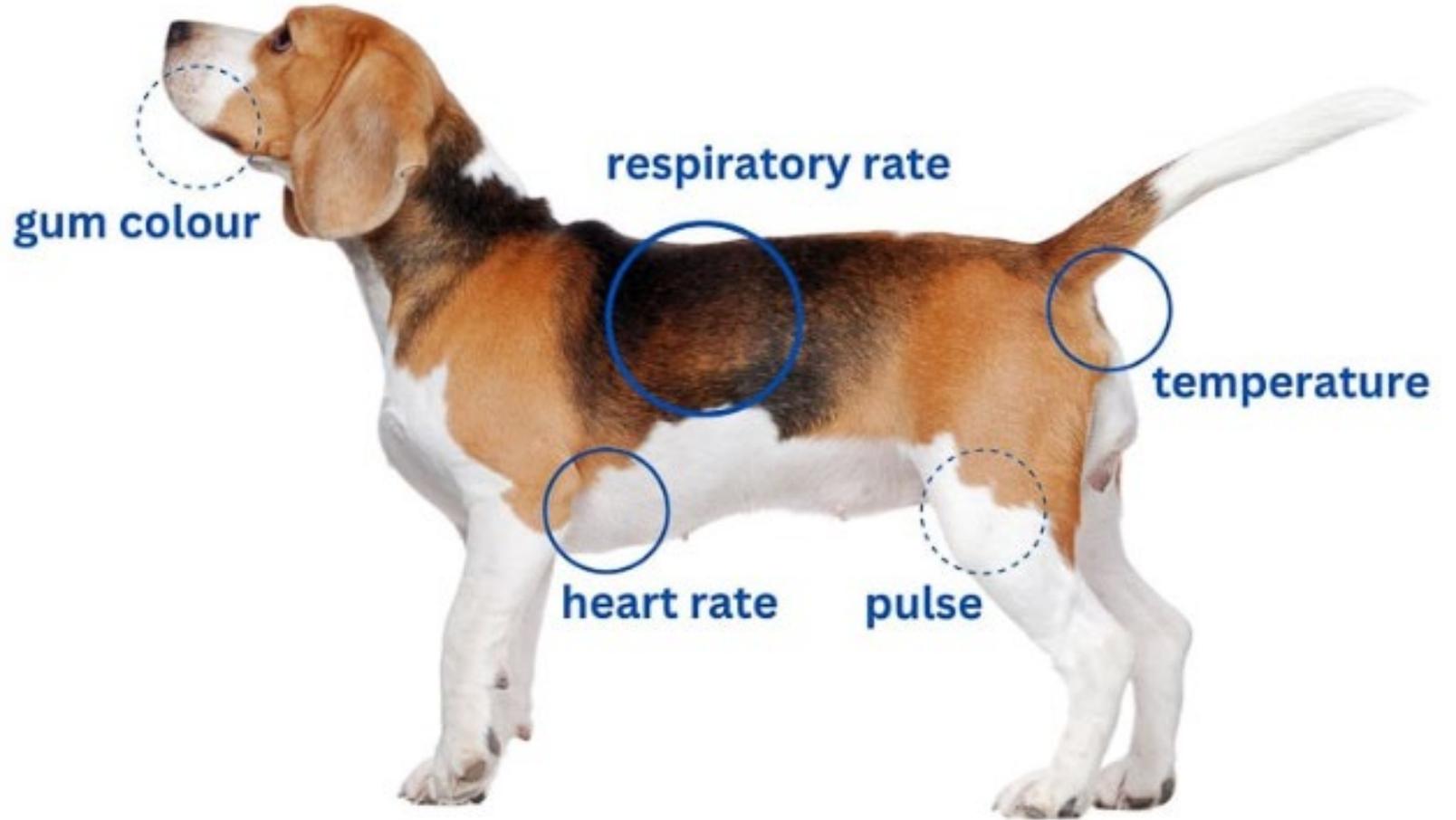


정상 바이탈

개& 고양이



2025 진료수의사 이 현 주

Vital sign?

활력 징후

vitals plural noun

vi·tals 'vī-təlz

Synonyms of *vitals* >

- a** : internal bodily organs (such as the heart, lungs, and brain) that are essential to life
especially : the vital organs of the abdomen (such as the liver and kidneys)

활력 징후(Vital Signs, Vitals, V/S)는 체온, 맥박, 호흡, 혈압 등을 측정하여 신체의 상태를 평가하는 기본적인 지표입니다.

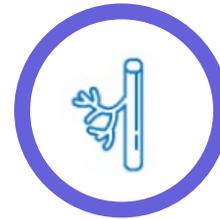
Vital sign check !



RR
Respiratory rate



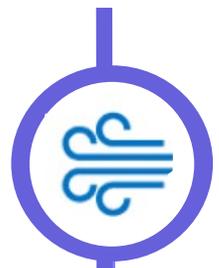
HR
Heart rate



BP
Blood pressure



BT
Body tempreate



Respiration



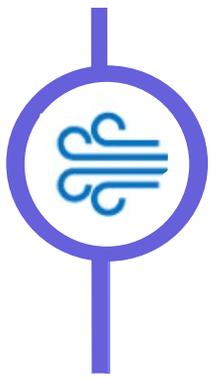
Heart rate



Blood pressure



Body temperature



Respiration



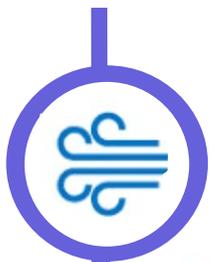
Heart rate



Blood pressure



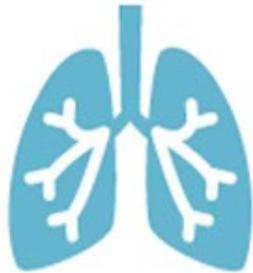
Body temperature



Normal range of RR



JUST BREATHE



normal respiratory rate

| | |
|------|-----------------------------|
| DOGS | 12–30 breaths per minute |
| CATS | 20–30 breaths per minute |

how to find respiratory rate



① make sure your pet is calm and cool.



② count how many times the chest expands in 10 seconds.



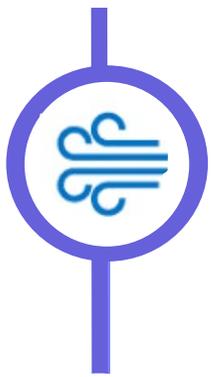
③ multiply by six to get the breaths per minute.

