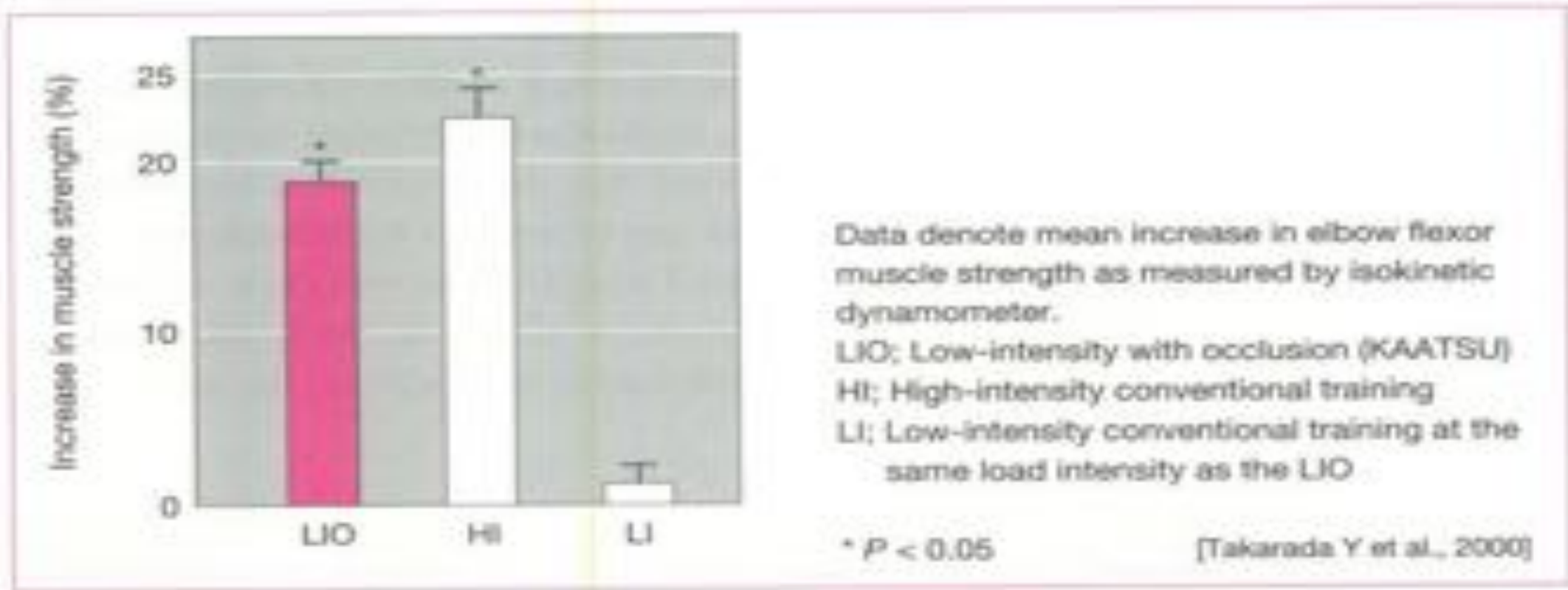


Fig. 4.3 Increase in muscle strength after KAATSU TRAINING on the elbow flexor muscle at 30 - 50% 1RM.

HOW DOES KAATSU WORK?

- By creating an impeded (not occluded) circulation, simple exercise becomes unsustainable.
- This produces 2 local mechanisms of vascular distension/emptying and disturbance of homeostasis in exercising muscle, both which prompt up-regulation of anabolic processes like angiogenesis and muscle hypertrophy.
- These disturbances are communicated to the CNS and the CNS responds by reflex increases in heart rate and ventilation along with initiation of an anabolic neuro-humoral cascade.

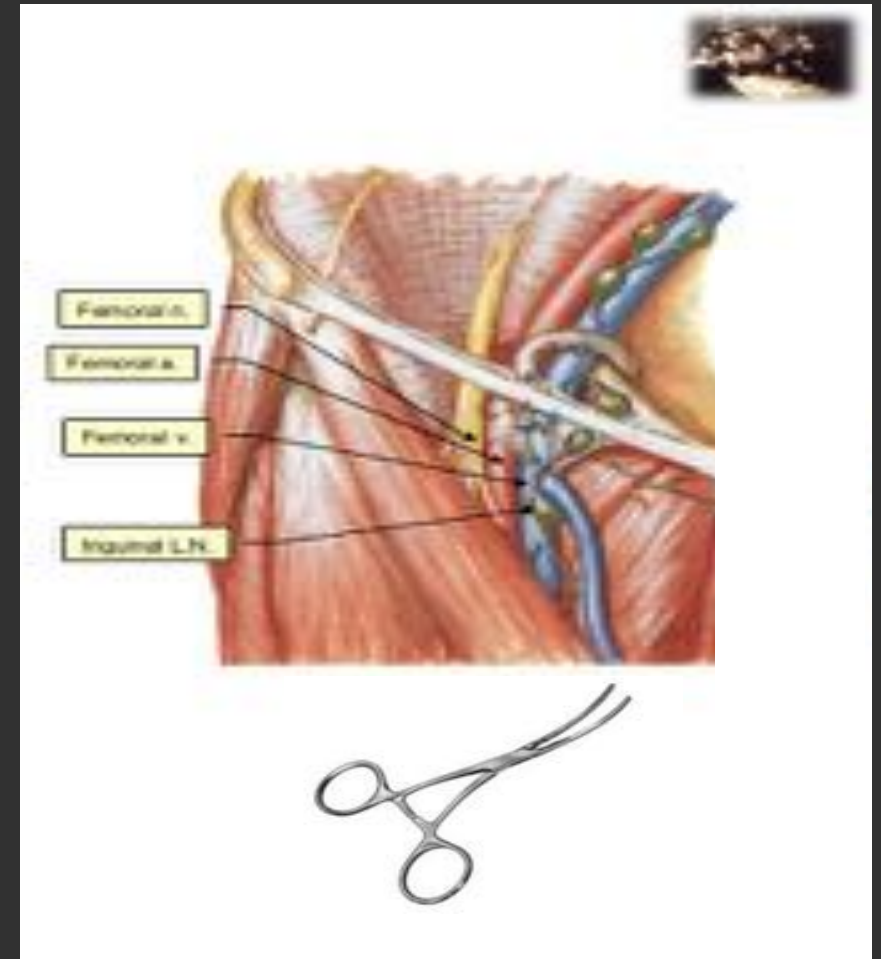
IF THE FEMORAL VEIN WERE CLAMPED...

Femoral venous outflow would stop.

Distal venous channels and capillary beds would dilate and distend.

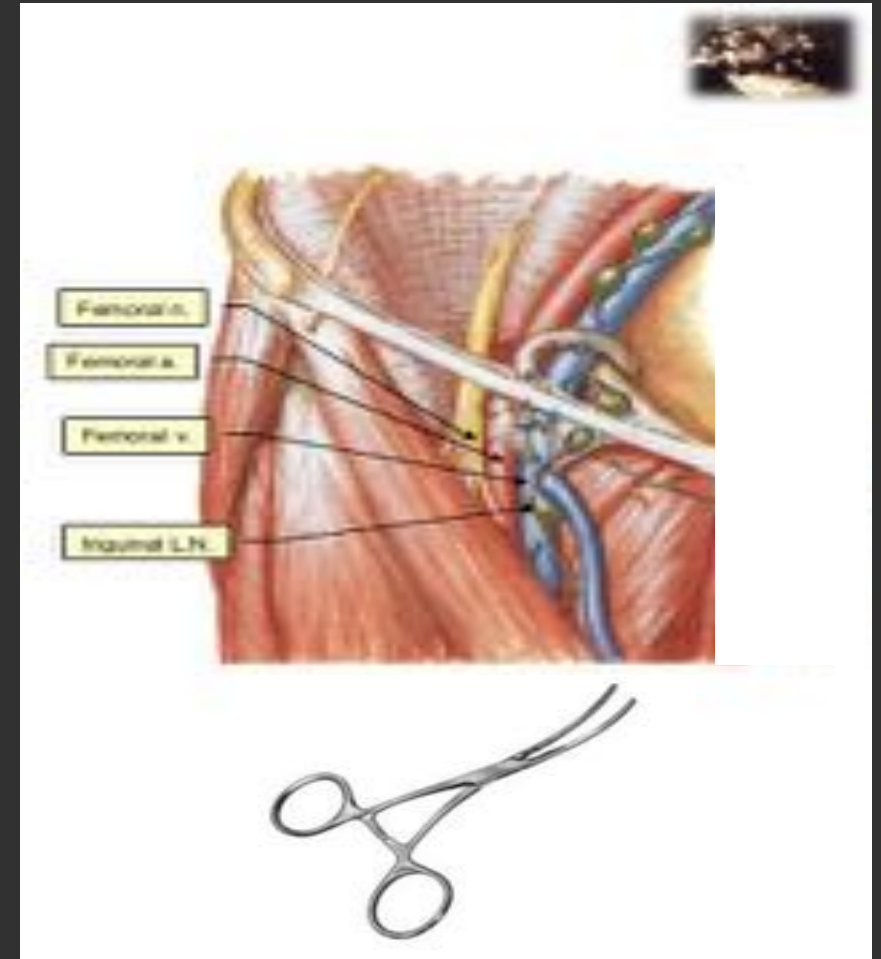
The femoral artery would keep pumping blood into the extremity.

Soon (5-10 seconds), the limit of the outer fascial compartments would be reached and the limb would become congested and swollen. Arterial inflow would slow and eventually stop.



NOW, IF THE CLAMP WERE REMOVED...

- The femoral vein would rapidly empty, returning blood to the heart and collapsing the venous/capillary vessels.
- Arterial inflow to the extremity would resume.
- The extremity would remain maximally vasodilated.



If the clamp were repeatedly applied for 20 seconds and then removed for 5 seconds, an impeded, but pulsatile, venous circulation would be created.

- That is what happens with KAATSU Cycle, only a narrow pneumatic band of air pressure is used.
- The blockage of flow is incomplete and has gradations to it.
- With KAATSU Ai Bands properly applied, an impeded, pulsatile venous circulation is created with the artery pushing blood into the extremity when it can.

PRESSURES OF 300-400 mmHg ARE USED?!?

- Imagine that the pressure of the surgical clamp is infinite. No venous blood gets by it.
- Imagine that the 300mmHg of air pressure in the band is on the outside of the extremity.
- Imagine that blood (a non-compressible liquid) forces itself past the blockage and compresses air in the band.
- Imagine that the band of pressure produced in the band reduces rapidly as it goes deeper into the extremity.
- Imagine that the band pressure starts out somewhat narrower than the cuff and that width narrows as it goes deeper into the extremity.

KAATSU at 300 mmHg
13.1 mls/min

This shows the pulse
of arterial blood and
One can see some
retrograde flow



Here we have
the patent artery
and vein above it

KAATSU PRESSURE HAS LITTLE TO DO WITH USER'S ARTERIAL BLOOD PRESSURE

- KAATSU pressure is applied to the veins and moderates venous outflow.
- Moderating venous outflow eventually modifies arterial inflow.
- Blood flow into an extremity must soon match blood flow out of the extremity. However, there is some capacitance for holding extra blood in the extremity, but once that capacitance is reached, blood flow in must match blood flow out.

MECHANISM AND CHARACTER OF BLOOD FLOW IN AN EXTREMITY WITH KAATSU AIR BANDS

- When a muscle contracts, pressures in that muscle can reach high levels.
- They squeeze any blood in the muscle or vessels in the muscle, back into the major arteries and veins.
- Veins have valves, which causes blood to flow only in one direction, back to the heart.
- With KAATSU, the veins are holding lots of blood and with muscle contraction that blood is squeezed past the pressure blockage of the band.

MECHANISM AND CHARACTER OF BLOOD FLOW IN AN EXTREMITY WITH KAATSU AIR BANDS

- Sometimes, if the pressure differentials are in favor of this, when the muscle contracts, in addition to robust venous outflow, there is retrograde arterial flow.
- With KAATSU Training, and muscle contraction happening every 1-2 seconds, an impeded, pulsatile blood flow in the extremity is established.

MECHANISM AND CHARACTER OF BLOOD FLOW IN AN EXTREMITY WITH KAATSU AIR BANDS

- With KAATSU Cycle (pressure on and off with no exercise), band inflation occurring every 20-60 seconds, followed by deflation for 5-20 seconds, similarly, an impeded, pulsatile circulation is established, including an distended vasculature distal to the band, followed by an emptying of the capillaries and veins.

KAATSU VS. TOURNIQUETS, ELASTIC BANDS

- It has taken Dr. Sato, over 30 years to find just the right way to produce this impeded circulation in a safe, controlled and reliable way.
- This is why the KAATSU equipment is necessary to produce and monitor this impaired circulation.
- Other methods and equipment are not capable of reproducibly creating these conditions.

KAATSU EXERCISE LEADS TO A 'DISTURBANCE OF HOMEOSTASIS IN WORKING MUSCLE

- When light, easy exercises are added to this impeded circulation, the exercise quickly becomes unsustainable.
- pO_2 , pH, drop to critical levels with even mild exercise (e.g., unweighted arm curls).
- High levels of lactate are generated.
- ATP levels drop, as ADP and P_i levels rise.
- ATP dependant Electrolyte pumps (e.g. Ca^{++}) can not maintain proper electrolyte gradients.

MECHANISMS OF KAATSU

- **Local vascular mechanism:** There is alternating distension and emptying of the venous/capillary vascular space.
- **Local muscle mechanism:** There is “disturbance of homeostasis” in the muscle. These disturbances are communicated to the CNS.
- **Systemic mechanism:** The CNS reflex stimulates cardiovascular responses and releases an anabolic neuro-humoral cascade.

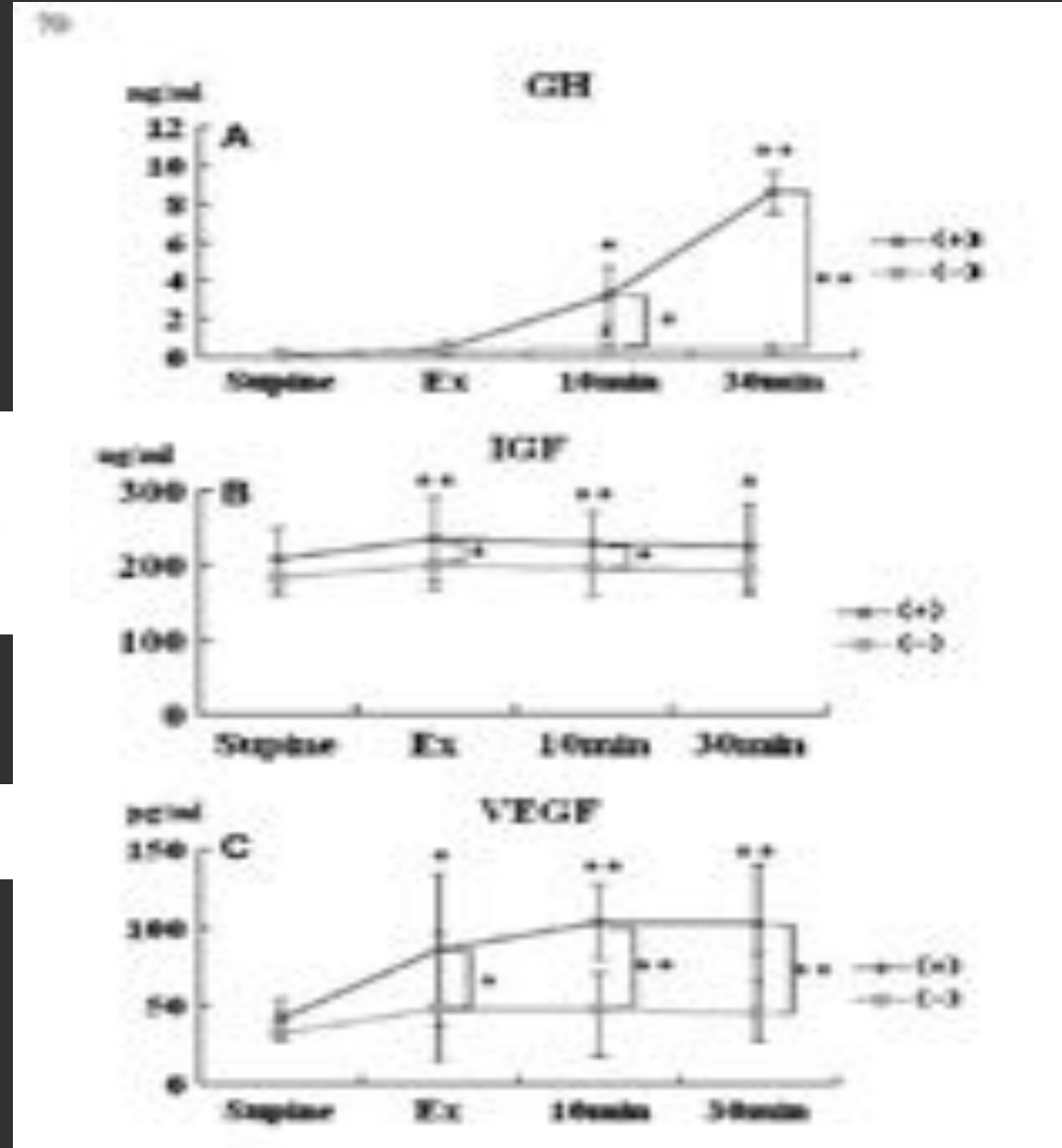
THE CNS REACTS

- There is a reflex initiation of a neuro-humoral-immuno anabolic/healing/adaptation cascade.
- All vascular tissues that have had this distension/emptying flow characteristics stimulate an angiogenic response.
- All muscular-tendon-bone units that have been exercising enjoy an anabolic growth response.
- Any current injuries are augmented/aided/accelerated by the healing, anabolic milieu.

Hemodynamic and hormonal responses to a short-term, low intensity, resistance exercise with the reduction of muscle blood flow

Haruhito Takano · Toshihiro Morita · Haruko Iida
Ken-ichi Asada · Masayoshi Kato · Kansei Uno
Ken Hirose · Akihiro Matsumoto · Katsu Takenaka
Yasunobu Hirata · Fumio Eto · Ryozo Nagai
Yoshiaki Sato · Toshiaki Nakajima

Eur J Appl Physiol (2005) 95: 65–73



CONCLUSION OF CASE REPORTS

- In all 3 cases, KAATSU Cycle and KAATSU Training were the primary and critical rehabilitation tool in returning these elite athletes to their sport.
- In all 3 cases, the athletes were competing much earlier than expected.
- In all 3 cases, the whole athlete was re-conditioned for the demands of their sport, with minimal loss of fitness.

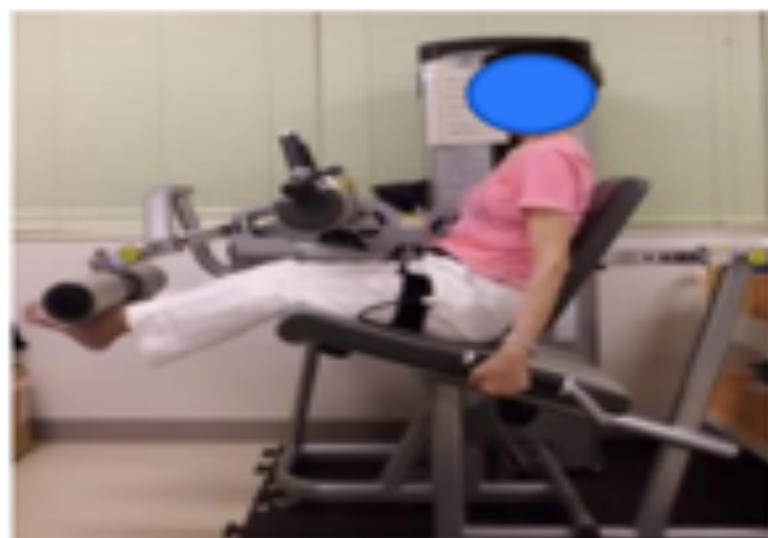
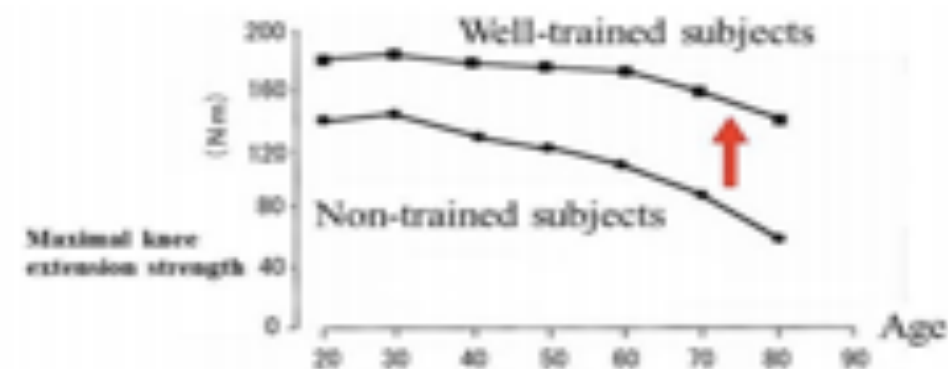
CONCLUSIONS

- KAATSU is safe, when proper equipment is used and KAATSU protocols are properly applied.
- KAATSU is efficacious at:
 - Building strength with short workouts (30 minutes) and in as few as 10 sessions.
 - Improving performance where specific strength is a critical parameter
- KAATSU accelerates return to sport.

