



비엔 마취 세미나

: 진통: 술 중, 후 진통 (국소마취, 오피오이드, 진통소염제)

Previous seminar

- Anesthetic machine
 - Anesthetic machine check
 - Gas delivery system
 - Vaporizer
 - Oxygen flush valve
 - Breathing circuit
 - Breathing tube
 - Reservoir bag
 - Pop-off valve
 - Canister
 - Leaking test for rebreathing system
- Laryngoscope
 - Miller vs. Macintosh
- Endotracheal tube
 - Size
 - Inflating cuff
 - Leaking test for cuff
- NPO
- Aspiration
- Monitoring
 - HR, BP, SpO₂
- Gas sampling line

Pain management

Pain management

- Definition of pain
- Pain evaluation
- Classification of pain
- Duration of pain
- Type of analgesic drugs

Local anesthesia technique

- Infiltration
- Dental
 - Infra-orbital nerve block
 - Mental nerve block
 - Mandibular nerve block
- Forelimb
 - RUMM nerve block
- Hindlimb
 - Femoral and sciatic nerve block
- Epidural anesthesia

통증의 정의

- 통증은 신체의 손상 또는 질병으로 인한 **불쾌한 감각과 정서적 경험**으로 정의됩니다. 통증은 보호 메커니즘의 일부로, 신체의 위험 신호를 전달합니다.
- **통증 관리**는 통증을 체계적으로 평가하고 그에 맞는 적절한 조치를 취하는 과정입니다.



통증의 평가

TABLE 1

Pain Assessment Methods and Tools for Use in Cats

TOOL	ACUTE OR CHRONIC PAIN	USER	EASE OF USE	PURPOSE	VALIDITY*
Physical examination	Acute and chronic	Veterinarian	Moderate, requires training	Screening, diagnosing, monitoring	Not formally validated as an assessment of pain
Clinic observation	Acute and chronic	Veterinarian and veterinary technician	Moderate, requires training	Monitoring	Not formally validated as an assessment of pain
Physiological variables (heart rate; respiration; blood pressure)	Acute	Veterinarian and veterinary technician	Simple	Screening, monitoring	Not specific indicators of pain
Wound palpation	Acute	Veterinarian and veterinary technician	Simple	Monitoring	Not formally validated as a stand-alone assessment of pain; forms part of several validated tools
Home videos and photos	Acute and chronic	Owner collects information Veterinarian evaluates	Moderate, requires instructions	Screening, monitoring	Not formally validated as an assessment of pain
Actigraphy (activity monitoring)	Chronic	Clinical Research	Challenging to setup and operate	Monitoring	Valid

평가 항목

- 통증의 강도
- 성격
- 지속 시간
- 위치

평가 기준

- 시각적 아날로그 척도
- 주관적 평가

통증의 평가

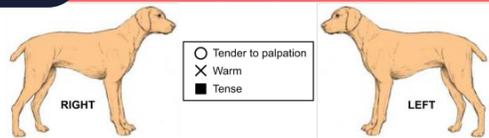


Date _____
Time _____

Colorado State University
Veterinary Medical Center
Canine Acute Pain Scale

Rescore when awake
 Animal is sleeping, but can be aroused - Not evaluated for pain
 Animal can't be aroused, check vital signs, assess therapy

Pain Score	Example	Psychological & Behavioral	Response to Palpation	Body Tension
0		Comfortable when resting Happy, content Not bothering wound or surgery site Interested in or curious about surroundings	<input type="checkbox"/> Nontender to palpation of wound or surgery site, or to palpation elsewhere	Minimal
1		Content to slightly unsettled or restless Distracted easily by surroundings	<input type="checkbox"/> Reacts to palpation of wound, surgery site, or other body part by looking around, flinching, or whimpering	Mild
2		Looks uncomfortable when resting May whimper or cry and may lick or rub wound or surgery site when unattended Droopy ears, worried facial expression (arched eye brows, darting eyes) Reluctant to respond when beckoned Not eager to interact with people or surroundings but will look around to see what is going on	<input type="checkbox"/> Flinches, whimpers cries, or guards/pulls away	Mild to Moderate Reassess analgesic plan
3		Unsettled, crying, groaning, biting or chewing wound when unattended Guards or protects wound or surgery site by altering weight distribution (i.e., limping, shifting body position) May be unwilling to move all or part of body	<input type="checkbox"/> May be subtle (shifting eyes or increased respiratory rate) if dog is too painful to move or is stoic <input type="checkbox"/> May be dramatic, such as a sharp cry, growl, bite or bite threat, and/or pulling away	Moderate Reassess analgesic plan
4		Constantly groaning or screaming when unattended May bite or chew at wound, but unlikely to move Potentially unresponsive to surroundings Difficult to distract from pain	<input type="checkbox"/> Cries at non-painful palpation (may be experiencing allodynia, wind-up, or fearful that pain could be made worse) <input type="checkbox"/> May react aggressively to palpation	Moderate to Severe May be rigid to avoid painful movement Reassess analgesic plan