1. RRR, Resting respiratory rate

- 안정시 호흡수
- 자율신경계 이외의 다른 생리적 변화(감정/흥분상태, 운동상태 등) 영향을 받음
- 심폐기능 외적인 요소에 영향 받음

2. SRR, Sleeping respiratory rate

- 수면시 호흡수
- 심폐기능을 간접적으로 평가하는 지표
 - healthy 13-15회/분



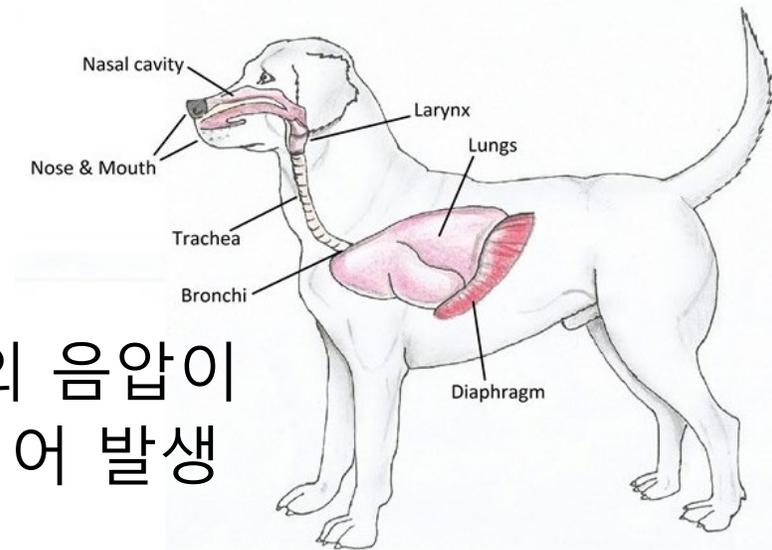
Respiratory physiology

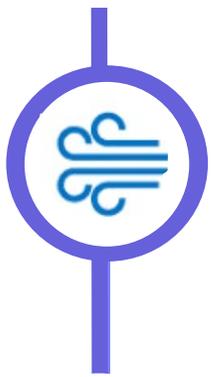
1. 들숨(흡기, inspiration)

- 갈비사이근육이나 가로막(횡격막)과 같은 호흡에 관여하는 근육의 작용으로 가슴 또는 가슴안이 확대되고 그 결과 가슴 내의 음압이 높아짐에 따라 발생

2. 날숨(호기, expiration)

- 호흡근이 이완되어 가슴이 좁아지고 가슴안의 음압이 낮아짐에 따라 허파가 그 탄성에 의해 수축되어 발생





Respiratory physiology

• Respiratory system work

1. 뇌에서 호흡을 조절

- 연수(medulla oblongata) : 호흡 속도와 깊이를 조절하는 호흡중추

2. 자율신경계의 역할

- ANS(autonomic nervous system) : 교감/부교감 신경에 의한 호흡조절
- 스트레스, 운동, 긴장상황 → 교감신경 활성화
- 휴식, 이완된 상태 → 부교감신경 활성화

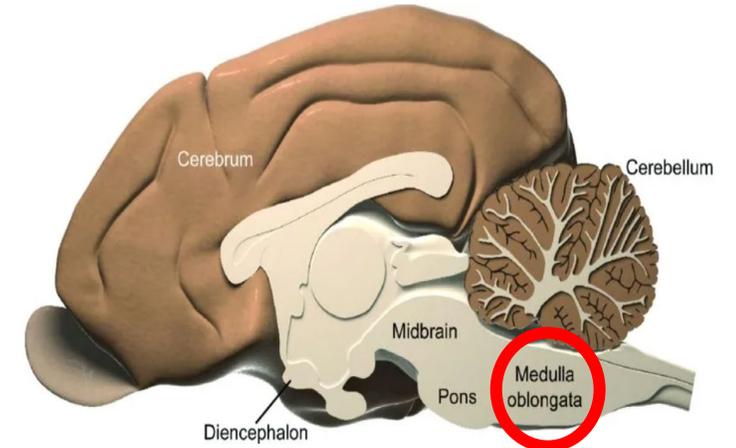
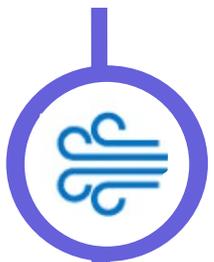


Figure 3.1 Schematic midsagittal illustration of the brain, depicting major anatomical landmarks. (The Ohio State University. Reproduced with permission.)



Respiratory physiology

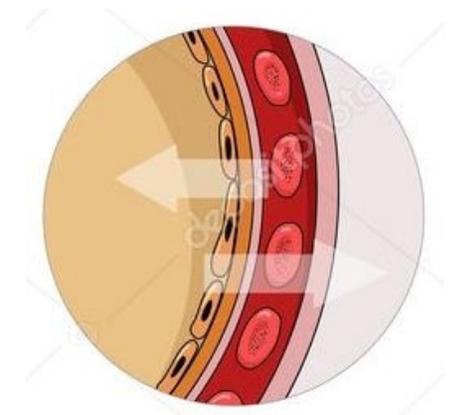


1. 가스교환

- 개/고양이의 신체에 있는 모든 세포는 역할을 하기 위해 산소 필요
- 산소와 이산화탄소의 교환

2. 체온조절

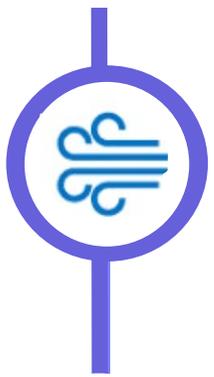
- 따뜻한 공기를 내뿜고 차가운 공기를 들이마셔 체온하강



3. 그 외

- balancing the pH of the body, producing sound, Sense of smell





Respiratory disturbance

1. Dyspnea, 호흡곤란

- 숨쉬기 힘든 상태, 숨이 차거나 불편함



2. Tachypnea, 빈호흡 ↔ Bradypnea, 서호흡

- 분당 호흡수가 정상보다 증가한 상태



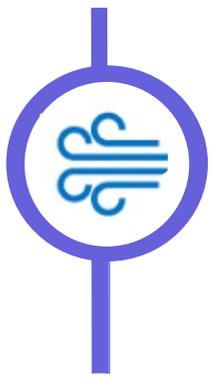
3. Hyperpnea, 과호흡 ↔ Hypopnea, 얇은 호흡

- 산소요구량이 증가하여 호흡의 깊이가 증가한 상태

4. Apnea, 무호흡

- 일시적 또는 지속적인 호흡 정지



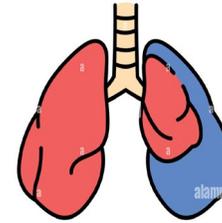


Respiratory disturbance

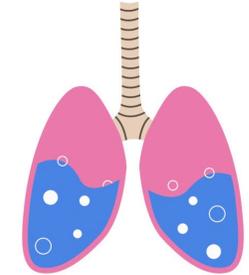


1. Dyspnea, 호흡곤란

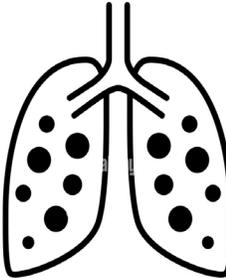
- Airway obstruction
- Pneumothorax, Pleural effusion, Pulmonary edema, pneumonia 등