CONCLUSIONS

- KAATSU simply tricks the brain into thinking a huge, horrendous workout has occurred and it must repair the damage, where in reality, little damage has been done and rebuilding just makes structure and function better rapidly.
- KAATSU allows significant maximal intensity training while injured joints, bones, and muscles heal expeditiously.

Sarcopenia, the loss of muscle mass, is an important problem in the older population.



Muscle strength is decreased with age.

Muscle volume is quickly decreased **0.45 Kg/year** at ages >50 years old.

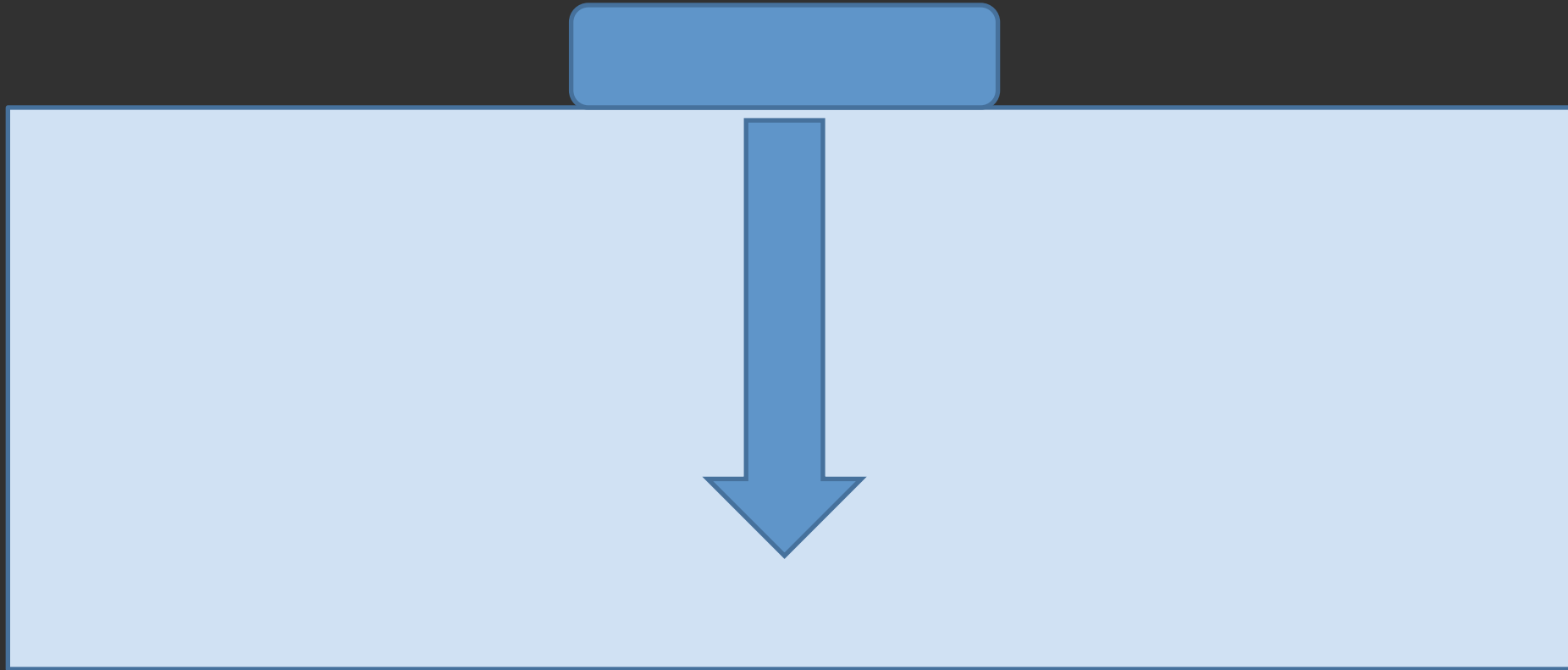
(1%/day in space, 0.6%/day bed rest).

Especially, fast twitch fiber decreased to 50% by 80 years old.

To prevent it, high-intensity resistance exercise is usually required, but it cannot be performed in the elderly people.

In this symposium, I present our recent data of KAATSU training in elderly persons and basic researches using rat KAATSU model.

KAATSU Contraindications & Complications



KAATSU Air Bands are safe because the narrow width makes it hard to pressurize at the core. Unlike Blood Pressure Cuffs, the KAATSU Air Band pressure becomes significantly less as it goes deeper into the limb. The pressure is narrower than the band and that width narrows as it goes deeper into the limb. Therefore, it is easy to apply pressure to frail limbs.

KAATSU Contraindications & Complications

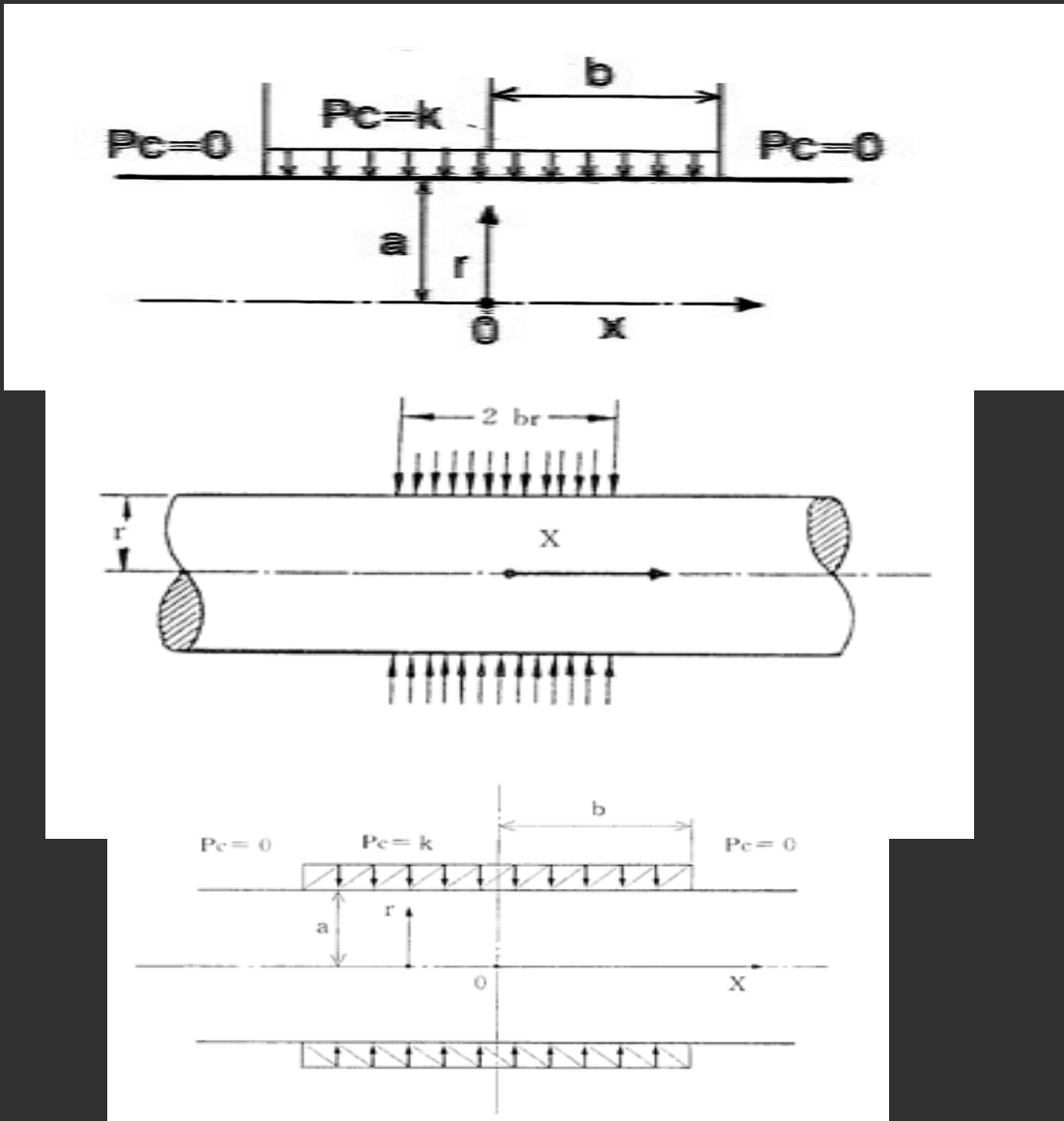


図3 上腕の円筒形モデル

Fig. 3 Cylindrical model for upper arm

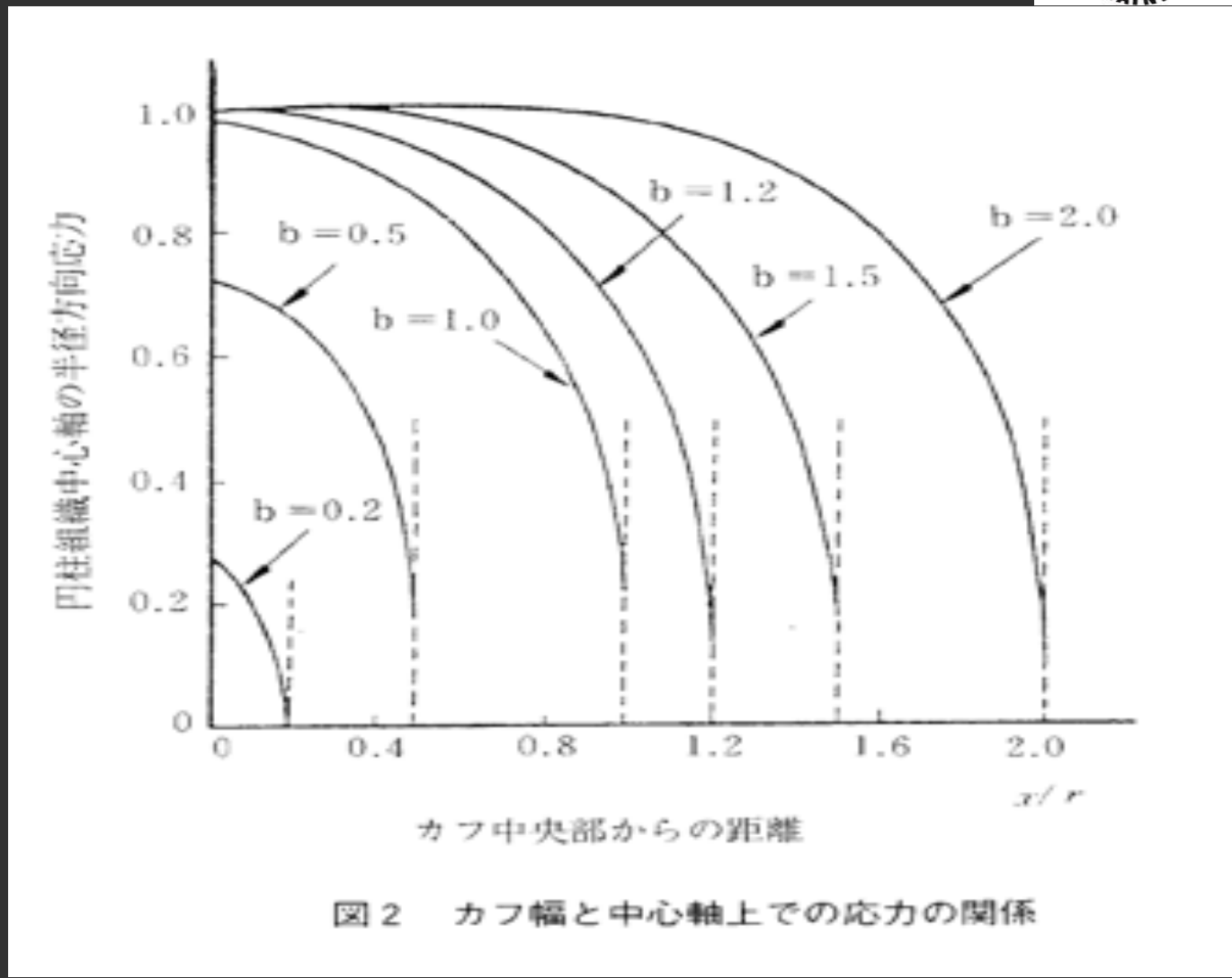


図2 カフ幅と中心軸上での応力の関係

Fig 2 Stress relations between cuff's width and center axis

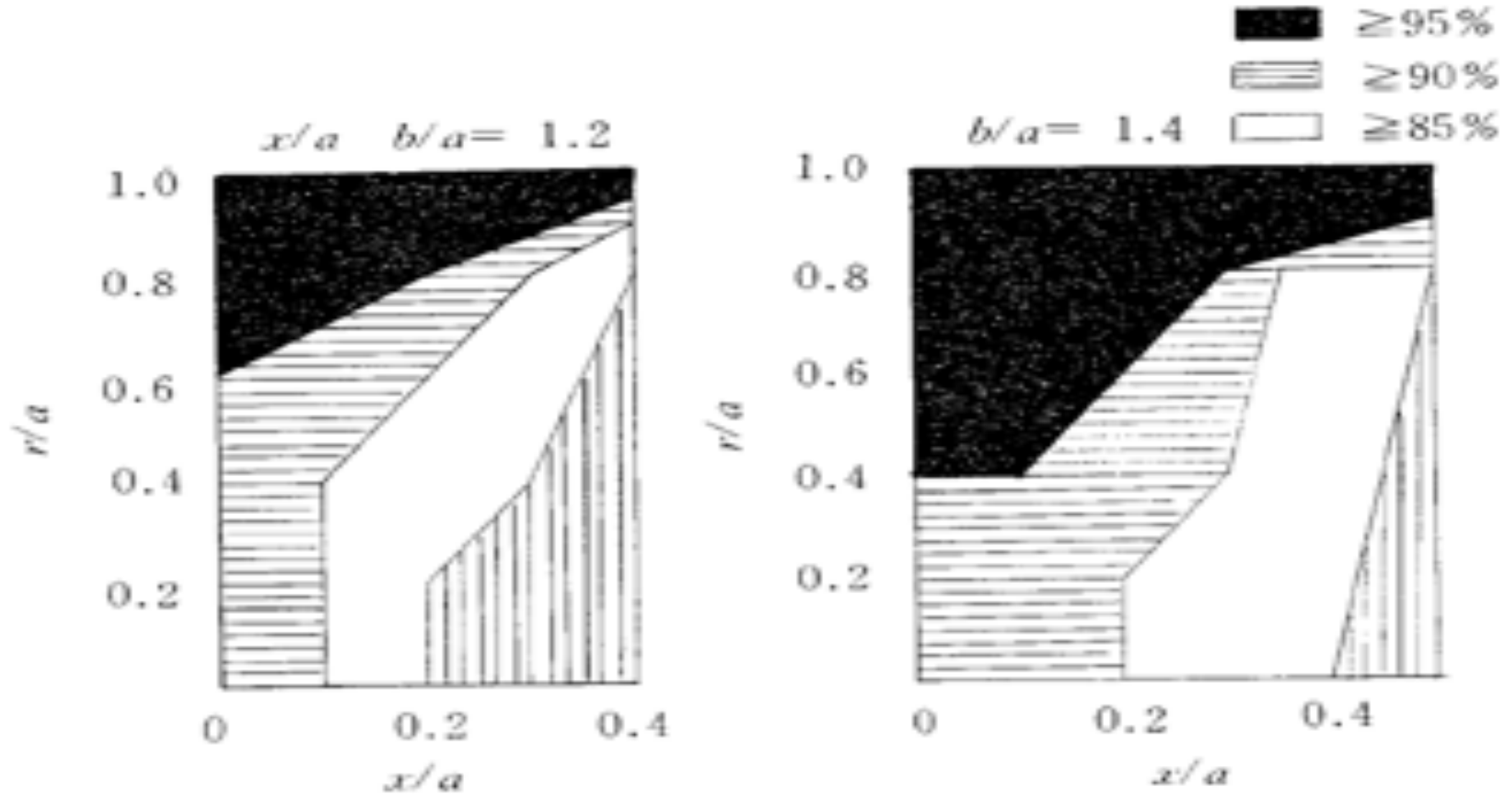
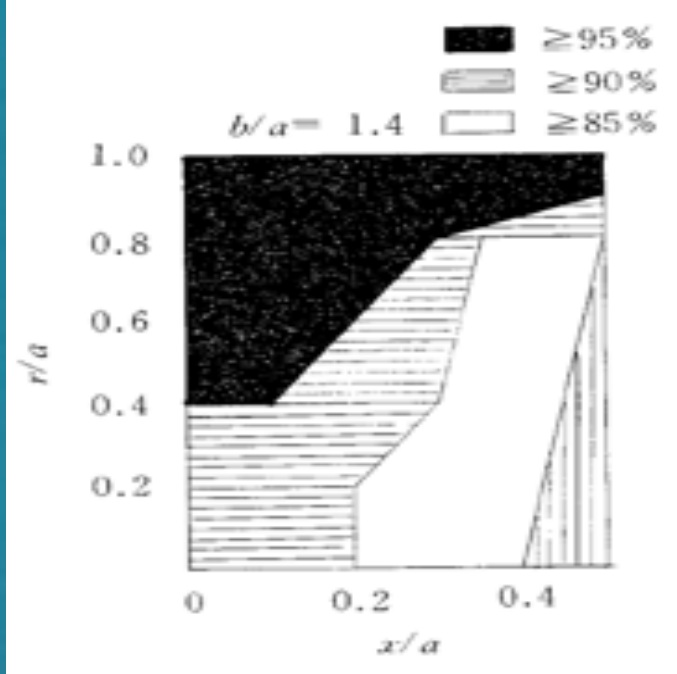
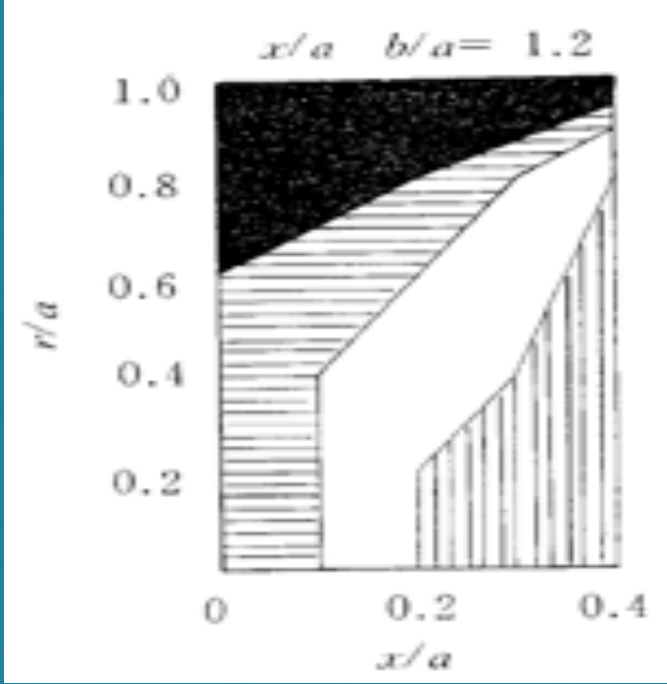
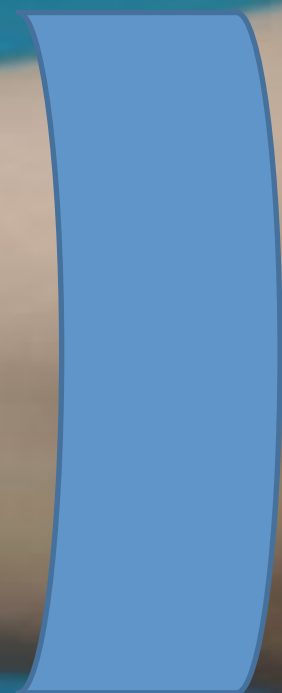
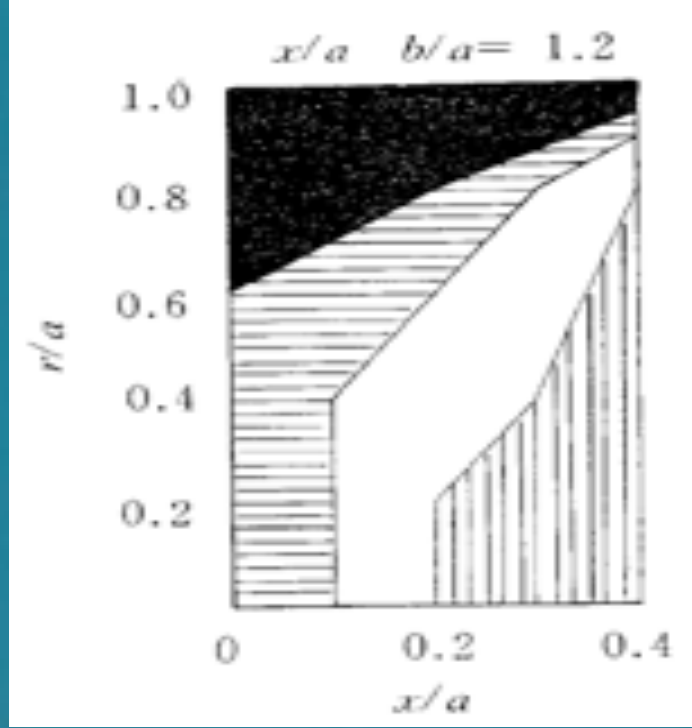