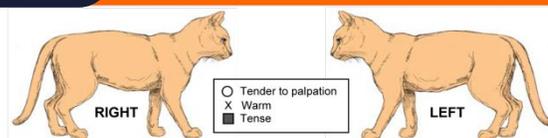
Comments _____



Colorado State University
Veterinary Medical Center
Feline Acute Pain Scale

Pain Score _____
No Score _____

Pain Score	Psychological & Behavioral	Response to Palpation	Body Tension
0	Animal is sleeping and cannot be evaluated Content and quiet when unattended Comfortable when resting Interested in or curious about surroundings	<input type="checkbox"/> Not bothered by palpation of wound or surgery site, or to palpation elsewhere	Minimal
1	Signs are often subtle and not easily detected in the hospital setting; more likely to be detected by the owner(s) at home Earliest signs at home may be withdrawal from surroundings or change in normal routines in the hospital, may be content or slightly unsettled Less interested in surroundings but will look around to see what is going on	<input type="checkbox"/> May or may not react to palpation of wound or surgery site	Mild
2	Decreased responsiveness, seeks solitude Quiet, loss of brightness in eyes Lays curled up or sits tucked up (all four feet under body, shoulders hunched, head held slightly lower than shoulders, tail curled tightly around body) with eyes partially or mostly closed Hair coat appears rough or fluffed up May intensively groom an area that is painful or irritating Decreased appetite, not interested in food	<input type="checkbox"/> Responds aggressively or tries to escape if painful area is palpated or approached <input type="checkbox"/> Tolerates attention, may even perk up when petted as long as painful area is avoided	Mild to Moderate Reassess analgesic plan
3	Constantly yowling, growling, or hissing when unattended May bite or chew at wound, but unlikely to move if left alone	<input type="checkbox"/> Growls or hisses at non-painful palpation (may be experiencing allodynia, wind-up, or fearful that pain could be made worse) <input type="checkbox"/> Reacts aggressively to palpation, adamantly pulls away to avoid any contact	Moderate Reassess analgesic plan
4	Prostrate Potentially unresponsive to or unaware of surroundings, difficult to distract from pain Receptive to care (even mean or wild cats will be more tolerant of contact)	<input type="checkbox"/> May not respond to palpation <input type="checkbox"/> May be rigid to avoid painful movement	Moderate to Severe May be rigid to avoid painful movement Reassess analgesic plan



Comments _____

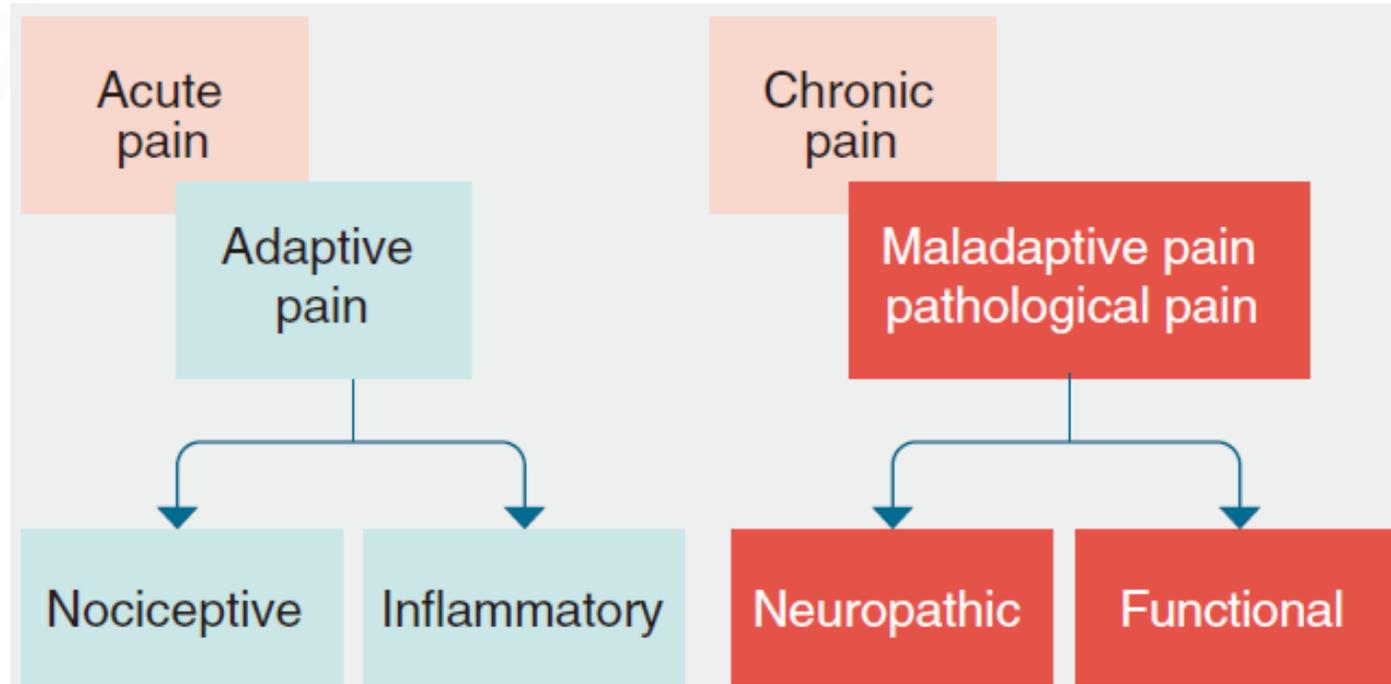
TABLE 1 (Continued)