pneumothorax



pulmonary edema



pneumonia



2. Tachypnea, 빈호흡

- 생리학적 원인 : 체온상승, 흥분, 긴장, 통증
- 질병적 원인 : 호흡곤란, 대사성 산증 등 다양



excitement

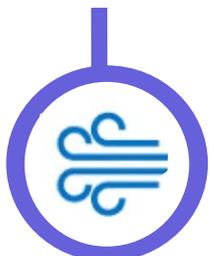


panting



pain

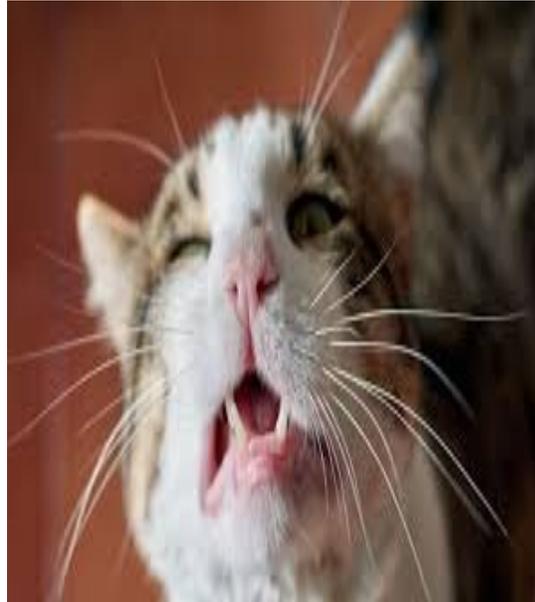




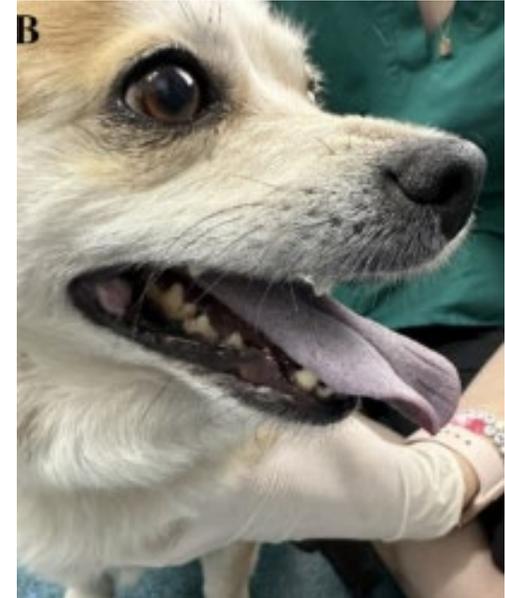
Respiratory Monitoring



Orthopnea
견좌자세



Open breathing
개구호흡



Cyanosis
청색증



Respiration



Heart rate



Blood pressure



Body temperature

Normal range of HR

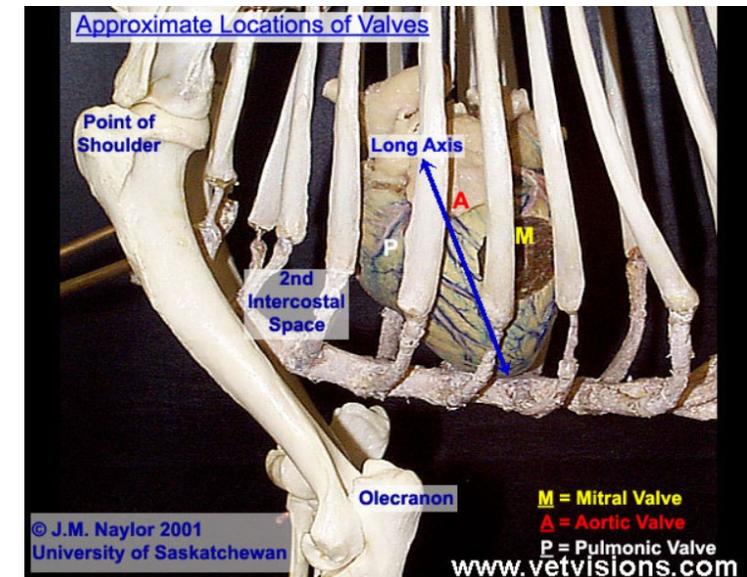
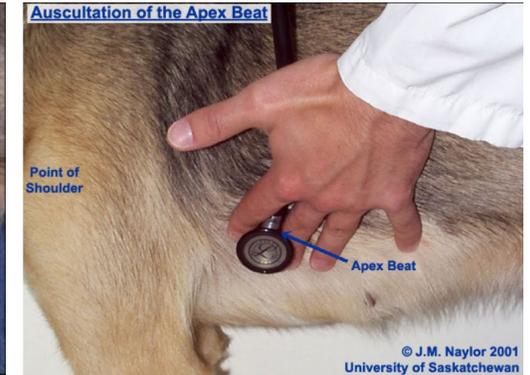
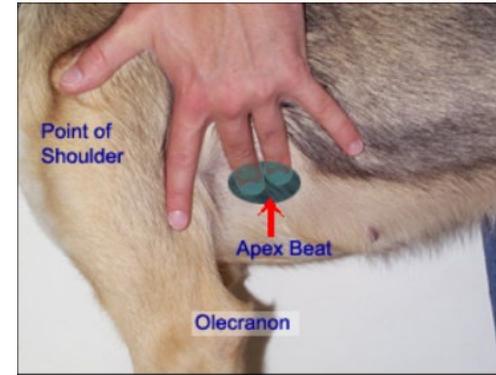
IN A HEARTBEAT



| normal heart rate | |
|-------------------|-----------------------------|
| DOGS | 80-160 beats per minute |
| CATS | 140-240 beats per minute |

how to find heart rate

-  put your hand on your pet's chest (resist the urge to pet him).
-  count how many pulses you feel in 15 seconds.
-  multiply by four to get the beats per minute.



Normal range of HR

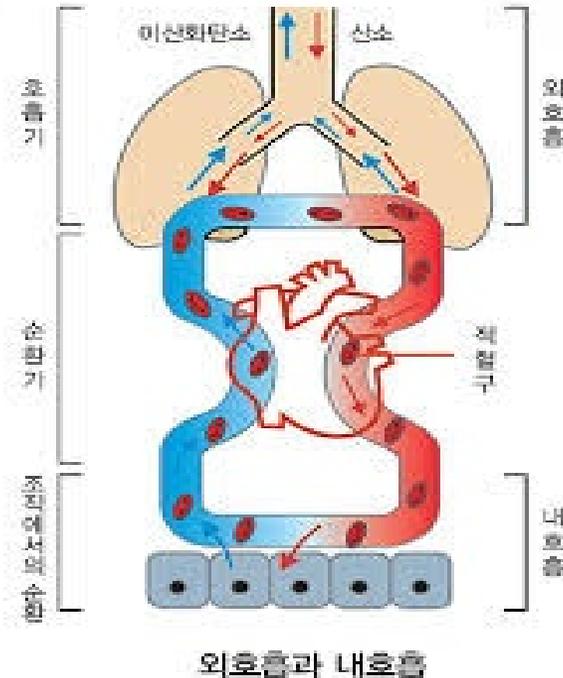
| Pulse | Dogs | | | | Cats |
|-------|--------|--------|--------|--------|---------|
| | Puppy | Small | Medium | Large | |
| | 70-220 | 90-180 | 80-160 | 70-140 | 140-220 |



Normal Heart Rate

- Adult Dog - 60 to 160 BPM
- Toy Breeds - Up to 180 BPM
- Newborn Puppy - 160 to 200 BPM
- 2 Week Old - Up to 220 BPM