図5 カフ圧力伝達領域

Fig. 5 Cuff pressure transmission region

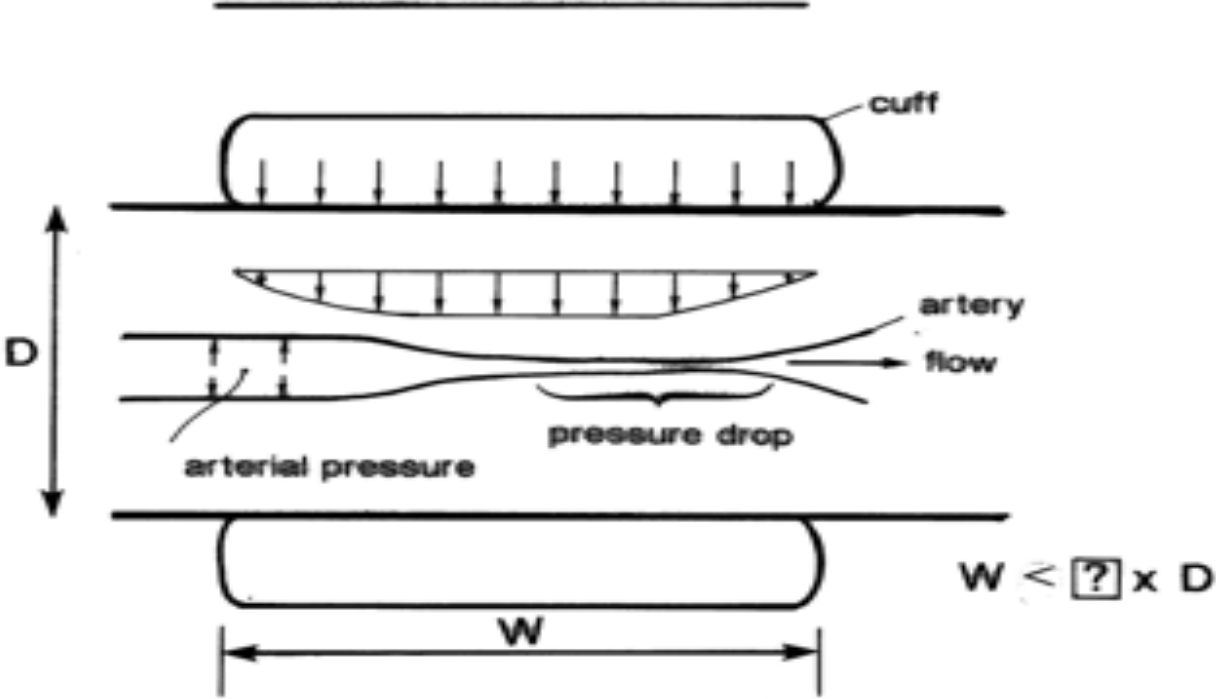




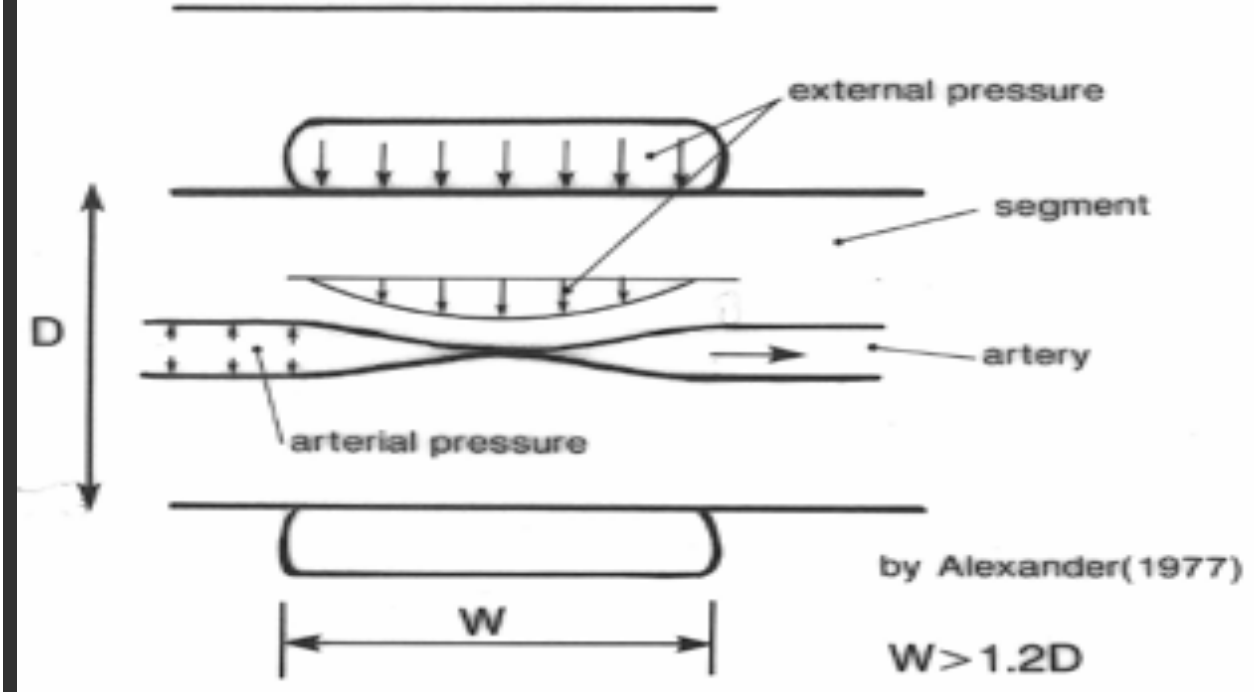


KAATSU Contraindications & Complications

Large-cuff effect

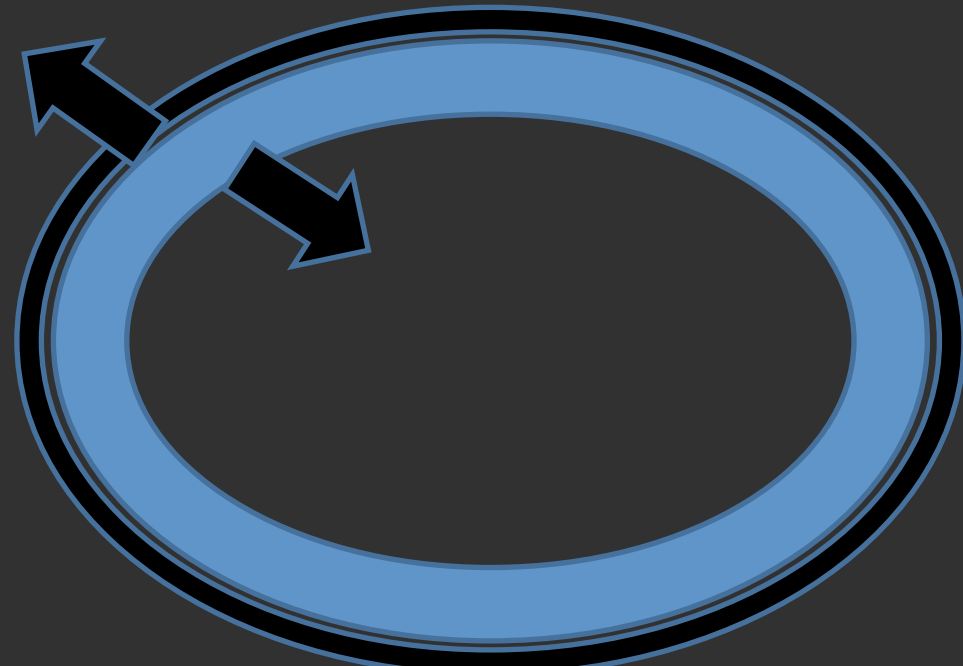
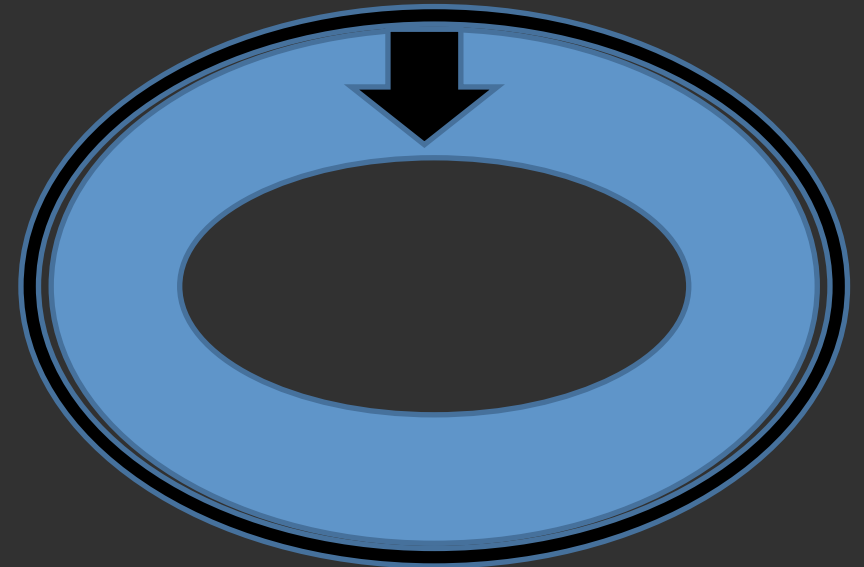


Small-cuff effect



KAATSU Contraindications & Complications

2. KAATSU Bands and Blood Pressure Cuff Elasticity Difference

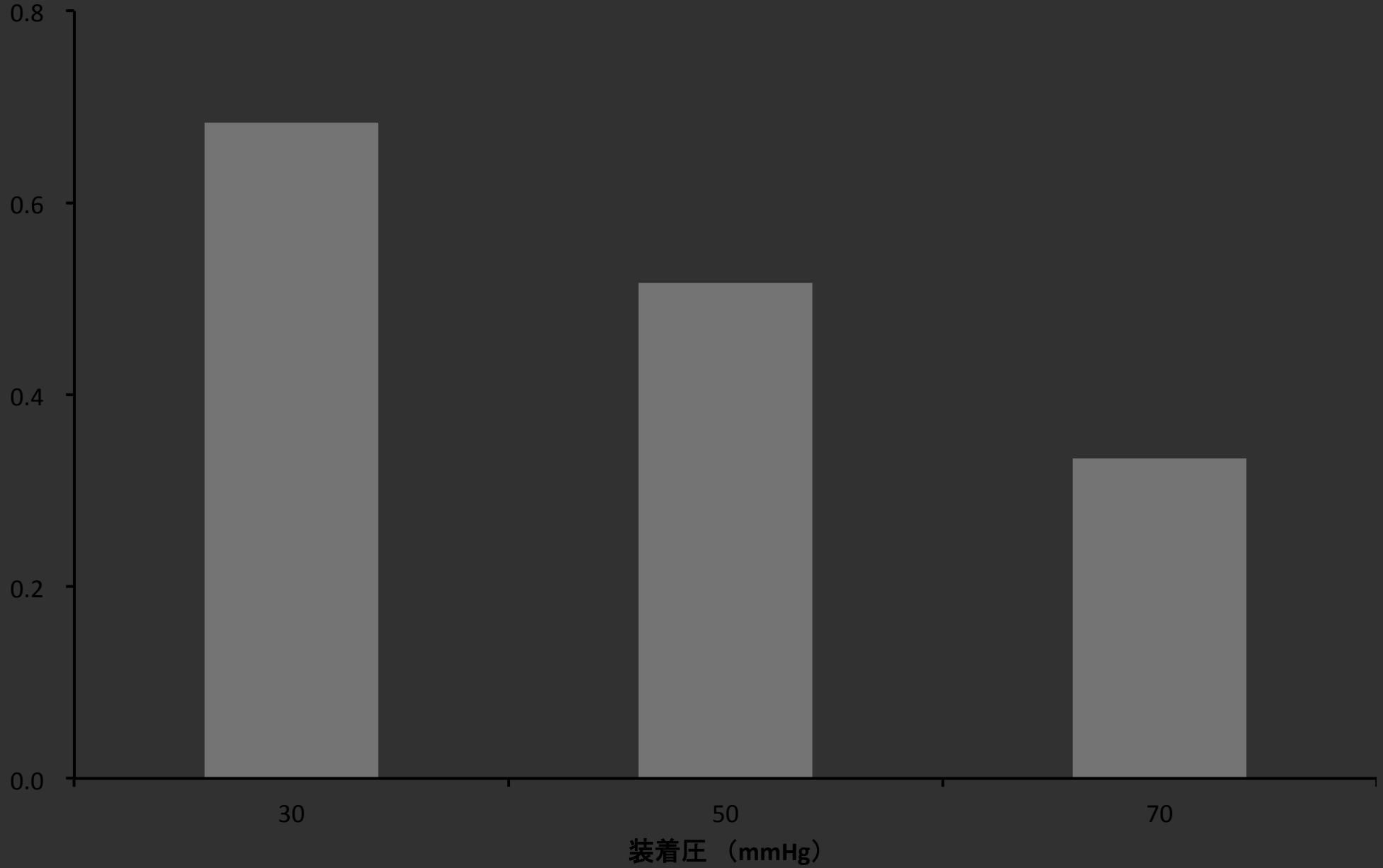


KAATSU Contraindications & Complications



Circumference
stretching

周囲径の伸び (cm)



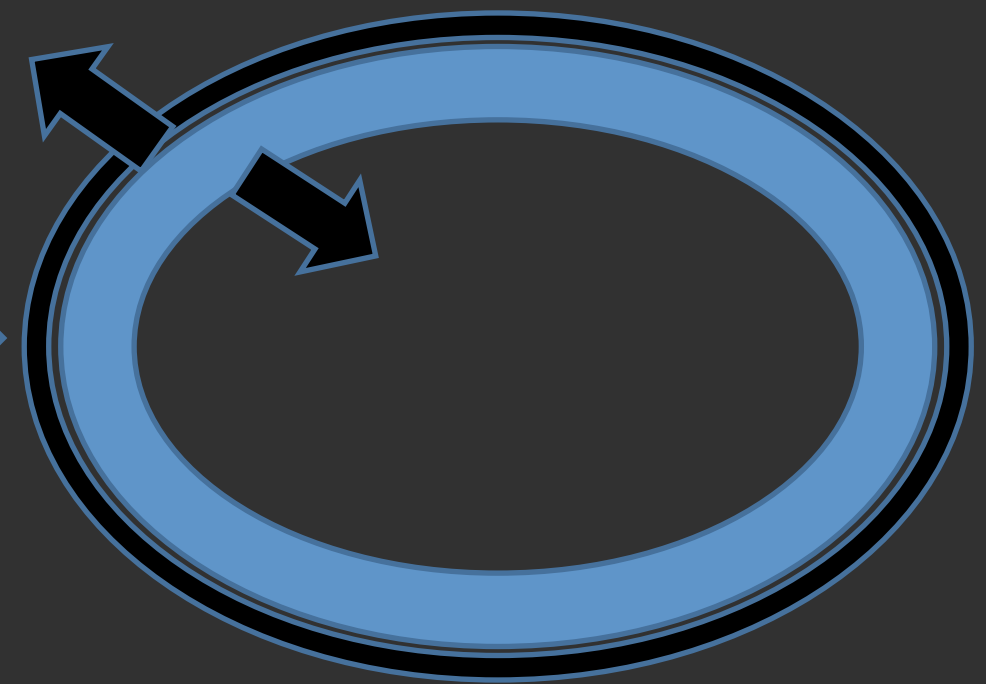
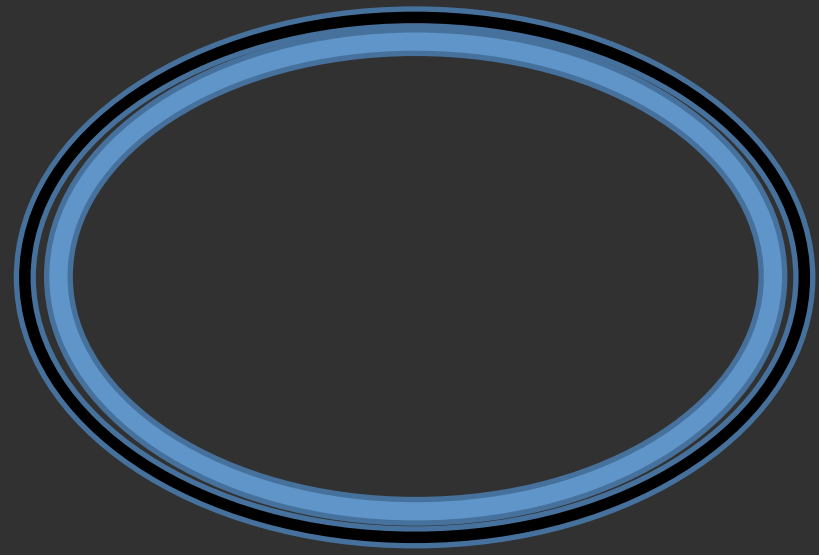
Pressure (mmHg)

装着圧 (mmHg)