TOOL	ACUTE OR CHRONIC PAIN	USER	EASE OF USE	PURPOSE	VALIDITY*
CLINICAL METROLOGY INSTRUMENTS (CMIS)					
Colorado Acute Pain Scale Feline ^a	Acute	Veterinarian and veterinary technician	Simple	Monitoring	Not validated
Glasgow Composite Measure Pain Scale—feline ^b	Acute	Veterinarian and veterinary technician	Moderate	Monitoring	Moderately validated
UNESP-Botucatu Multidimensional Composite Pain Scale ^c	Acute	Veterinarian and veterinary technician	Moderate	Monitoring	Valid
Feline Grimace Scale ^d	Acute	Veterinarian and veterinary technician	Simple	Screening, monitoring	Valid
Musculoskeletal Pain Screening Checklist (MiPSC) ^e	Chronic, osteoarthritis	Owner	Simple	Screening	Valid
Feline Musculoskeletal Pain Index (FMPI) ^f	Chronic, osteoarthritis	Owner	Simple	Monitoring	Valid
Montreal Instrument for Cat Arthritis Testing—Caretaker (MICAT-C) ^g	Chronic, osteoarthritis	Owner	Simple	Monitoring	Moderately validated
Client-specific outcome measures ^h	Chronic, osteoarthritis	Owner	Moderate	Monitoring	Moderately validated
Health-related quality of life (HRQL) ⁱ	Chronic	Owner	Simple	Monitoring	Moderately valid (not specific to pain)

통증의 분류

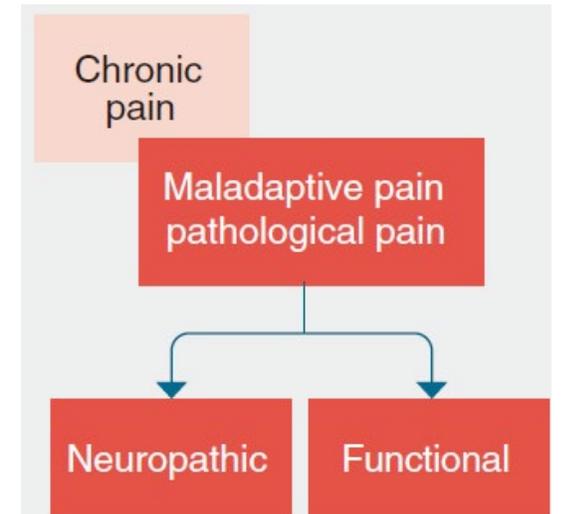
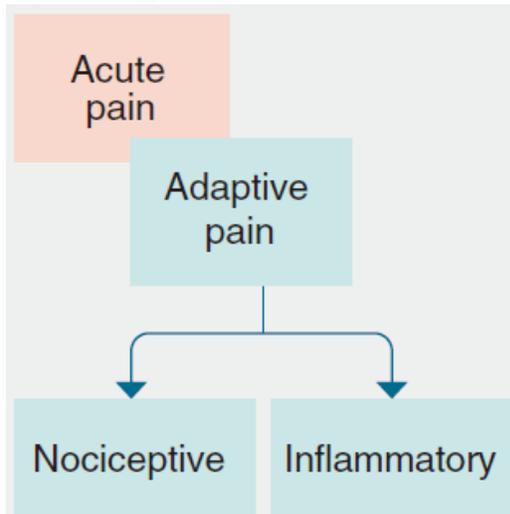
급성 통증: 짧은 기간 동안 발생하며 신체 손상에 반응하는 통증.