First two weeks: 220 to 260 bpm



심박출량(CO, cardiac output)

$$= \text{심박수(Heart Rate)} \times \text{1회 박출량(Stroke Volume)}$$

자견(Puppy), 자묘(kitten)

- 높은 기초대사율, 작은 심장크기, 체온조절 미성숙, 높은 활동성과 흥분



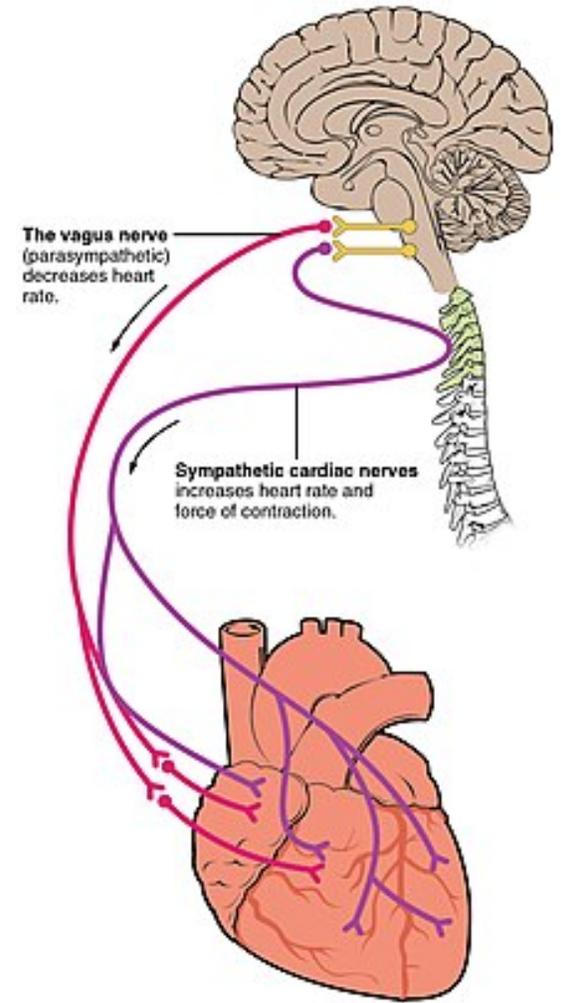
Cardiac physiology

1. 자율신경계의 역할

- 교감신경 자극 : NE 방출 → β -1수용체 결합 → **HR** ↑
- 부교감신경 자극 : 미주신경자극
ACh 분비 → 무스카린(M2)수용체 활성화 → **HR** ↓

2. 압수용기(Baroreceptor, 혈압감지)

- 대동맥동(aortic sinus), 경동맥소체(carotid body), 대정맥(vena cava) 등
- 혈압 상승 → 부교감신경 활성화 : **HR** ↓ ; baroreceptor reflex
- 혈압 감소 → 교감신경 활성화 : **HR** ↑





Cardiac physiology

Table 1: Major factors increasing heart rate and force of contraction^[1]

| Factor | Effect |
|--------------------------|---|
| Cardioaccelerator nerves | Release of norepinephrine |
| Proprioceptors | Increased rates of firing during exercise |
| Chemoreceptors | Decreased levels of O ₂ ; increased levels of H ⁺ , CO ₂ , and lactic acid |
| Baroreceptors | Decreased rates of firing, indicating falling blood volume/pressure |
| Limbic system | Anticipation of physical exercise or strong emotions |
| Catecholamines | Increased epinephrine and norepinephrine |
| Thyroid hormones | Increased T3 and T4 |
| Calcium | Increased Ca ²⁺ |
| Potassium | Decreased K ⁺ |
| Sodium | Decreased Na ⁺ |
| Body temperature | Increased body temperature |
| Nicotine and caffeine | Stimulants, increasing heart rate |

Table 2: Factors decreasing heart rate and force of contraction^[1]

| Factor | Effect |
|--------------------------------|---|
| Cardioinhibitor nerves (vagus) | Release of acetylcholine |
| Proprioceptors | Decreased rates of firing following exercise |
| Chemoreceptors | Increased levels of O ₂ ; decreased levels of H ⁺ and CO ₂ |
| Baroreceptors | Increased rates of firing, indicating higher blood volume/pressure |
| Limbic system | Anticipation of relaxation |
| Catecholamines | Decreased epinephrine and norepinephrine |
| Thyroid hormones | Decreased T3 and T4 |
| Calcium | Decreased Ca ²⁺ |
| Potassium | Increased K ⁺ |
| Sodium | Increased Na ⁺ |
| Body temperature | Decrease in body temperature |





Arrhythmia

1. Tachycardia, 빈맥

- 분당 심박수가 정상보다 **증가**한 상태
- 운동, 스트레스, 통증, 탈수, 고온환경, 빈혈, 심장질환, 대사성질환(갑기항 등) 등
- 빈맥 → 일시적 심박출량 증가 → 조직으로 산소전달 증가 → **too fast** → 심박출량 감소 → 관류 불량

2. Bradycardia, 서맥

- 분당 심박수가 정상보다 **감소**한 상태
- 심장질환, 전해질 불균형(hyperkalemia), 저체온증, 마취 및 진정제 효과 등
- 서맥 → 심박출량 감소 → 관류 불량

3. irregular heart beat





Cardiac monitoring



dyspnea
호흡곤란



Color of MM
점막 색상 변화
창백 or 청색증



Syncope
실신





Respiration



Heart rate



Blood pressure



Body temperature



혈압 측정 기법

1. Oscillometric sphygmomanometry

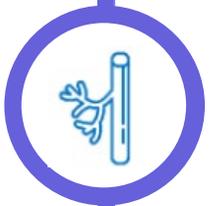
- 자동혈압감지 시스템 : cuff에 자동으로 압력을 넣으면서 동맥을 막고 천천히 압력을 제거, 혈관을 막았을때 **혈관벽이 진동하는 것**을 기계가 감지
- 측정 부위 : 다리, 꼬리
- 장착 위치 : 팔꿈치관절의 원위부, 뒷발허리뼈중앙, 꼬리기시부
- cuff 선택 : 개) 둘레의 40%정도, 고양이) 둘레의 30%정도
- 장점 : 마취한 개와 고양이에서 장시간 혈압 변동 모니터링 용이
- 단점 : 부정확할 수 있음



그림 99-2 Oscillometric혈압측정시 cuff를 올바르게 장착하는 모습 (개의 dorsal pedal artery에 장착). Cuff의 튜브를 혈압모니터에 연결하여 혈압측정 버튼을 누른다. 환자는 외측 (측면)으로 눕힌다.