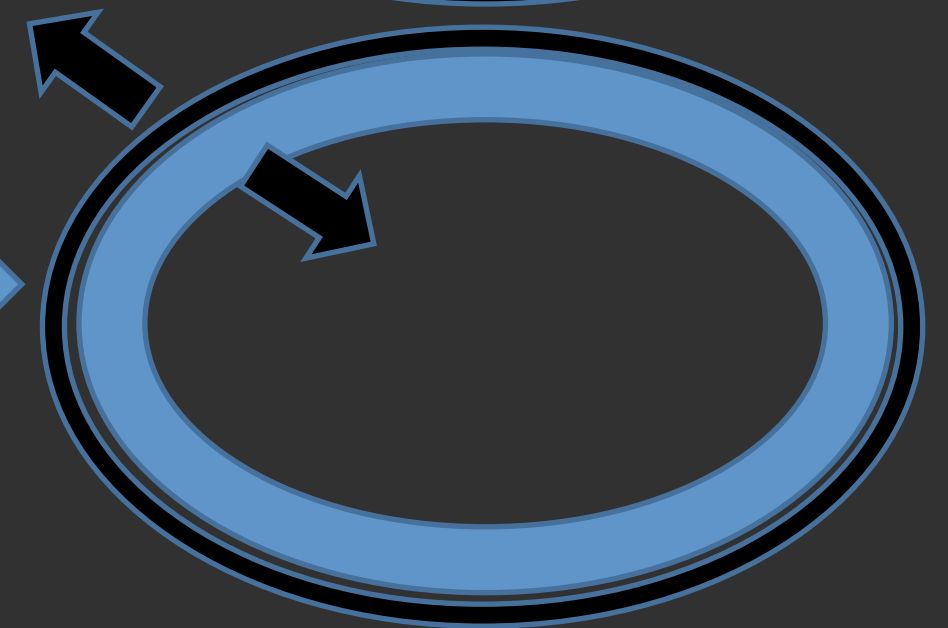
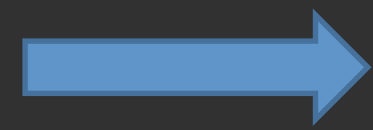
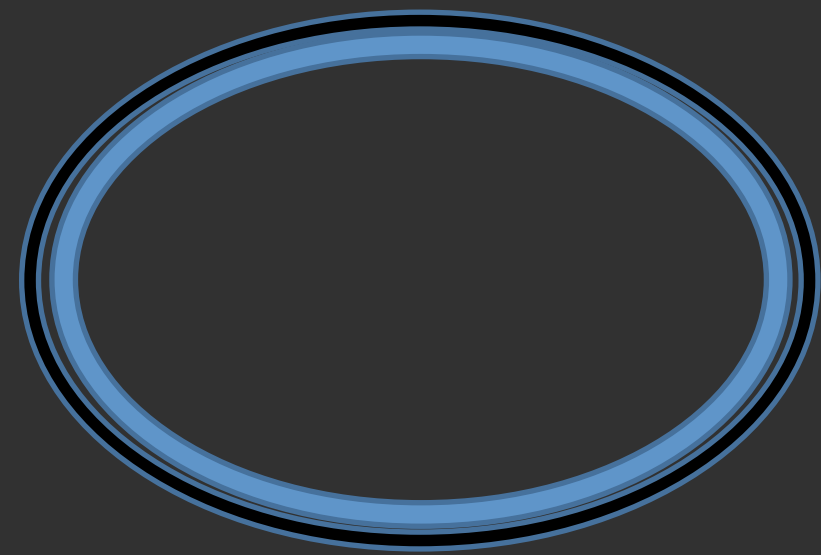
KAATSU Contraindications & Complications

Outer pressure on KAATSU Air Bands

low



high

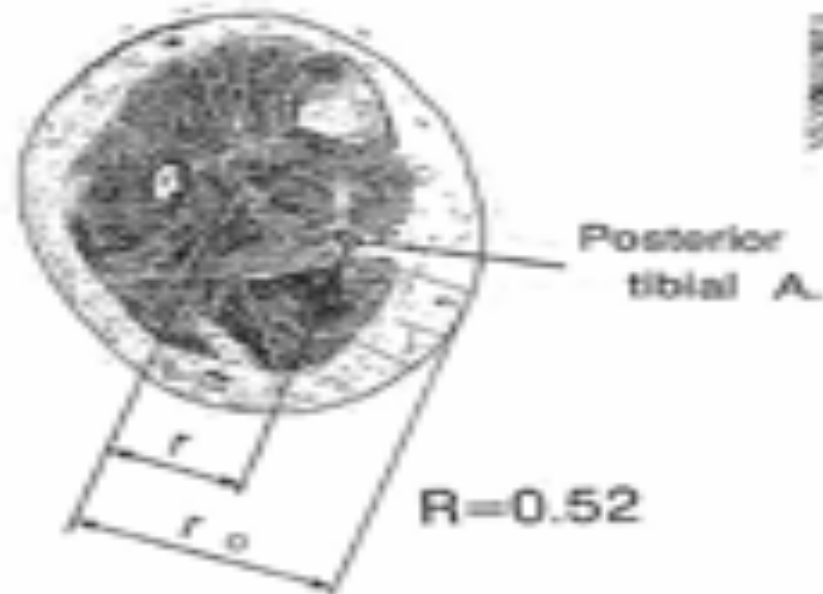
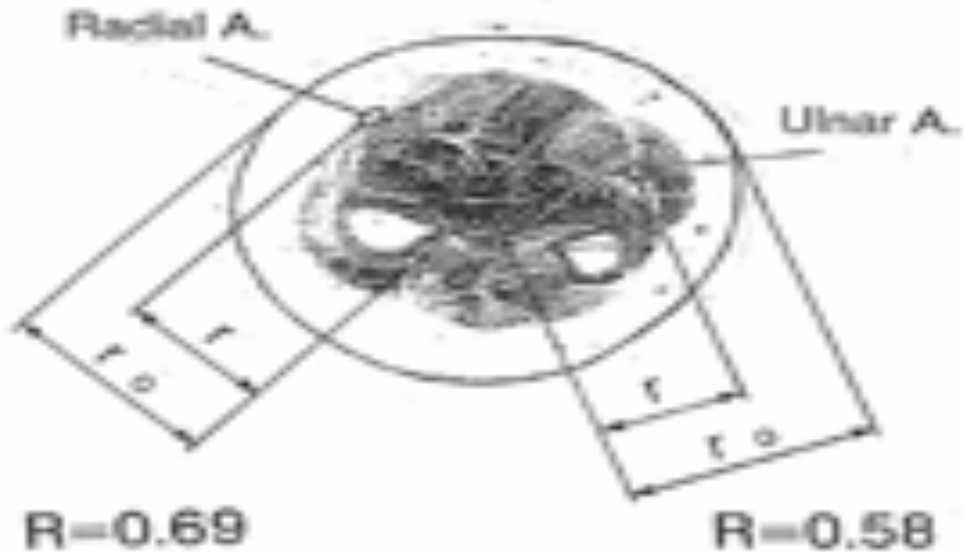
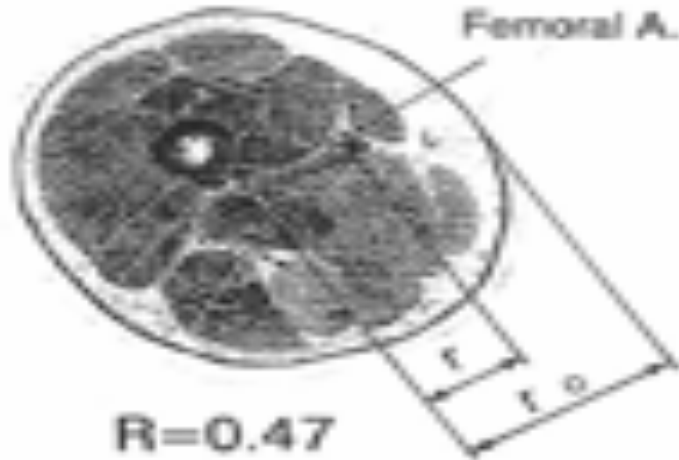
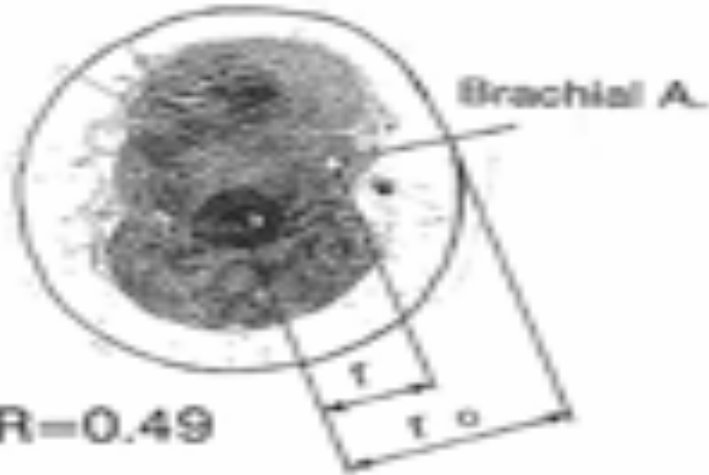


KAATSU Contraindications & Complications

Arms

Legs

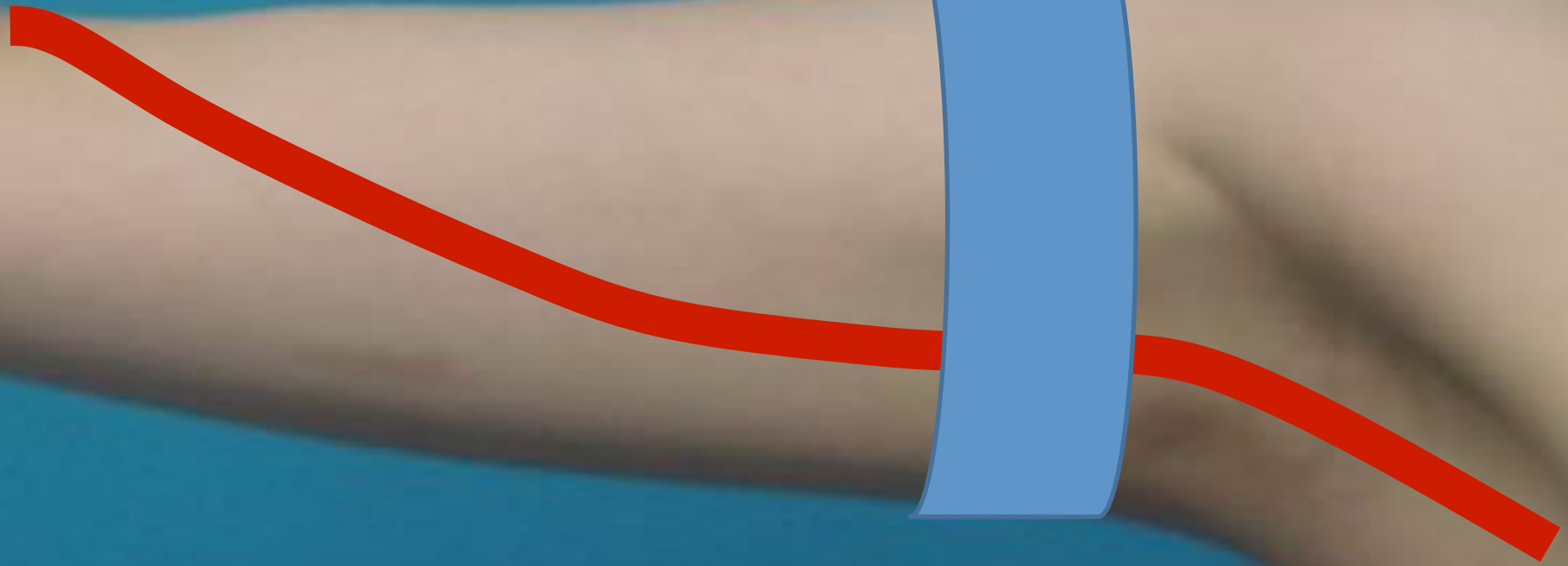
Digital A.



$R=0.50 \sim 0.65$

$$R = \frac{r}{r_0}$$

Artery

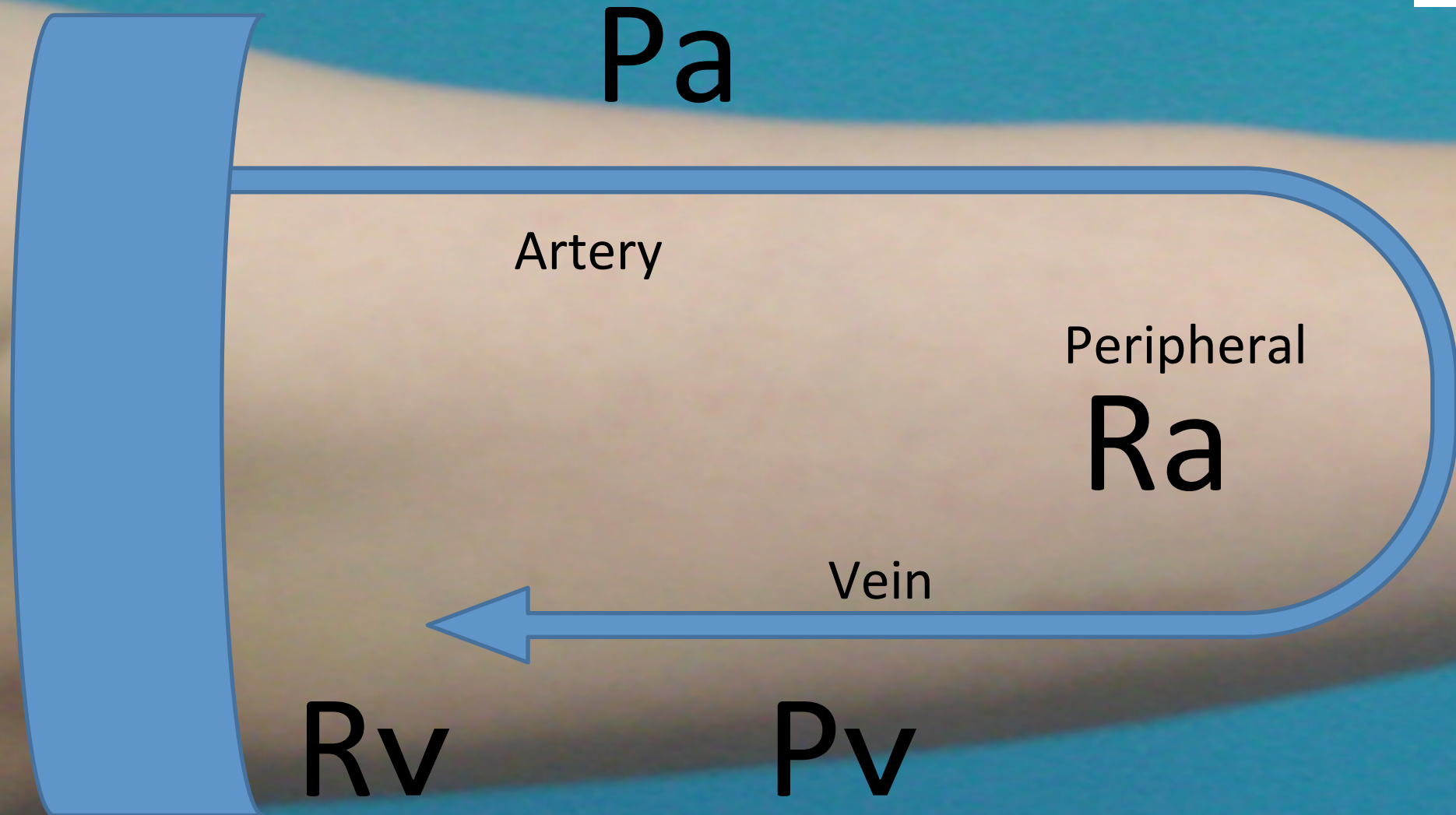


P (Pressure)

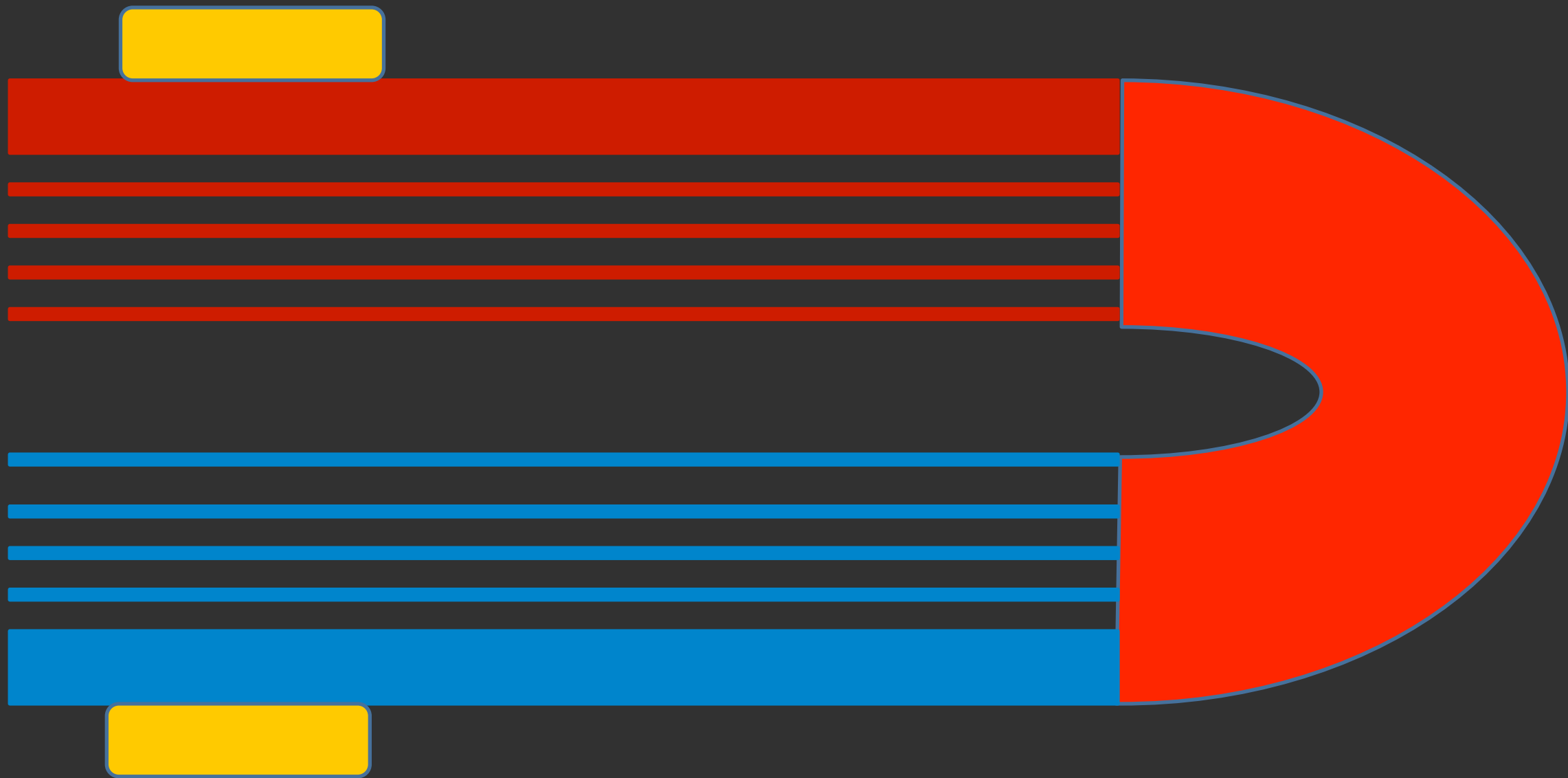
R (Vascular Resistance)