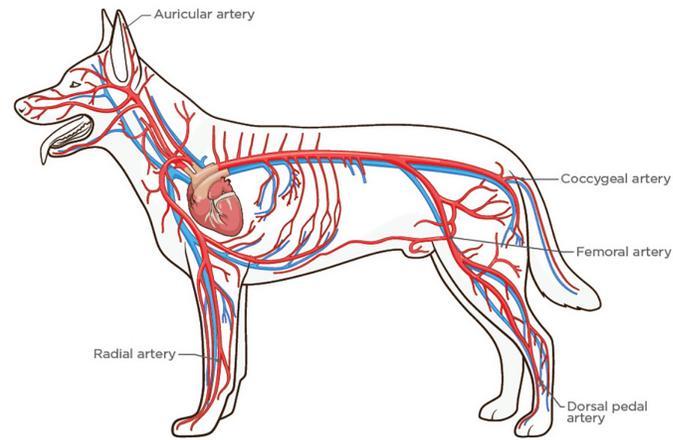


그림 99-3 고양이에서 Oscillometric 혈압측정을 위해 커프를 장착한 모습. 고양이는 긴장이 풀려있고 흉골자세로 누워있다.





혈압 측정 기법



2. Doppler sphygmomanometry

- 초음파 혈류감지 시스템 : 말초동맥의 혈류를 감지하는 방법
- 측정 부위 : 전지(superficial palmar arterial arch), 후지(dorsal pedal artery), 꼬리(꼬리복측)
- 장점 : 비침습적 혈압측정법 중 가장 정확, 높은 재현성, 움직임영향 최소, 작은 혈관도 측정 가능, 부정맥 영향 최소, 빠름
- 단점 : 숙련도에 가장 영향을 많이 받는 측정법

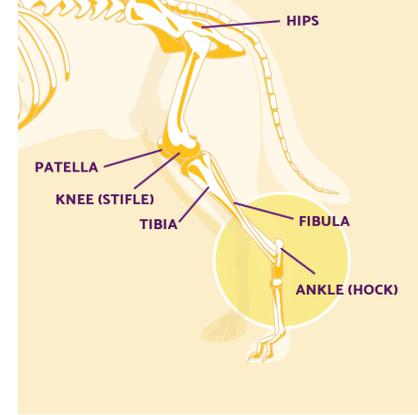




혈압 측정 기법

2. Doppler sphygmomanometry

- cuff 선택 : 개) 둘레의 40%정도, 고양이) 둘레의 30%정도
- 장착 위치 : 전지(노뼈중간), 후지(발목관절 근위부), 꼬리(기시부)
- 측정방법
 - 혈류 흐르는 소리가 감지
 - 소리가 들리지 않을때까지 cuff 바람 채우기
: 최고점에서 40mmHg 정도 추가로 채우기
 - 바람을 천천히 빼기 시작해서 도플러에서 소리가 다시 들리기 시작하는 시점 : 수축기 혈압, SAP
 - 추가로 바람을 계속 빼다보면 도플러 소리가 갑자기 약해지는 변화시점 : 이완기 혈압, DAP



40% of circumference



그림 99-4 Doppler혈압계를 이용한 혈압측정방법. 망막박리 때문에 급성실명된 고양이의 전지에서 혈압을 측정하고 있다. 앉은 자세에서 커프를 장착한 발목의 위치가 심장과 같은 높이어야 하고 환자를 편안하게 보정해야 한다.



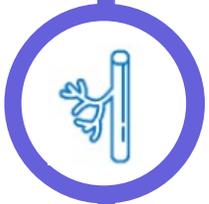


Normal range of BP

TABLE 1 Blood Pressure Reference Ranges for Dogs and Cats¹

| | SYSTOLIC (mm Hg) | DIASTOLIC (mm Hg) | MEAN (mm Hg) |
|-----|-----------------------------|------------------------------|-------------------------|
| Dog | 90-140 | 50-80 | 60-100 |
| Cat | 80-140 | 55-75 | 60-100 |

- **Type of equipment, Blood pressure cuff size and placement, psychosocial and physiological factors for patient**

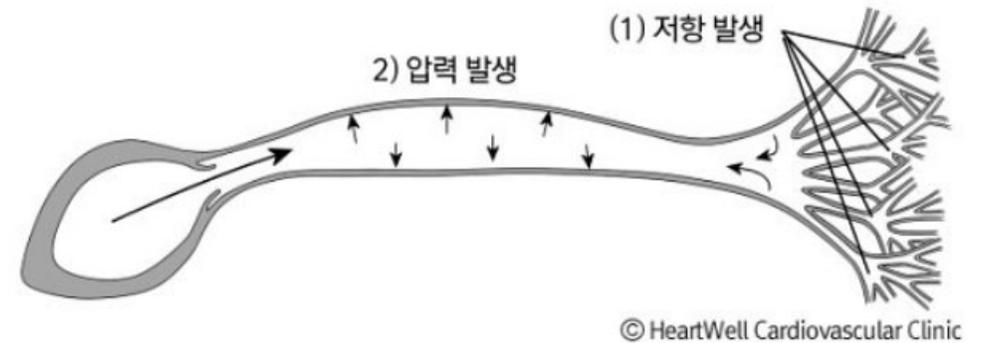
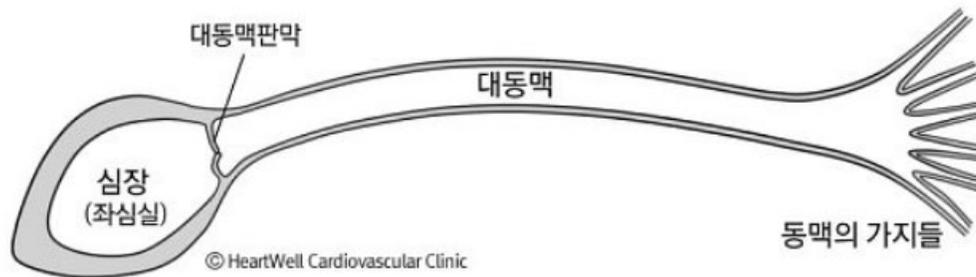




Blood pressure physiology

1. 혈압, BP

- 혈류가 동맥 벽에 가하는 압력
- 전신혈관저항(SVR, Systemic vascular resistance), 심박출량(CO)
- 심장의 수축과 말초혈관의 저항 사이에 발생하는 압력