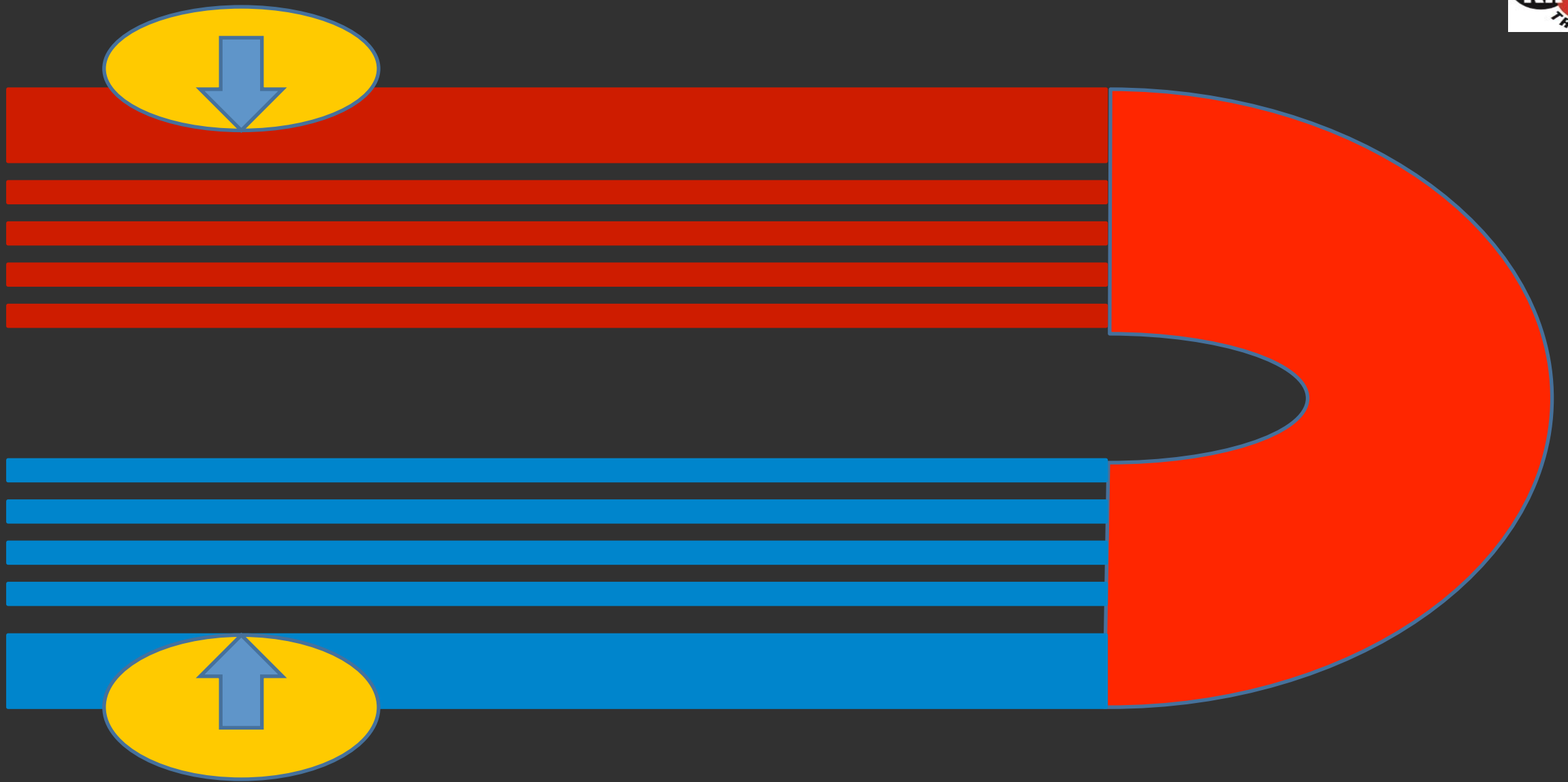
Q (Blood Flow)

A diagram of a blue blood vessel. A horizontal line on the left transitions into a U-shaped loop on the right, which then returns to a horizontal line on the left. The text 'P (Pressure)' is positioned above the top horizontal section, 'R (Vascular Resistance)' is centered within the loop, and 'Q (Blood Flow)' is positioned below the bottom horizontal section. A blue arrow points to the left from the bottom horizontal section.
$$\text{Pressure (P)} = \text{Blood flow (Q)} \times \text{Peripheral resistance (R)}$$

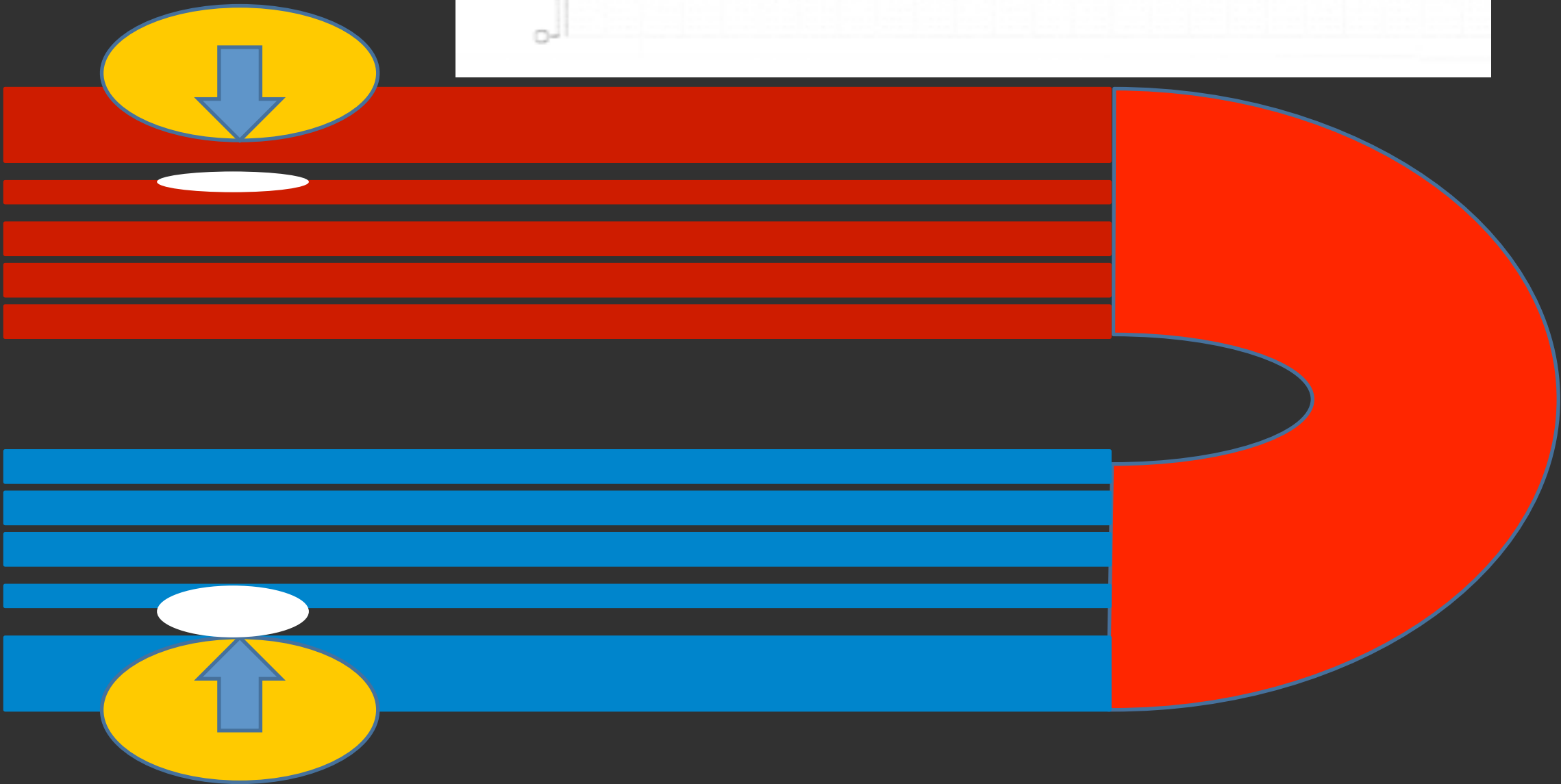
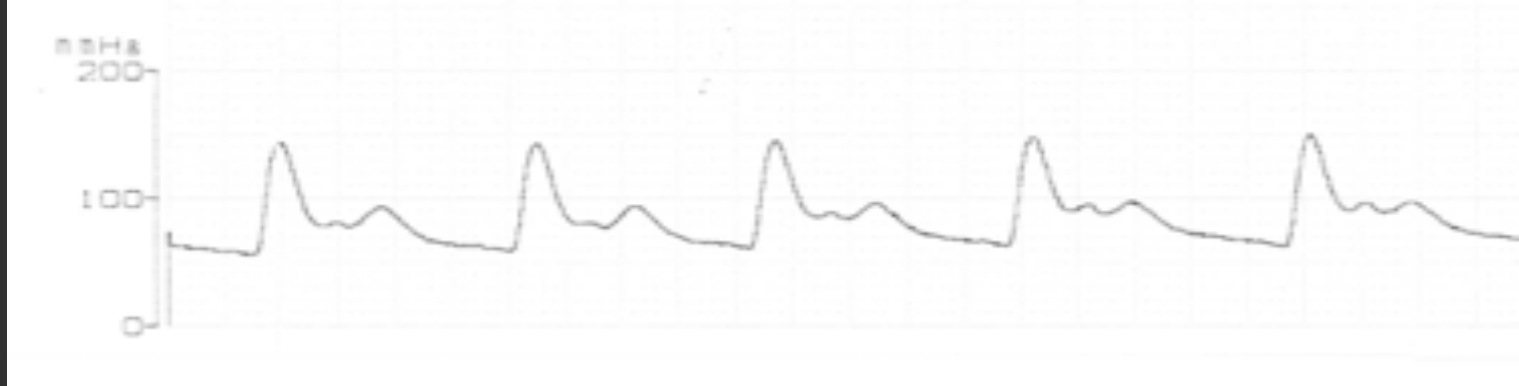


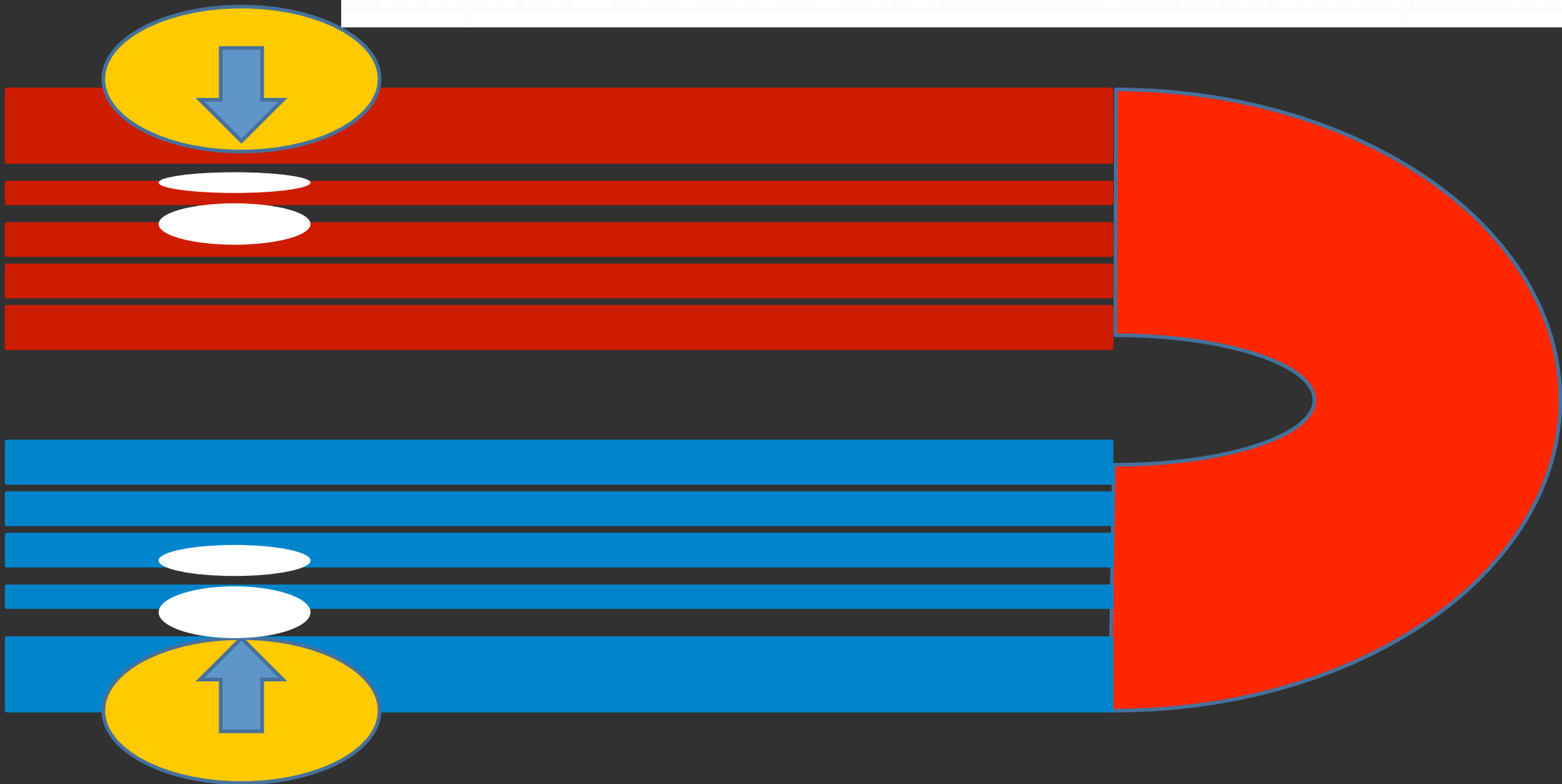
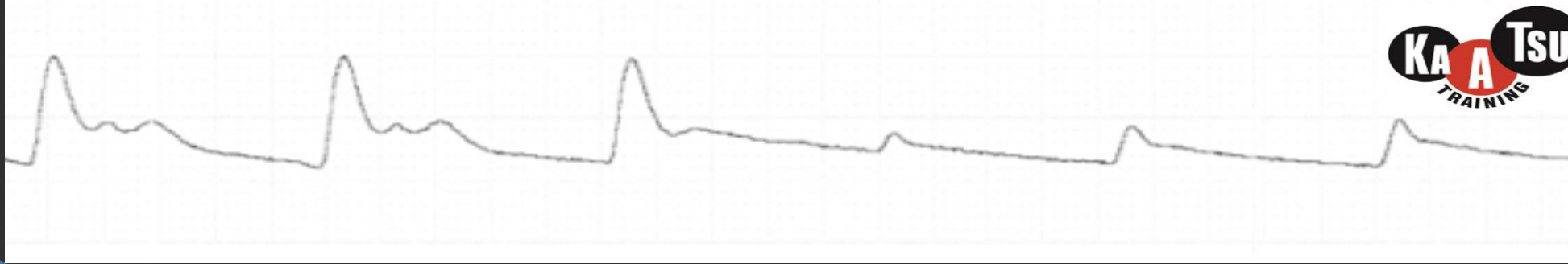
$$Q = \frac{P_a - P_v}{R_a + R_v} \times k \quad \text{K is a fixed number}$$

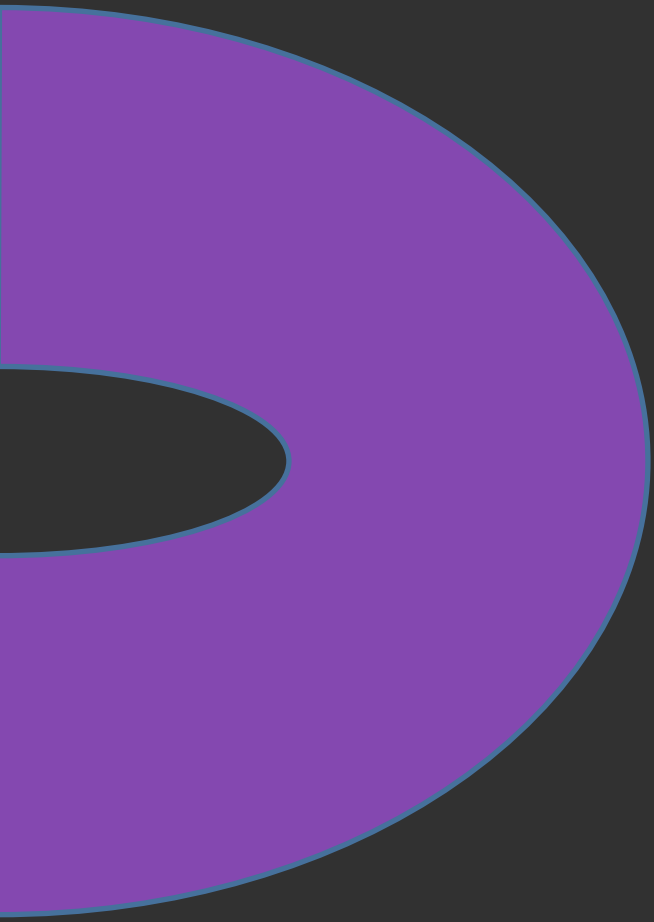
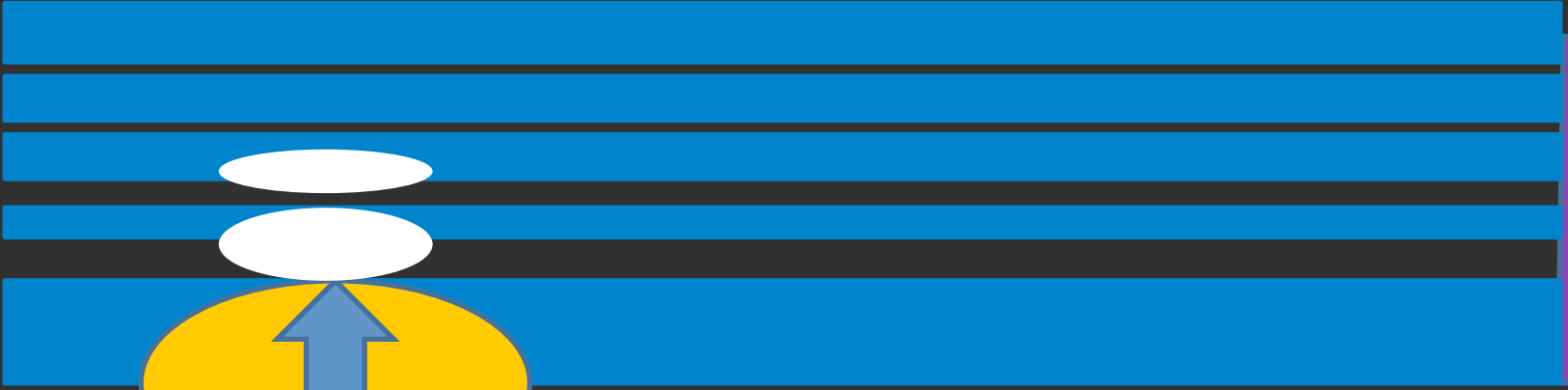
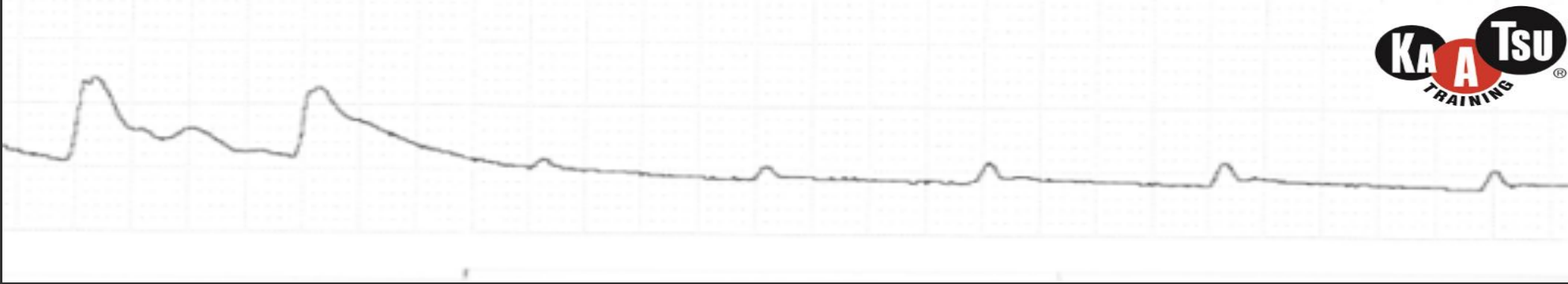