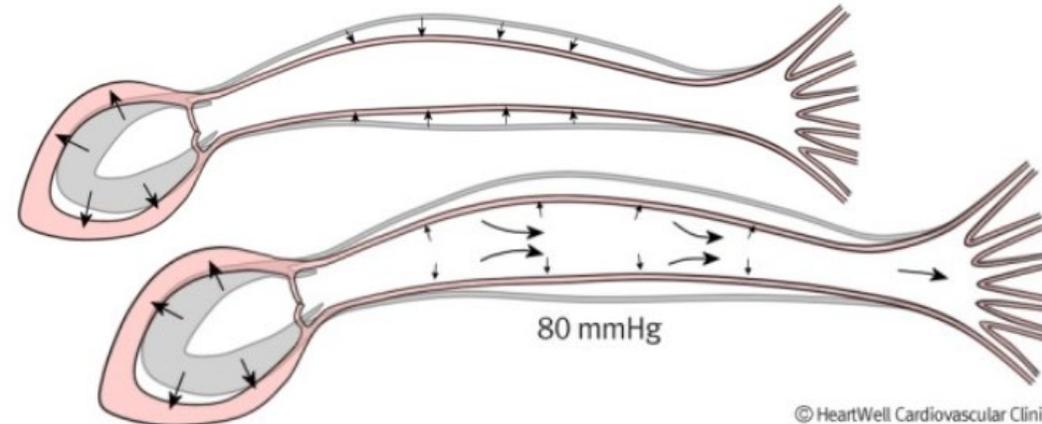
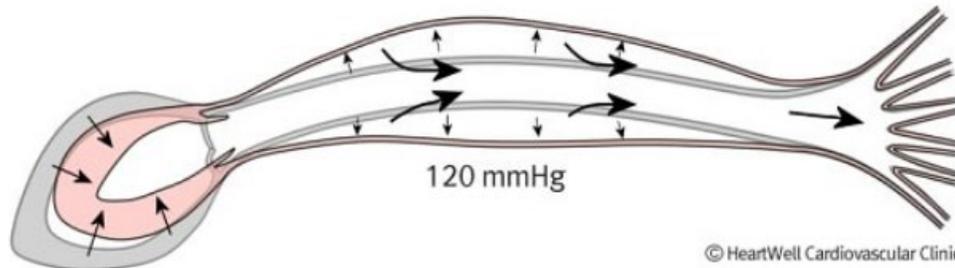
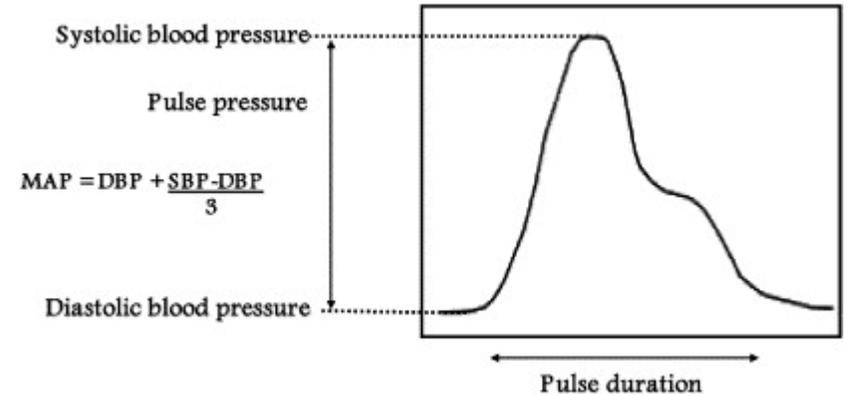




Blood pressure

2. 수축기/이완기/평균동맥압

- 수축기혈압(SAP, systolic arterial pressure)
: 좌심실이 전신에 혈액을 보내는 심실수축기 시기(동맥혈압의 최대치)
- 이완기혈압(DAP, diastolic arterial pressure)
: 심장이완기, 심실이 이완되시기(혈압 최소치)
- 평균동맥압(MAP, mean arterial pressure)
: 전체 심장 주기의 평균, $MAP = DAP + (SAP - DAP) \div 3$

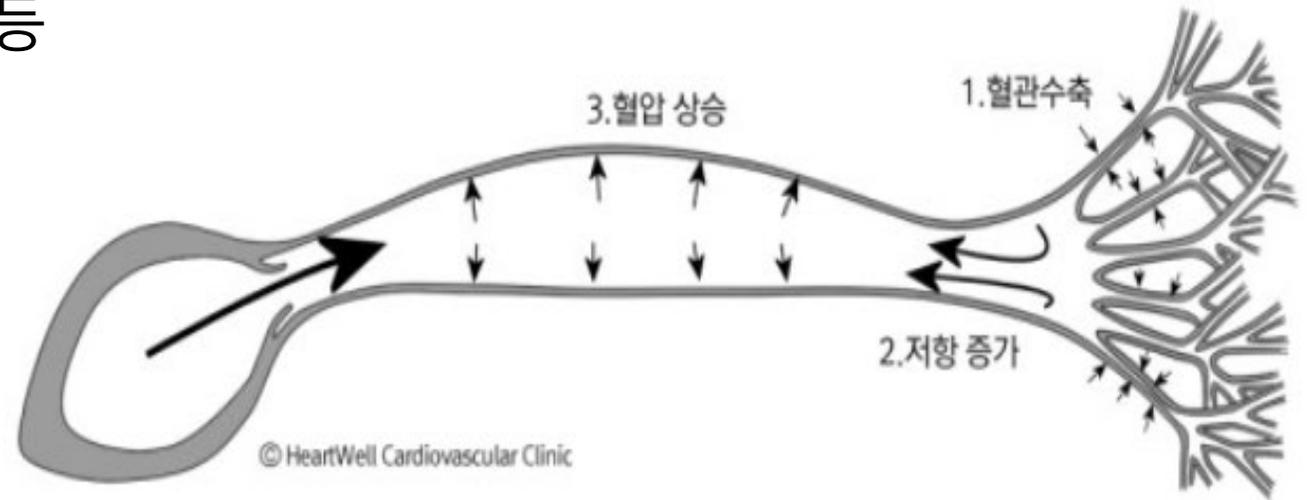




Blood pressure physiology

3. 혈관수축과 혈압과의 관계

- 말초혈관이 수축하면 저항이 늘어나고 이에 따라 혈압 상승
- Vasoconstriction factor, 혈관수축 인자
: Catecholamine, Angiotensin II, Endothelin I, Vassopressin, Thromboxan 등
- Vasodilation factor, 혈관이완 인자
: Nitric oxide, Prostacyclin 등





저혈압, Hypotension

1. Definition

- MAP < 60 mmHg, SAP < 80-90 mmHg
- SVR, HR, intravascular volume, contractility 중 하나에 이상

2. 원인

- 심인성(cardiogenic) : 심근병증, 심낭수, 부정맥 등
- 저혈량성(hypovolemic) : 출혈, 위장관 또는 비뇨기계의 체액손실, 화상, 에디슨
- 혈관긴장도 변화 : 패혈증, 아나필락시스, 코티솔생산감소(부신피질기능저하증) 등

3. 임상증상

- 약한 말초맥박 박동, 사지냉감, 쇼크, 의식저하 등





고혈압, Hypertension

1. Definition

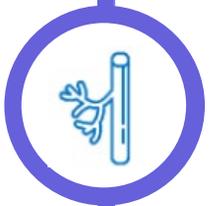
- systolic BP > 160 mmHg, diastolic BP > 95 mmHg or both

2. 원인

- 전신고혈압의 증상을 보이거나 고혈압을 유발하는 전신질환에 이환
: 만성 신장 질환, 갑상선기능항진증, 부신피질기능항진증, 당뇨병, 갈색세포종 등

3. 임상증상

- 표적장기(TOD, target organ disease) : 눈, 신장, 뇌, 심장
 - 급성 실명, 안내출혈, 경련 등/ 활동성 및 식욕 변화, 무기력, 과도한 졸음 등 비특이적증상
- Classification : situational/ secondary/ idiopathic





Respiration



Heart rate



Blood pressure



Body temperature

Normal range of BT

TAKE A TEMP



| normal body temperature | |
|-------------------------|--------------|
| DOGS | 37.5 - 39 °C |
| CATS | 38 - 39.5 °C |