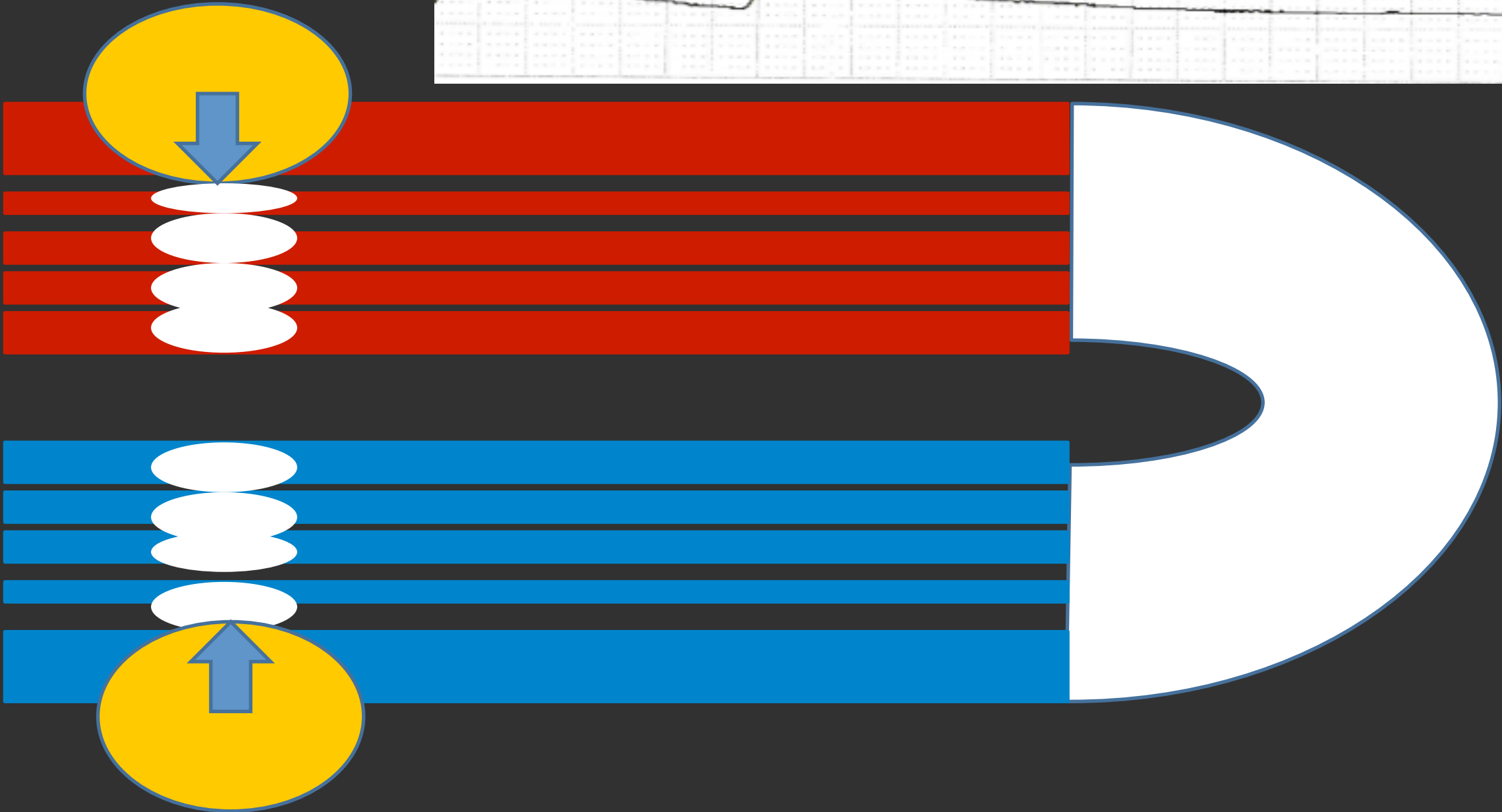
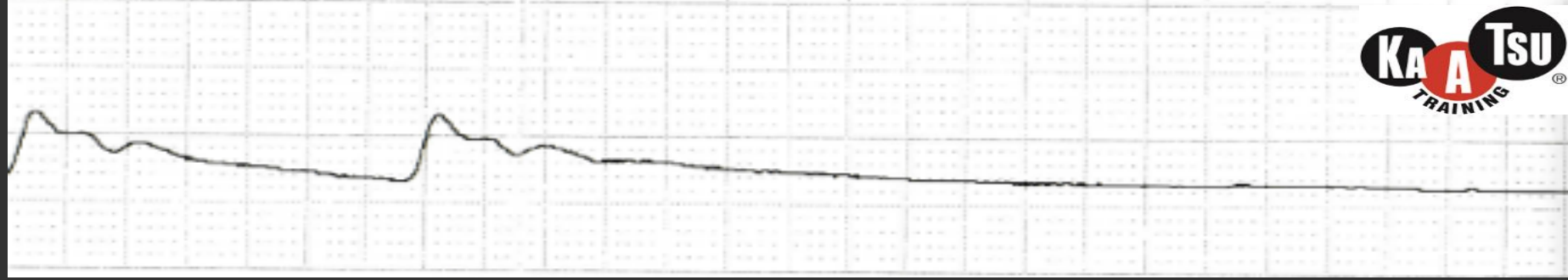


Those veins that are close to the surface are easy to occlude even with low pressure. That is why the blood flow of deeper veins increases.









Question. Why does SKU pressure increase as you continue KAATSU?

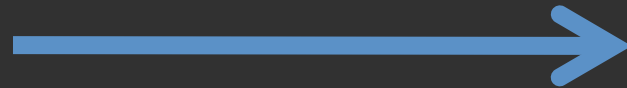
If you continue KAATSU Training, frail arteries and veins in the deep sections of your limbs starts expanding



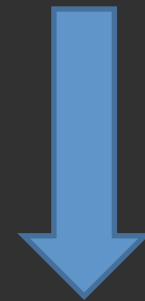
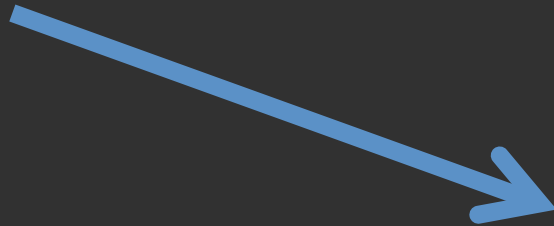
Vascular resistance is reduced and blood flow is increased.

Vasovagal reflex

Stimulations caused by stress, strong pain, excretion and abdominal internal organs disease and such.



Drop in heart rate
Vasodilation
Drop in blood pressure



Unpleasant feeling

KAATSU Contraindications & Complications

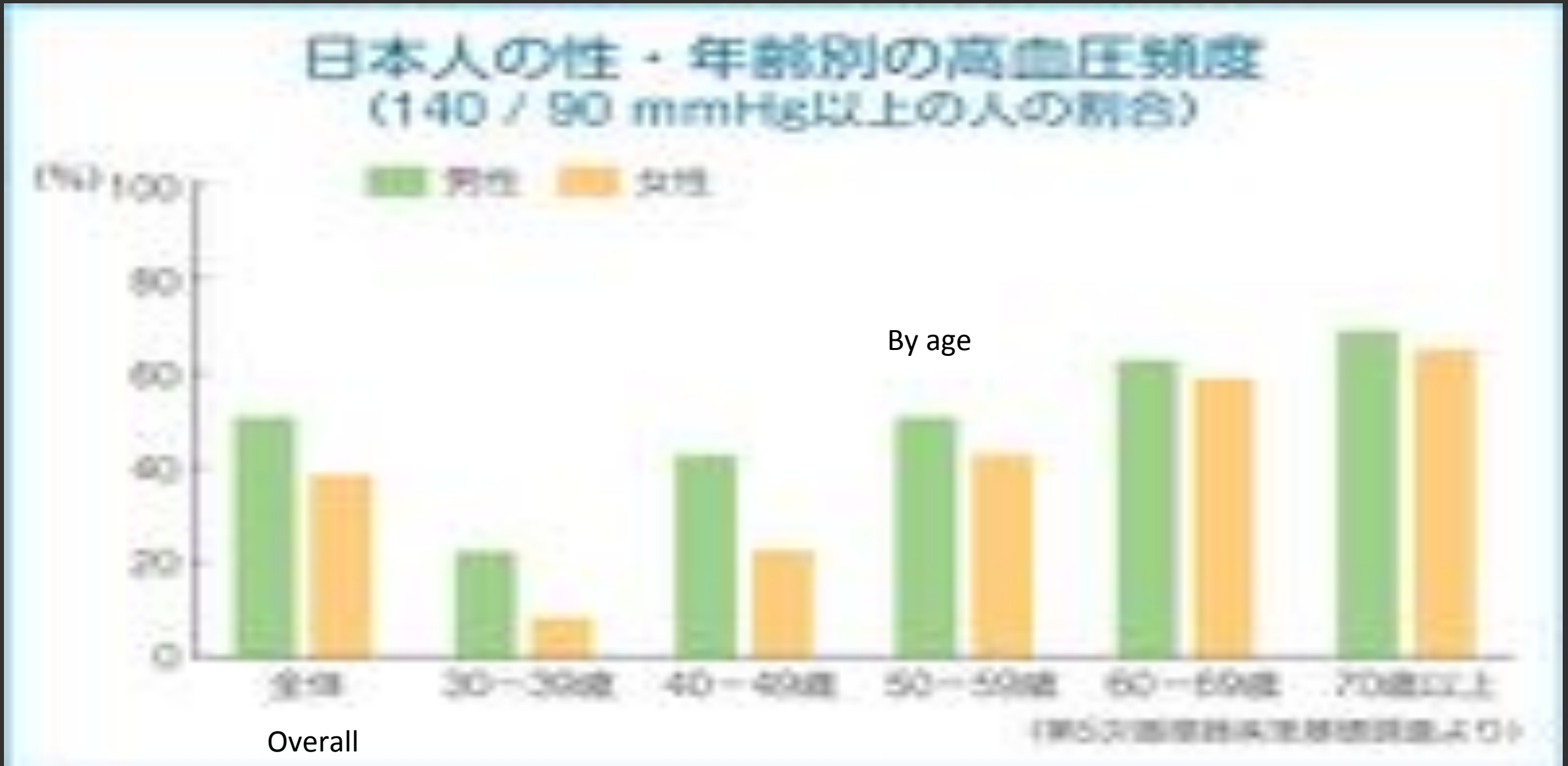
- Lie horizontally and elevate your feet
- Check your blood pressure
- Check your pulse
- Hydrate with water
- Intake of sugar
- Electrocardiogram if available



Blood pressure

Green = men Yellow = women

% of Japanese who have high blood pressure (over 140/90 mmHg)





- ① 心臟起搏點
- ② 房室結
- ③ 房室束

Impulse conduction system of the heart

Sinus node

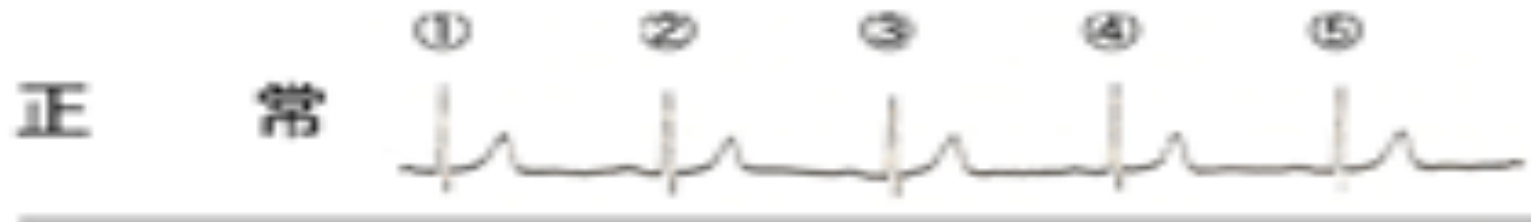
Atrioventricular node

Right ventricle

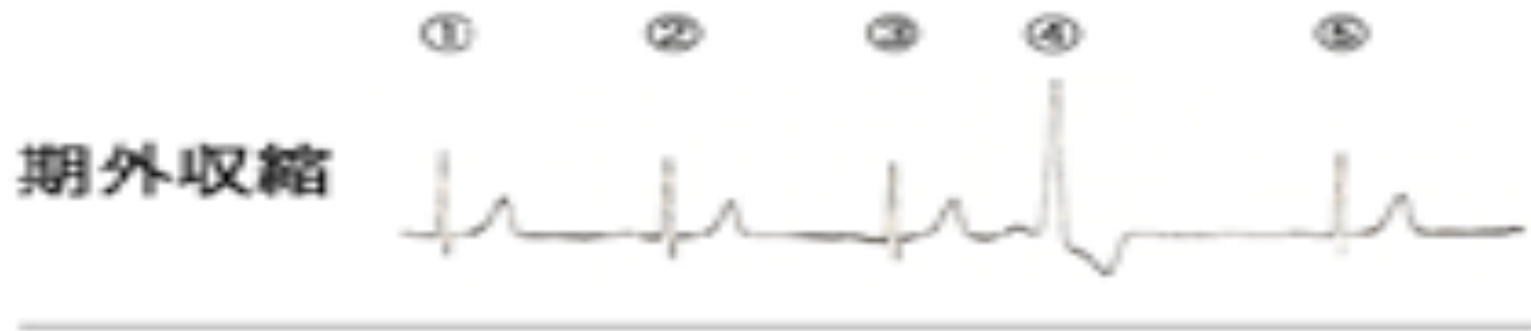
Left ventricle

It is common for older people to have no subjective symptoms.

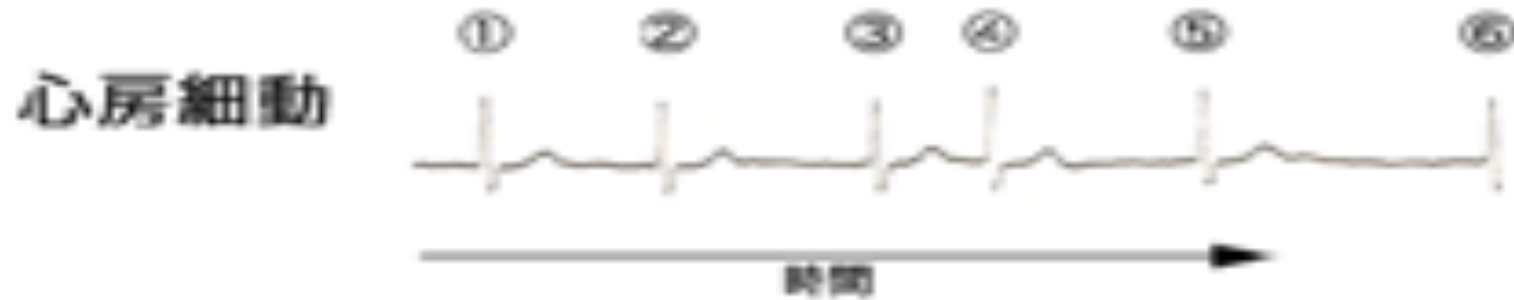
Normal



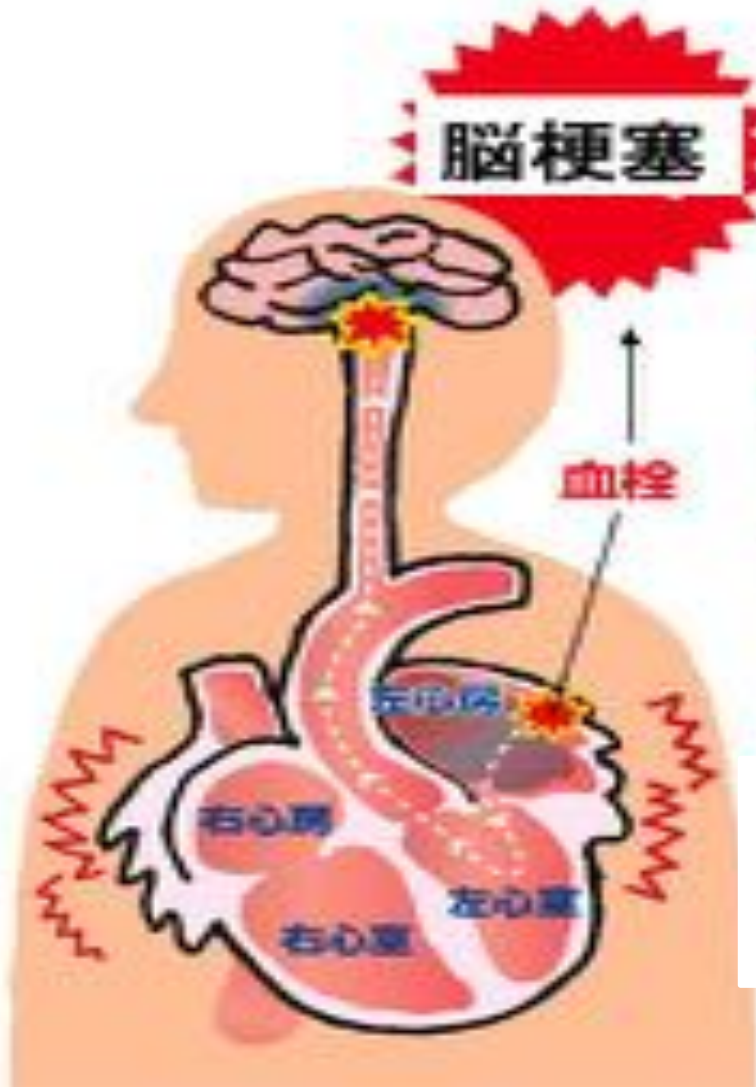
extrasystole



Atrial fibrillation



心房細動が原因の脳梗塞



心房細動では、
心臓が不規則に動くため、
心臓の中に血液のよどみ
(**静脈血栓の性格**)ができる。

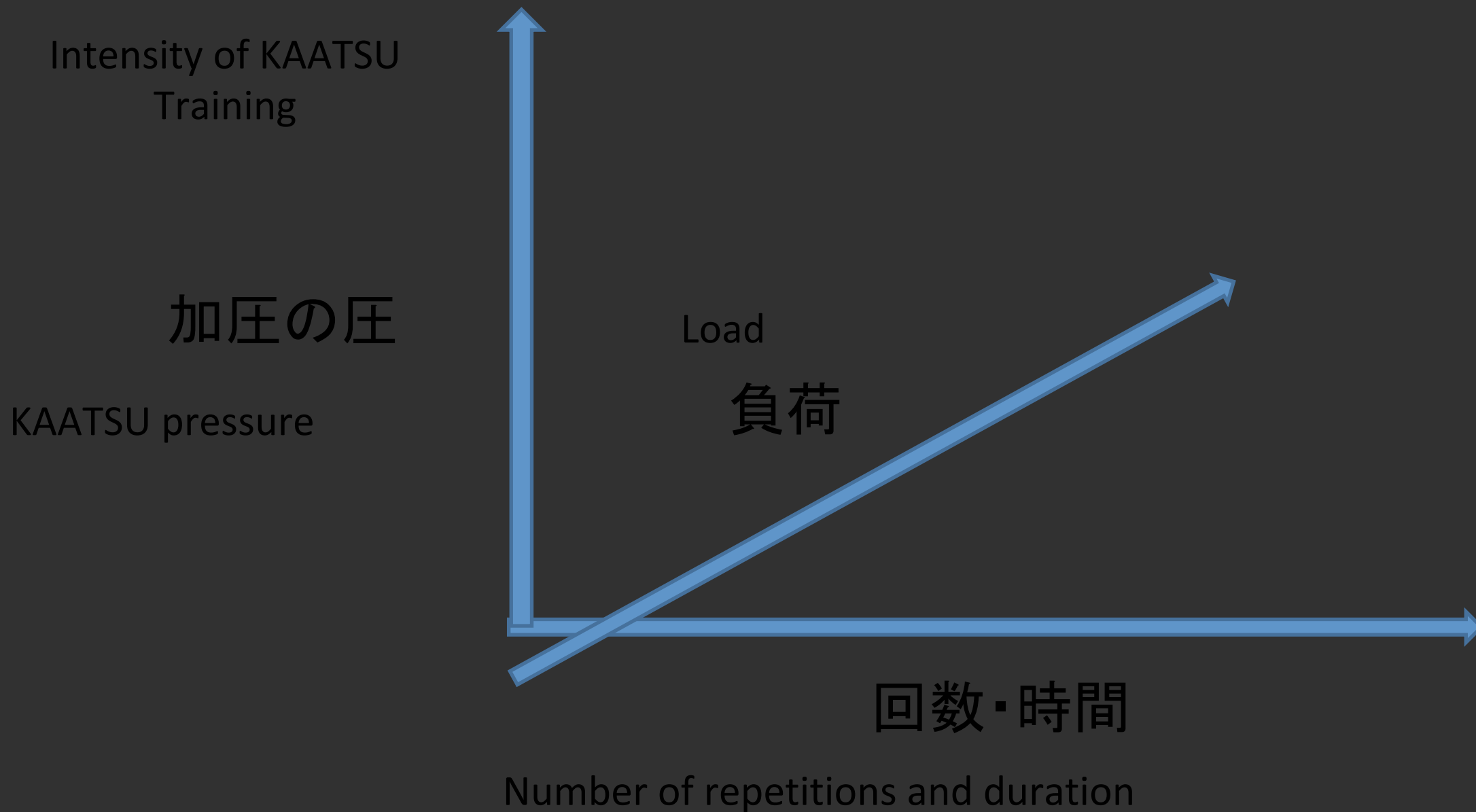
Stroke is caused because the heart operates irregularly in atrial fibrillation, stagnancy of the blood (character of the vein clot) is created.

心臓リハビリテーションの絶対的禁忌

- 急性心筋梗塞
- 不安定狭心症
- 心室頻拍あるいは重症不整脈
- 重症心不全 (NYHA class IV)
- 高度の大動脈弁狭窄症
- 急性肺塞栓あるいは肺梗塞
- 急性心筋炎あるいは心膜炎
- 急性大動脈解離

Prohibited for heart rehabilitation patients

- Acute myocardial infarction
- Unstable angina
- Ventricular tachycardia or severe arrhythmia
- Serious case of cardiac insufficiency (NYHA class IV)
- Serious aortic stenosis
- Acute pulmonary embolism or lung infarction
- Acute myocarditis or pericarditis
- Acute vena cava dissociation



When you exercise, reactive oxygen species will be generated due to aerobic metabolism.

- Reactive oxygen originated from mitochondria increases due to aerobic metabolism
- Catecholamine in blood will be increased and Hb is autoxidated during exercise and it promotes active oxygen generation.
- Ichemia due to exercise – reactive oxygen species production from return current or inflammation reaction.

Increase of active oxygen generation during exercise is inevitable.

⇒ 運動による活性酸素産生の増加は不可避である

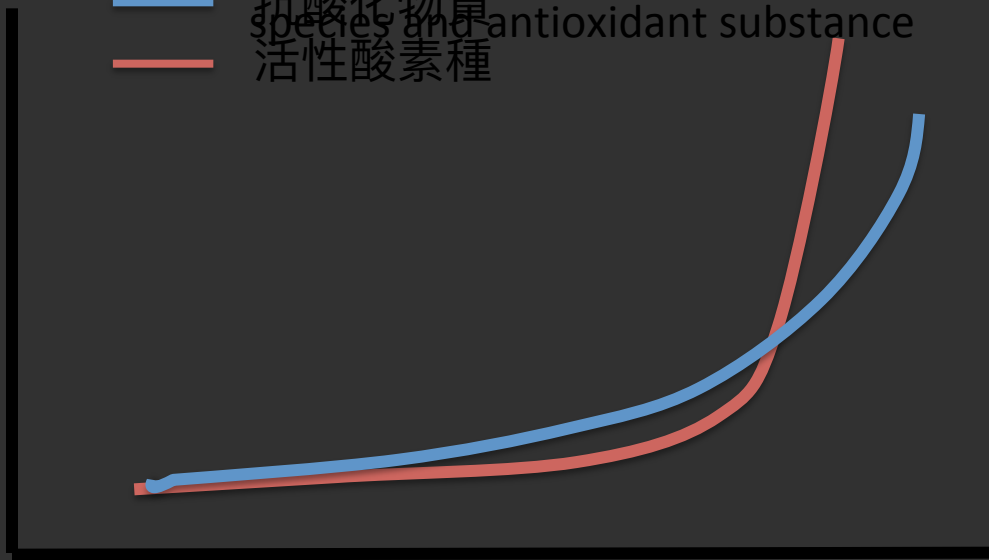
Blue line is antioxidant species and red line is active oxygen species

Relationships between exercise intensity and the production quantity of active oxygen

— 抗酸化物質 species and antioxidant substance
— 活性酸素種

産生量

Production quantity



運動強度

Exercise intensity

運動強度と
活性酸素種・抗酸化物質
産生量の関係

酸化ストレスナビゲーター p288
運動トレーニング 林幸仁
より引用

Oxidation stress state
smoking
Inflammation
Old age

Normal state

酸化ストレス状態

正常状態

喫煙
炎症
老化

抗酸化剤
活性酸素消去酵素

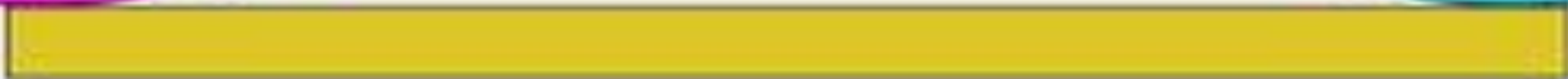
活性酸素生成系

Antioxidant
Active oxygen
scavenging enzyme

活性酸素消去系

Active oxygen generation system

Active oxygen scavenging system



d-ROM (determinable reactive oxygen metabolites)

⇒ 活性酸素代謝物測定

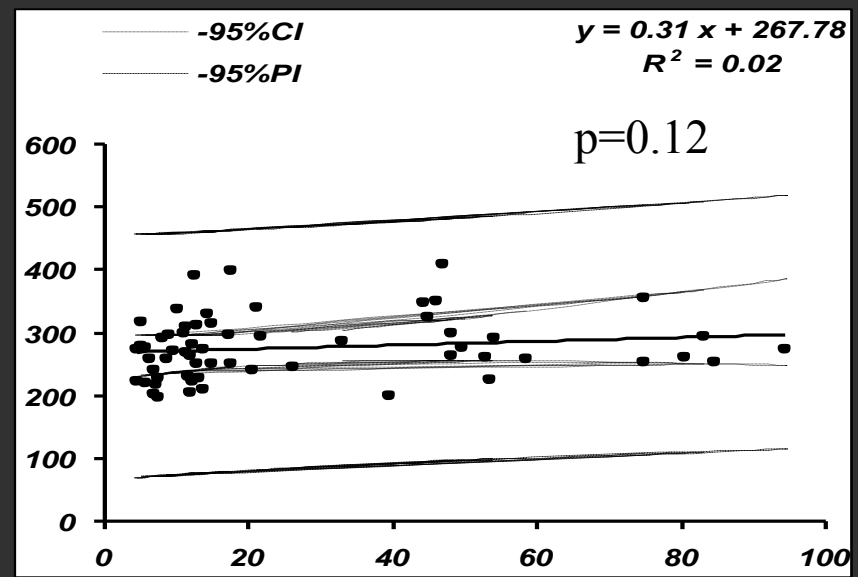
We do not directly measure active oxygen and free radical in vivo. Instead we comprehensively evaluate the degree of oxidation stress by measuring pyrrolidino? peroxide (oxidation stress degree marker) density with coloring reaction.

BAP (Biological Antioxidant Potential)

⇒ 抗酸化力測定

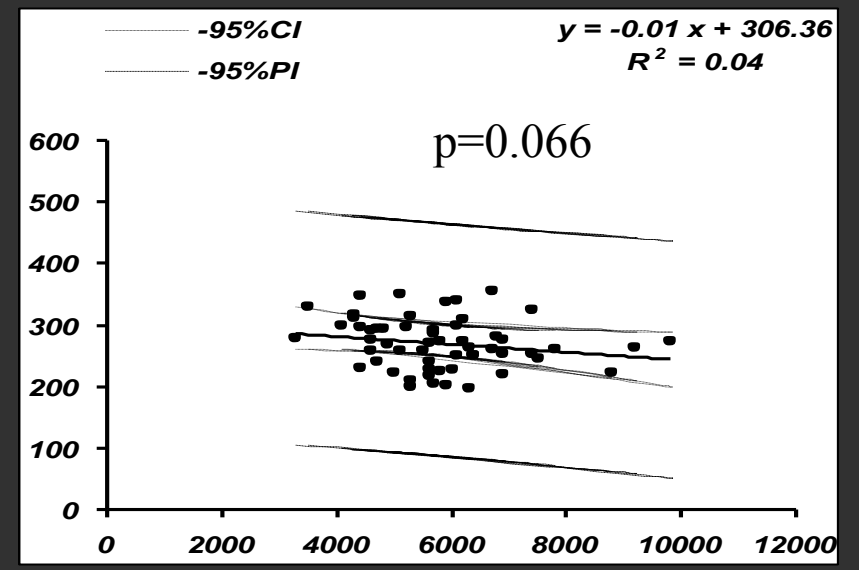
This will measure the power to prevent the chain reaction of oxidation caused by active oxygen and free radical.

dROM



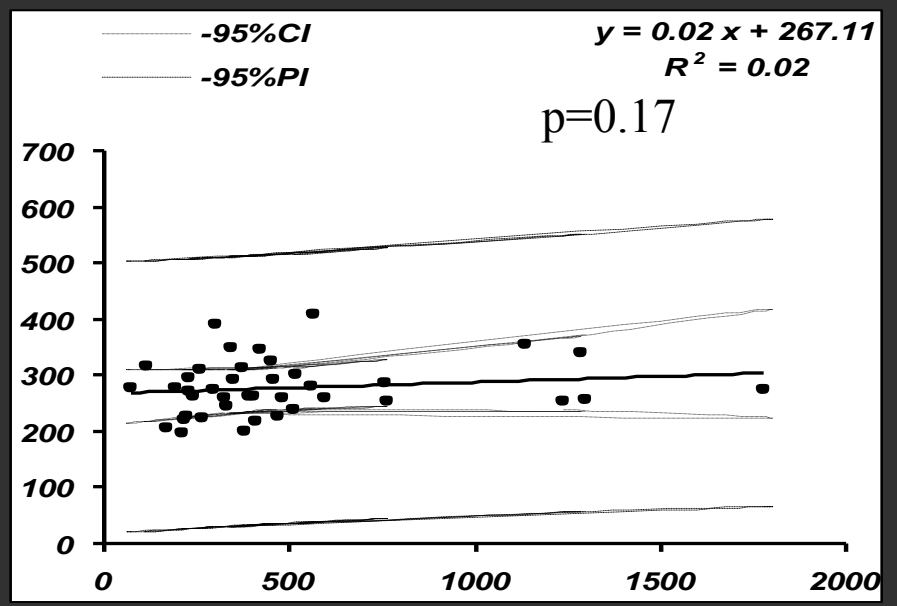
乳酸

dROM



白血球数

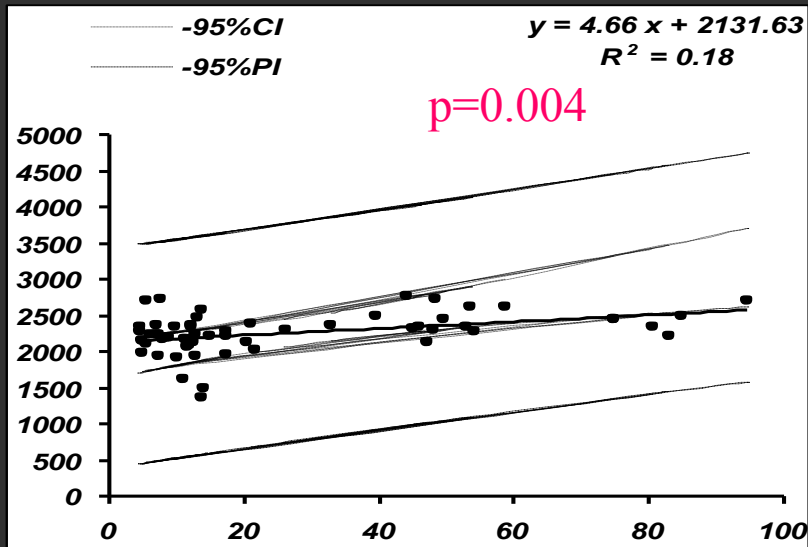
dROM



ノルアドレナリン

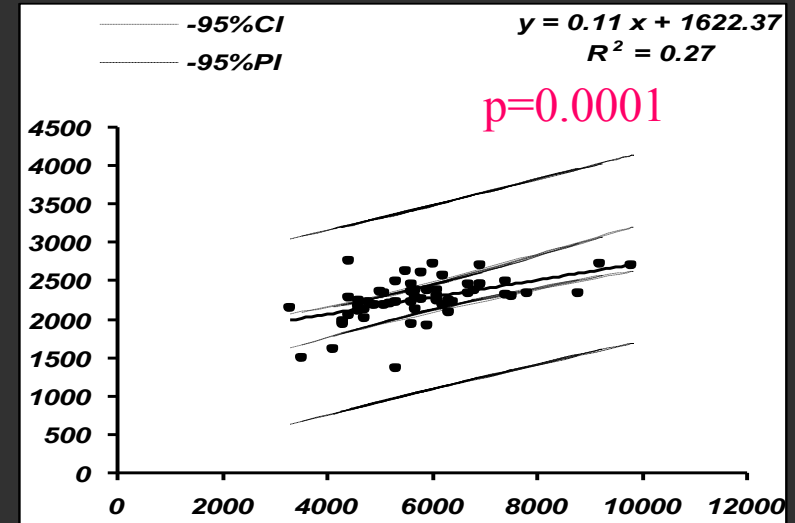
Relationships between dROM and lactic acid, white blood cell count, noradrenalin density for healthy individuals during exercise

BAP



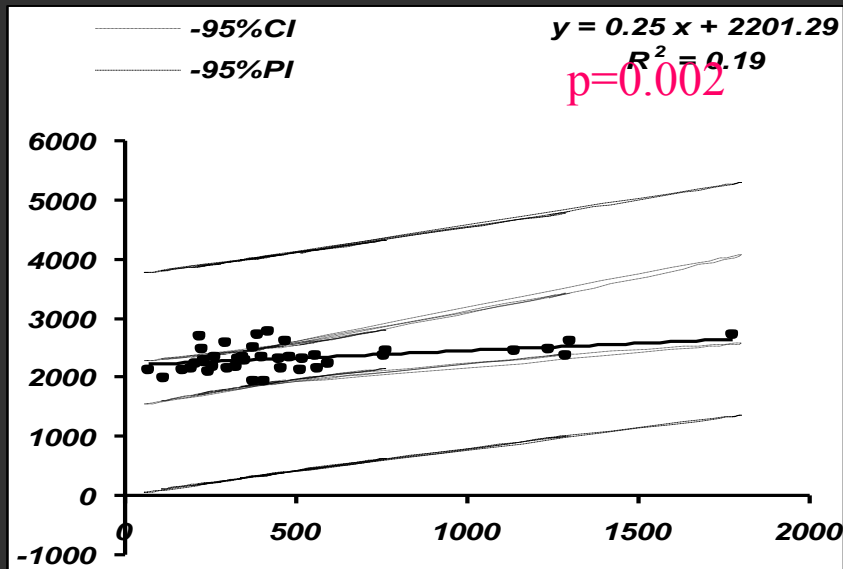
乳酸

BAP



白血球数

BAP

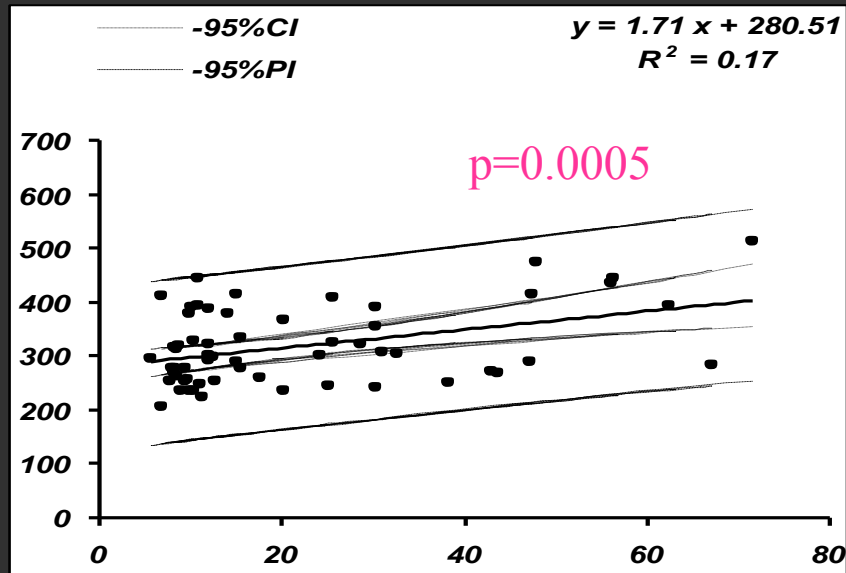


カテコールアミン

The relationship between BAP and lactic acid, white blood cell count, noradrenalin density in healthy individuals during exercise

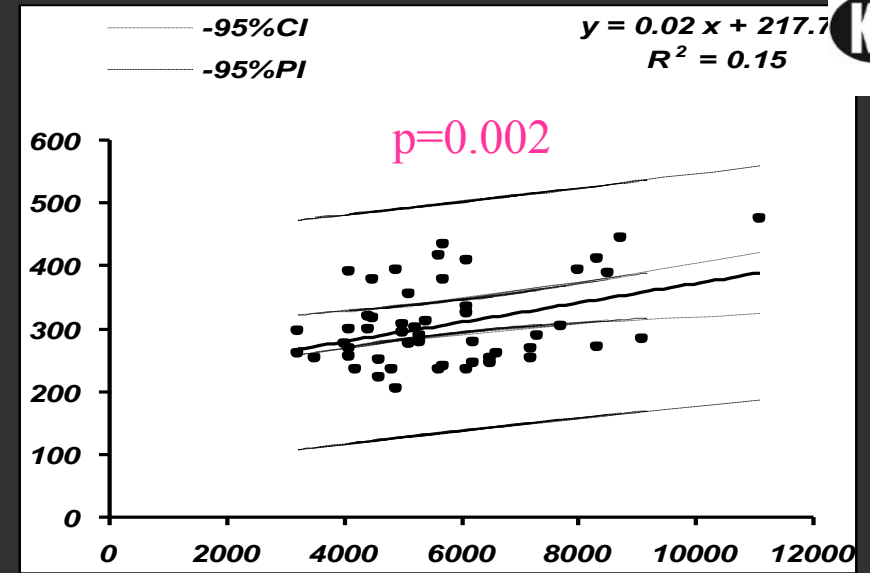
BAP in healthy individuals had a significant association with lactic acid, white blood cell count and noradrenalin (exercise intensity). On the other hand, no association with dROM was admitted.

dROM



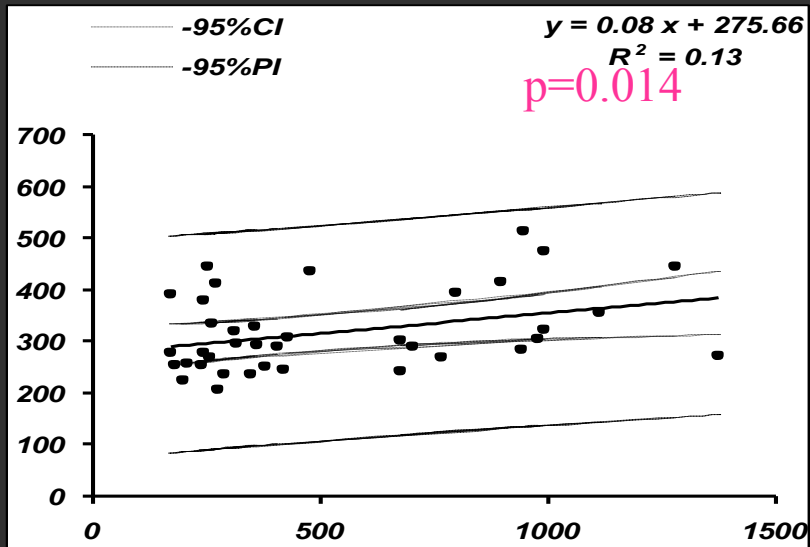
乳酸

dROM



白血球数

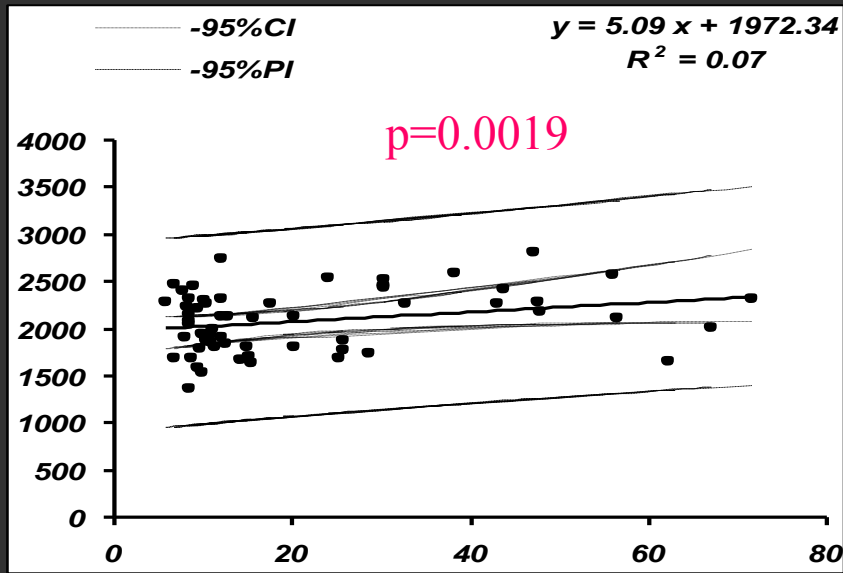
dROM



ノルアドレナリン

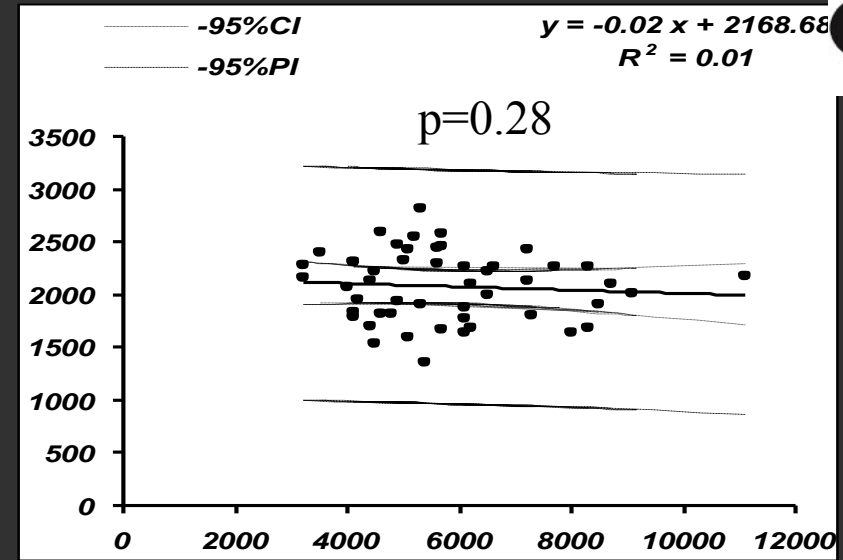
The relationship between dROM and lactic acid, white blood cell count, and noradrenalin density among patients doing exercise and undergoing heart rehabilitation