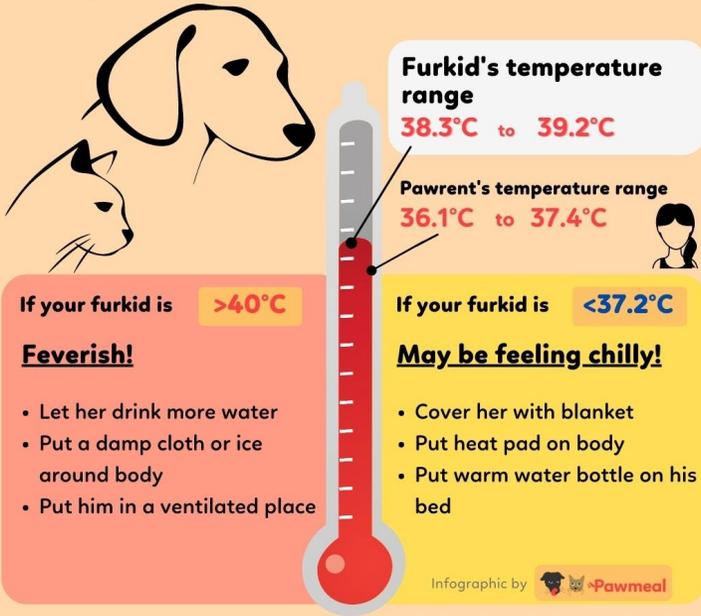
THE NORMAL BODY TEMPERATURE OF A DOG



The normal body temperature of a dog is between 101°F and 102.5°F (38.3°C and 39.2°C).

Newborn puppies have a slightly lower temperature, but it will increase as they develop.

What your pet's temperature means



Furkid's temperature range
38.3°C to 39.2°C

Pawrent's temperature range
36.1°C to 37.4°C

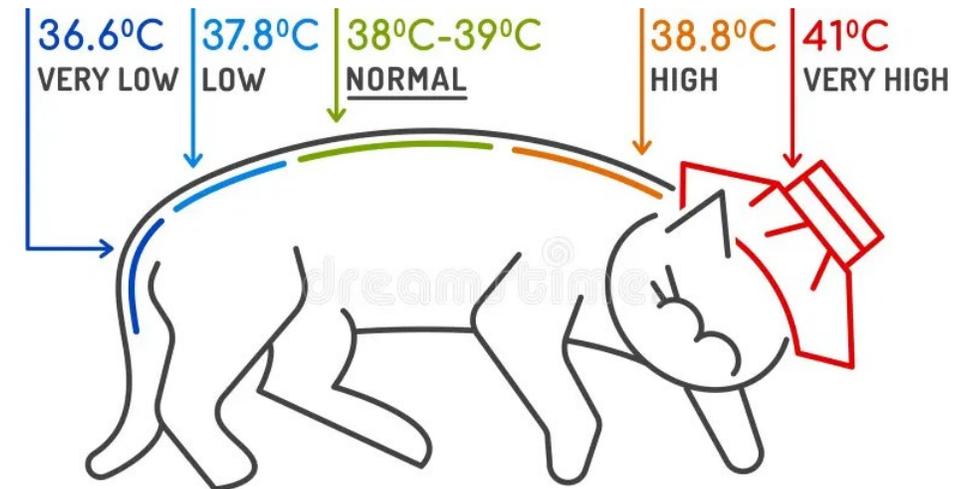
If your furkid is **>40°C**
Feverish!

- Let her drink more water
- Put a damp cloth or ice around body
- Put him in a ventilated place

If your furkid is **<37.2°C**
May be feeling chilly!

- Cover her with blanket
- Put heat pad on body
- Put warm water bottle on his bed

Infographic by Pawmeal



NORMAL TEMPERATURE FOR A CAT



Normal range of BT

1. 직장체온

- 가장 정확한 방법



2. 고막체온

- 적외선 귀 체온계 이용
- 직장체온측정보다 용이
- 부정확함



3. 액와부(겨드랑이) 체온

- 직장온도보다 낮게 나올 수 있음
- 고양이에서는 이도보다 액와추천



▶ [Can Vet J. 2011 Apr;52\(4\):403-406.](#)

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Comparison between auricular and standard rectal thermometers for the measurement of body temperature in dogs

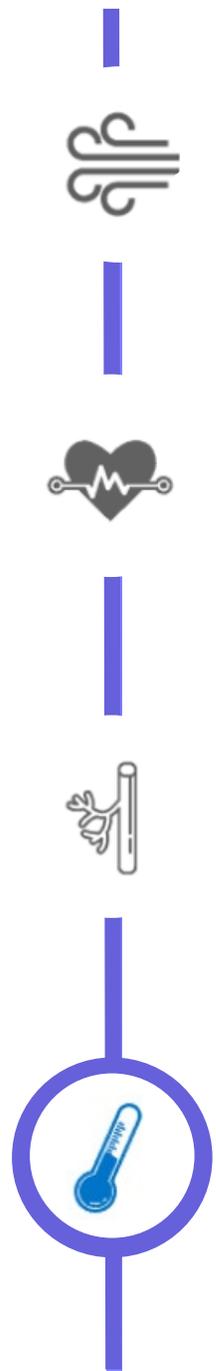
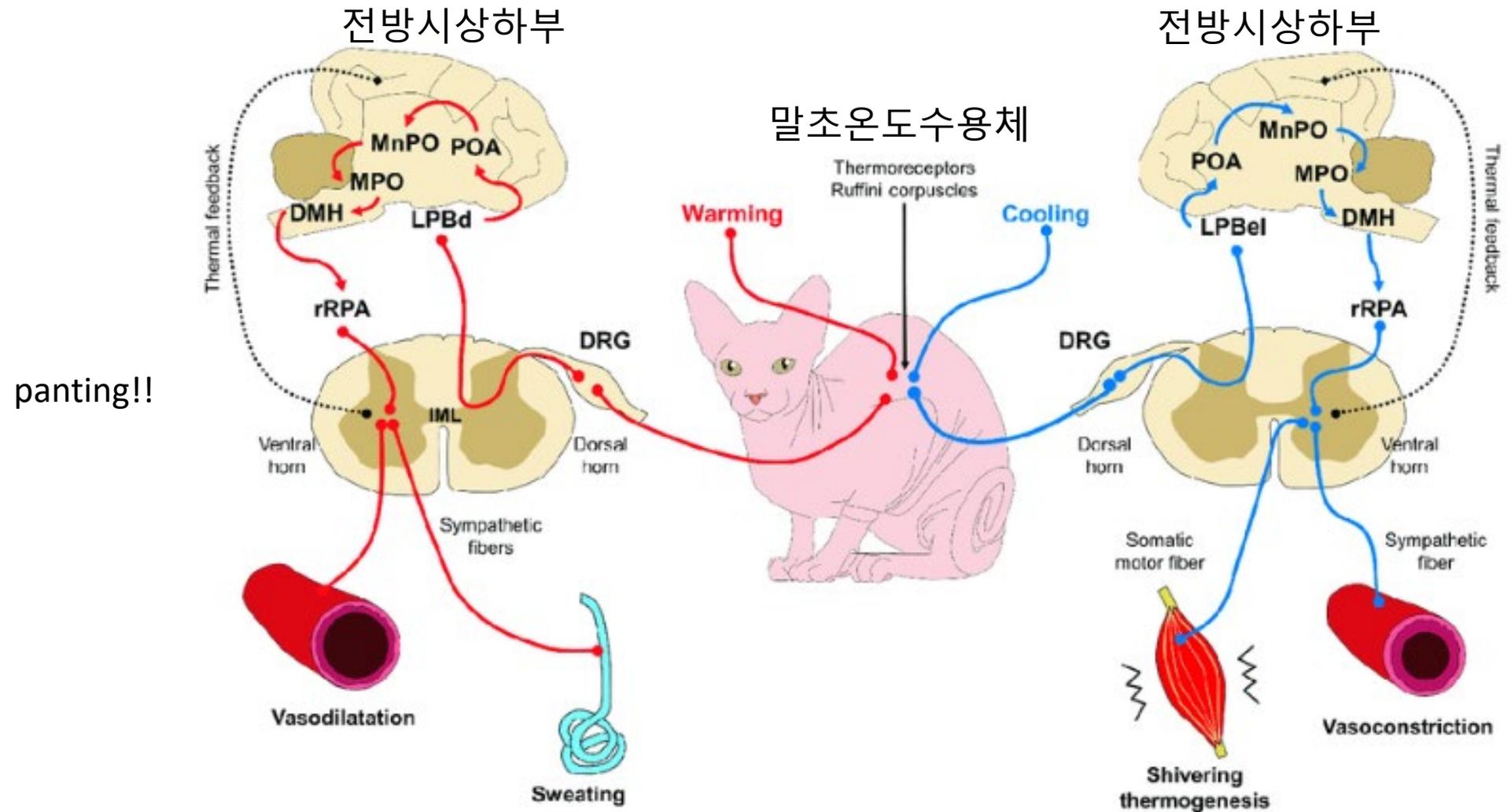
[Marlos G Sousa](#)^{1,✉}, [Roberta Carareto](#)¹, [Valdo A Pereira-Junior](#)¹, [Monally CC Aquino](#)¹