BAP



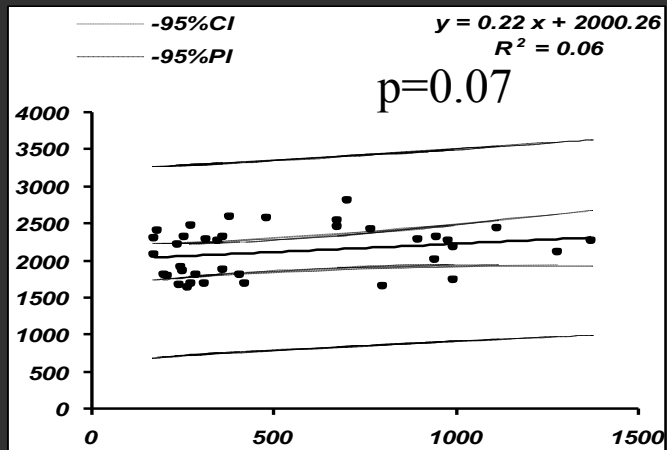
乳酸

BAP



白血球数

BAP



ノルアドレナリン

The relationship between BAP and lactic acid, white blood cell count, and noradrenalin density in patients doing exercise and undergoing heart rehabilitation

Significant relationship between dROM and lactic acid, white blood cell count, and noradrenalin was admitted in Cardiovascular disease patients. Relationship between BAP and lactic acid was admitted too.

Young healthy individuals
Red = active oxygen species

Blue = antioxidant substance

— 活性酸素種
— 抗酸化物質

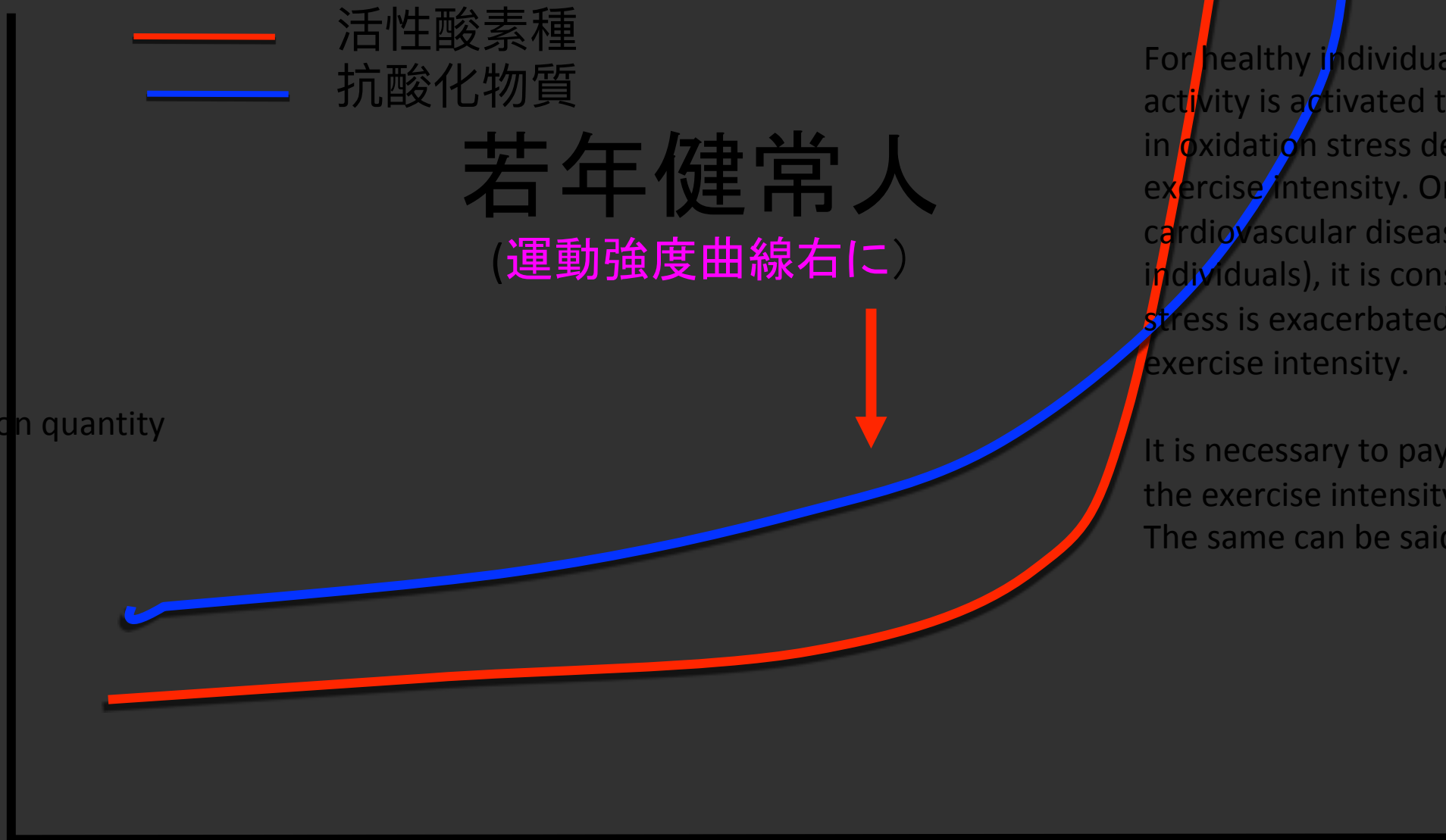
產生量

若年健全人

(運動強度曲線右に)



Production quantity



For healthy individuals, antioxidative activity is activated to prevent upswing in oxidation stress depending on the exercise intensity. On the other hand, for cardiovascular disease patients (or older individuals), it is considered that oxidation stress is exacerbated depending on the exercise intensity.

It is necessary to pay extra attention on the exercise intensity for elderly patients. The same can be said for KAATSU Training.

運動強度
Exercise intensity

Young healthy individuals
Red = active oxygen species

Blue = antioxidant substance

活性酸素種
抗酸化物質

產生量

若年健康人
(運動強度曲線右に)

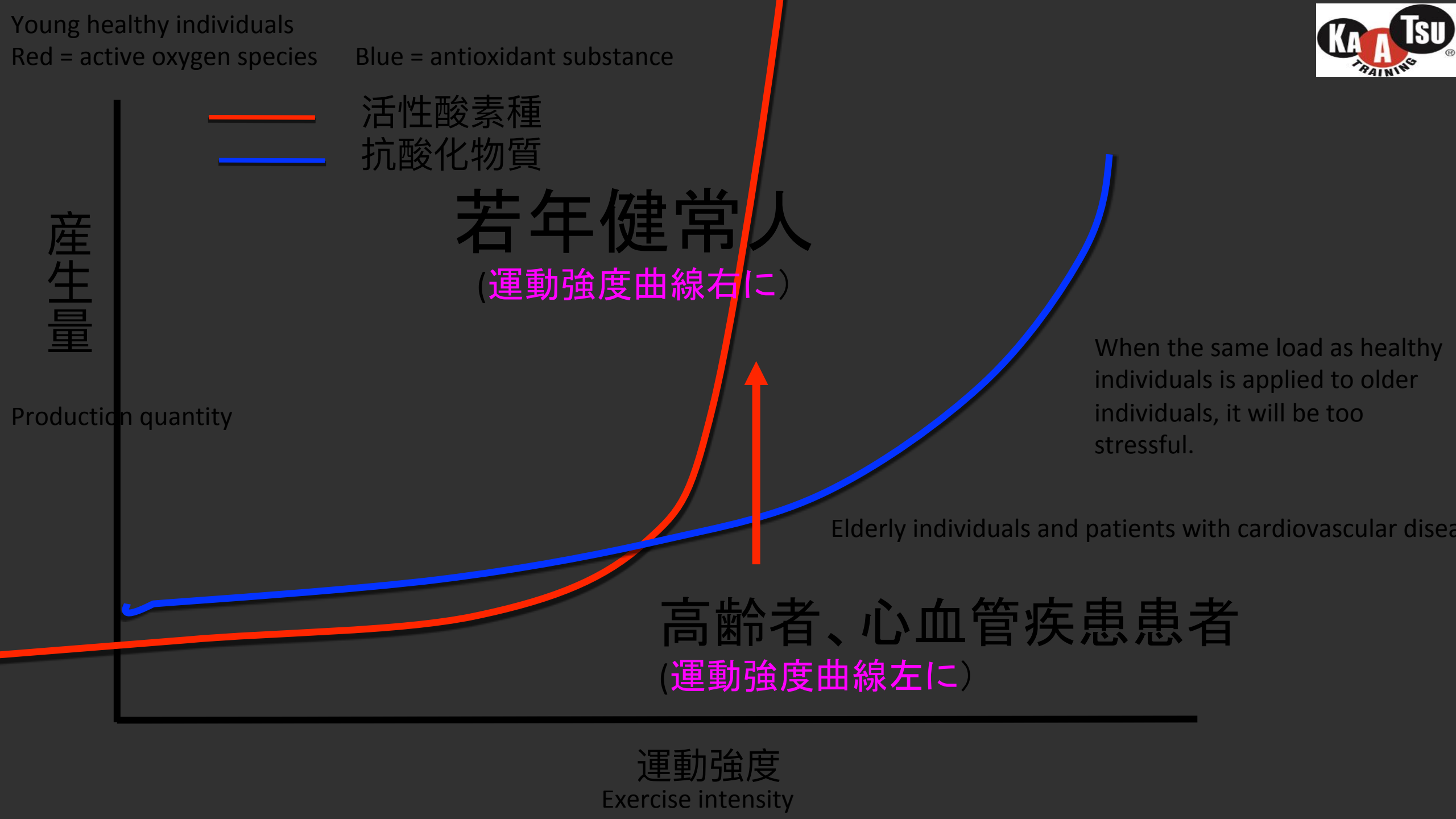
When the same load as healthy individuals is applied to older individuals, it will be too stressful.

Elderly individuals and patients with cardiovascular disease

高齡者、心血管疾患患者
(運動強度曲線左に)

運動強度
Exercise intensity

Production quantity



Young healthy individuals
Red = active oxygen species

Blue = antioxidant substance

— 活性酸素種
— 抗酸化物質

產生量

若年健全人
(運動強度曲線右に)

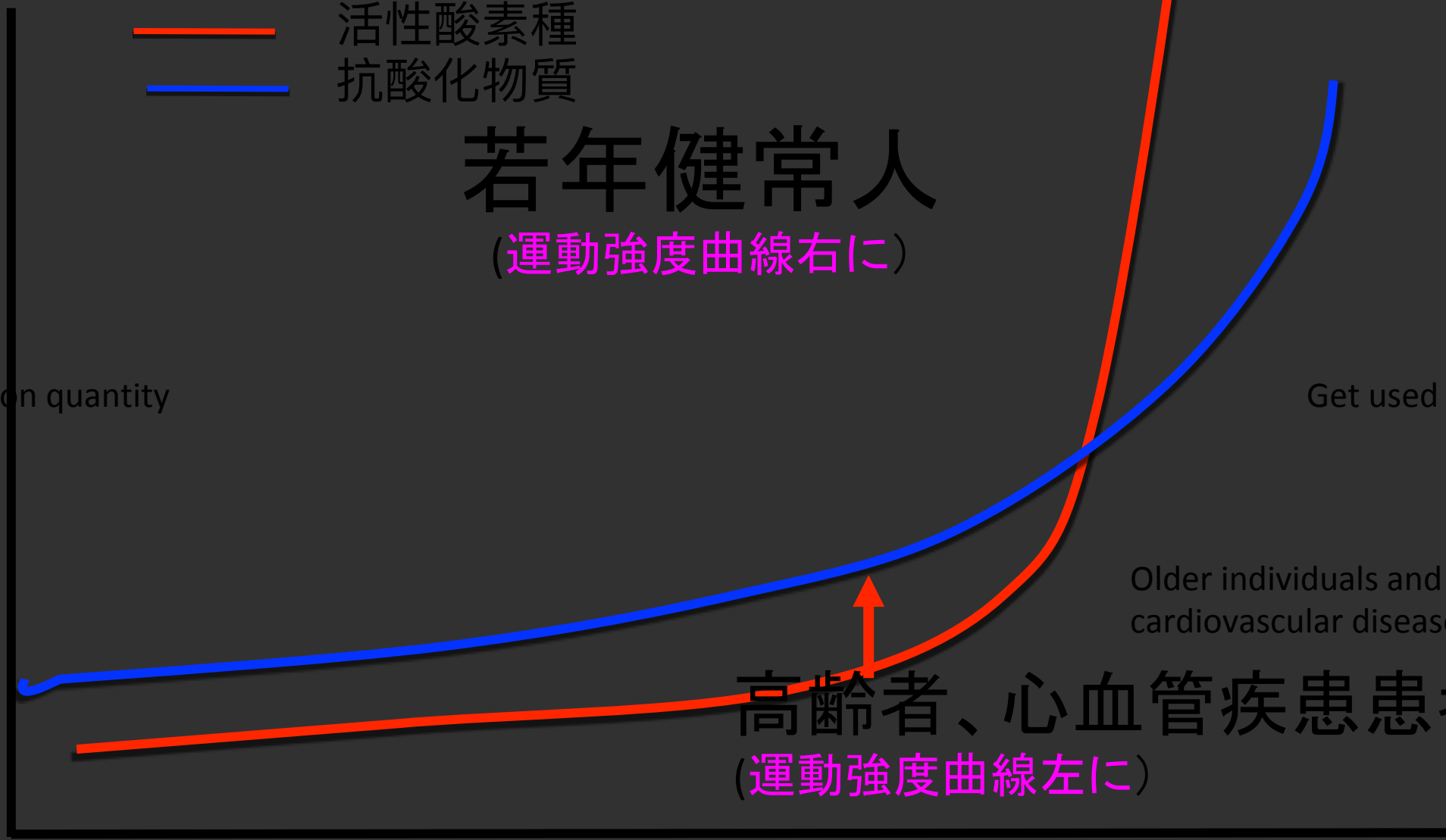
Production quantity

Get used to it gradually

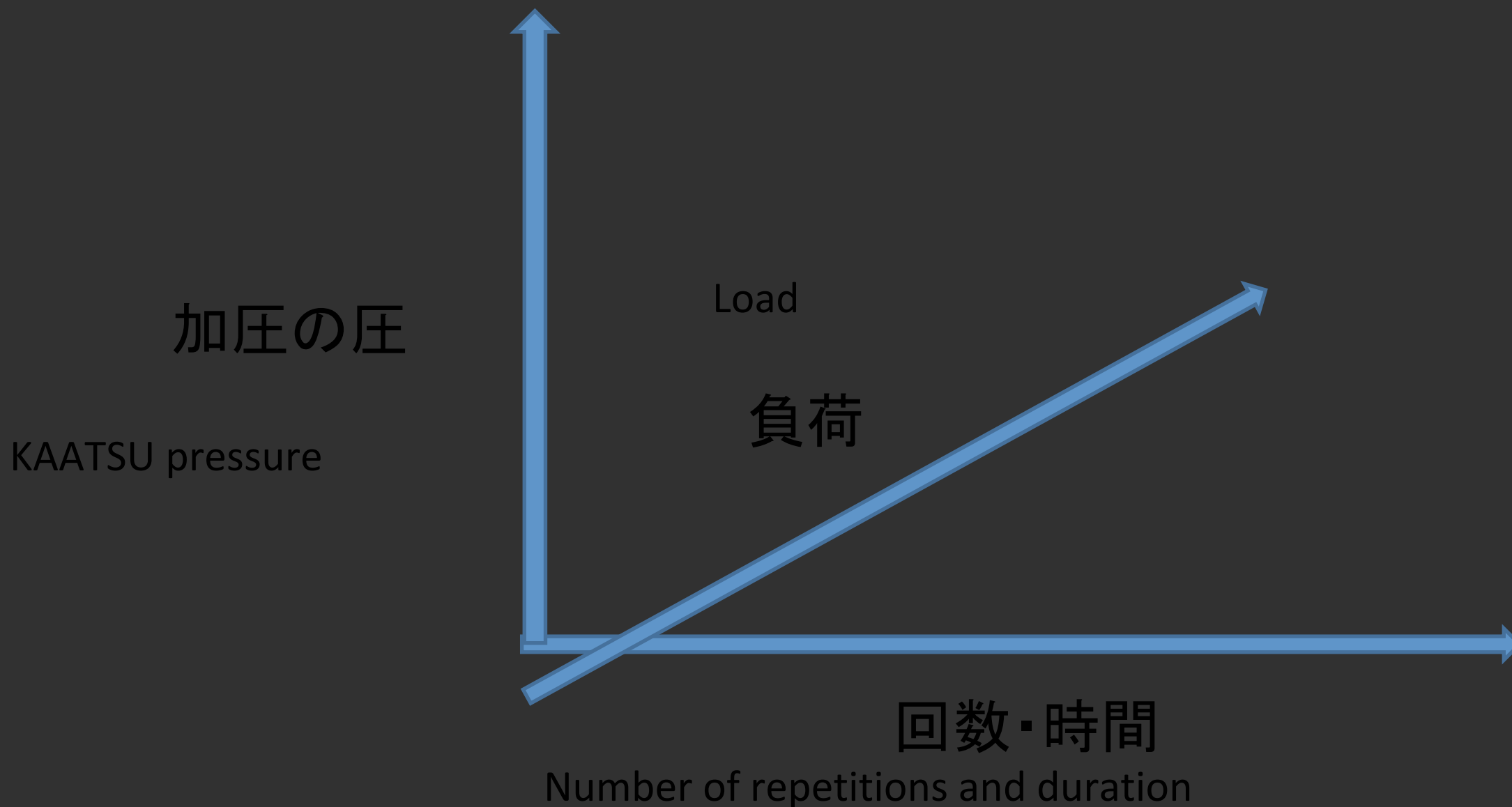
Older individuals and patients with cardiovascular disease

高齡者、心血管疾患患者
(運動強度曲線左に)

運動強度
Exercise intensity



The moderation of blood flow is a unique characteristic of KAATSU; therefore, it is better to gradually increase the KAATSU pressure instead of increasing the load



Lower Body Training



Core



Also, (1) walk with a book and (2) balance on one foot for core