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PMCID: PMC3058653 PMID: [21731094](#)

In hypothermic anesthetized dogs, auricular thermometry was correlated with rectal temperature (1). Nonetheless, lower correlation was obtained as animals recovered from anesthesia and body temperature increased. When Pearson's correlation was considered, our results also documented a correlation between auricular and rectal measurements. However, this analysis is not appropriate for comparing 2 methods of measurement. In this case, for example, biases indicated that auricular thermometry might unreliably overestimate rectal measurements. This poor concurrence has implications for clinical management when temperature needs to be measured accurately. Also, in cats with varying temperatures the documented limits of agreement between auricular and rectal measurements were believed to be unacceptable for clinical purposes (4). A study in dogs (5), however, documented a good agreement between these measurements sites, as supported by very small biases.

Control mechanism to regulate BT



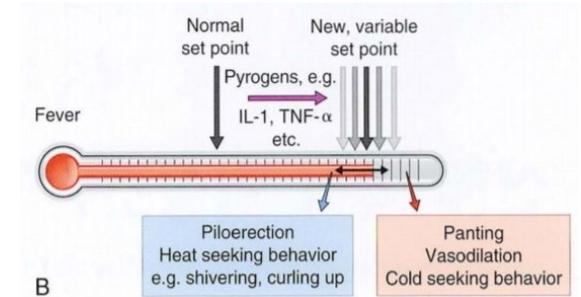


Fever VS Hyperthermia

”체온이 증가되는 현상”

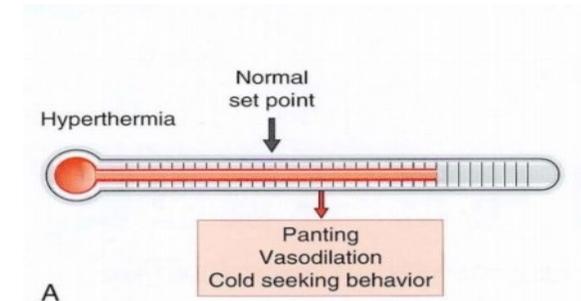
1. Fever, 고열(발열)

- 발열원에 의해 체온기준점 상승 : $BT > 39.2^{\circ}C$
- 체온을 낮추려는 반응을 보이지 않음
- 신체가 보이는 중요한 방어기전의 일부
- 감염, 면역매개반응, 종양, 염증, 기타 등



2. Hyperthermia, 고체온증

- 주로 환경 온도상승 때문에 발생 : $BT 40.5 - 43^{\circ}C$
- 체온을 낮추려는 생리/행동 반응 유도 : panting, cold seeking behavior
- 운동, 발작, 고대사성 질환(갑기항, 저칼슘혈증 등), 중독, 악성 고체온증, 약물(고양이 ketamine, opioid), 스트레스 등
- 해열제 사용 금기 : 해열제 부작용 및 효과 없음





Hypothermia

Hypothermia, 저체온증

- 항온동물에서 정상이하 체온을 유지하는 것 : $BT < 37^{\circ}C$
- 과량의 체열소실, 체열생산감소, 정상체온조절 기능붕괴 등
- 심혈관계, 호흡기계, 신경계, 대사체계(전해질, 산-염기, 응고계) 생리효과 유발
- 낮은 환경온도 노출, 질병의 합병증, 조직손상, 마취제 등 약물

- 재가온 안전속도 준수
: 시간당 $0.5 \sim 2^{\circ}C$ 씩만 올리기
: 재가온 쇼크, 화상, 과열 예방

표 49-2
재가온속도 ($^{\circ}C/hr$)²

| | 수동외부 재가온 | 능동외부 재가온 |
|----------|----------|----------|
| 1st hour | 1.4 | 1.5 |
| 2nd hour | 1.4 | 2.4 |

표 49-1
저체온증의 분류와 임상증상³

| 카테고리 | 체온 | 임상증상 |
|------|----------------------|--------------------------------------|
| 경증 | $36.7-37.7^{\circ}C$ | HR ↑, 정상MAP, 정상RR, 정상 LOC |
| 중등도 | $35.5-36.7^{\circ}C$ | ↓ MAP, ↓ HR (고양이), ↑ HR (개), 정신상태 몽롱 |
| 심함 | $33-35.5^{\circ}C$ | ↓ HR, ↓ MAP, 호흡억압, 심한 CNS 억압 |
| 위급함 | $<33^{\circ}C$ | 거의 죽은 것 같음, 치사율이 높음, Moribund |

CNS, Central nervous system; HR, heart rate; LOC, level of consciousness; MAP, mean arterial pressure; RR, respiratory rate.



Referance

- Noninvasive Blood Pressure Monitoring in the Canine and Feline Patient, March 10,2023: PEER REVIEWED, today's veterinary nurse
- Cote's clinical veterianary advisor dogs and cats, 4th
- Comparison between auricular and standard rectal thermometers for the measurement of body temperature in dogs, Marlos G Sousa 1, Roberta Carareto 1, Valdo A Pereira-Junior 1, Monally CC Aquino 1, Can Vet J. 2011 Apr;52(4):403–406.
- Textbook of Veterinary internal medicine : diseases of the dog and cat, eighth edition, ETTINGER