만성 통증: 3개월 이상 지속되는 통증으로, 신체 손상과 직접 관련이 없을 수 있습니다.



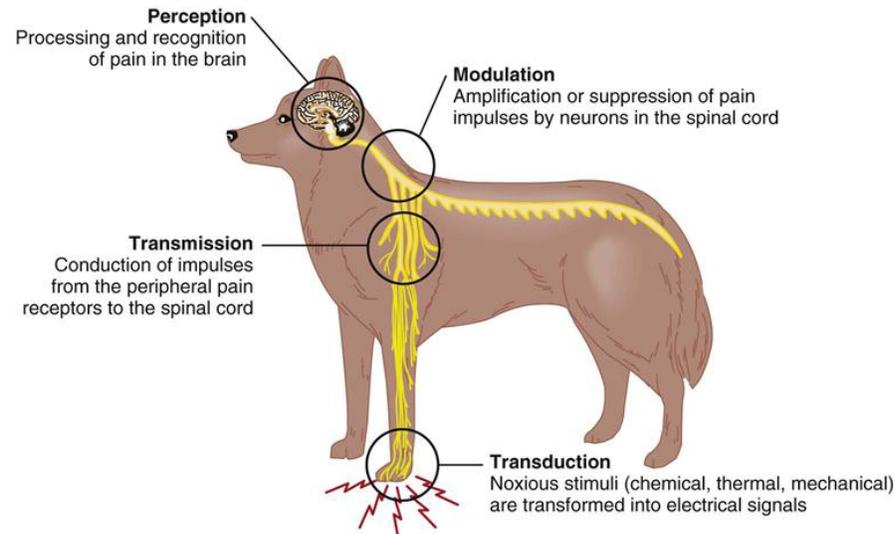
+ Ghost pain: neuroplastic pain (after amputation)

통증의 기간



진통제의 종류

- 비마약성 진통제: NSAIDs(비스테로이드성 항염증제), 염증성 통증에 사용됩니다.
- 마약성 진통제: 심한 통증에 사용되며, 오피오이드가 대표적입니다.
- 전신 마취제: 전신 마취를 통해 통증의 인식 과정을 낮춥니다.
- 국소 마취제: 국소 부위의 통증을 줄이기 위해 사용됩니다
- 진정제: 단독적인 진통 효과는 적을 수 있으나 다른 진통제의 효과를 상승시킴



진통제의 종류

- 마약성 진통제: 심한 통증에 사용되며, 오피오이드가 대표적입니다.
- 내장통을 완화하는데 추천됩니다.
- 변비, 오심, 호흡 곤란 등의 부작용이 발생할 수 있습니다.

TABLE 2.
Potency and Half-Life of Opioid Agents

Opioid Agonists	Potency	Half-Life
Morphine	1	2 to 3 hours
Meperidine	0.1	2 to 3 hours
Hydromorphone	5 to 8	2 to 3 hours
Oxymorphone	10	1 to 4 hours
Methadone	1	12 to 24 hours
Fentanyl	100	20 to 30 minutes
Sufentanil	1000	20 to 30 minutes
Alfentanil	20	10 to 15 minutes
Remifentanyl	100	5 to 8 minutes
Agonist/Antagonists		
Butorphanol	5	2 to 4 hours
Nalbuphine	1	4 to 5 hours
Pentazocine	0.3 to 0.4	2 to 3 hours

Opioid	Strength (Codeine)	Equivalent Dose (30 mg codeine)	Strength (Morphine)	Equivalent Dose (10 mg morphine mg)
Aspirin	13150	1080 mg	1/360	3600 mg
Difusinal	35811	480 mg	1/160	1600 mg
Dextropropoxyphene	35799	120 mg	14611	400 mg
Codeine	1	30 mg	35805	100 mg
Tramadol	1	30 mg	35805	100 mg
Anileridine	2.5	12 mg	35799	40 mg
Demerol	3.6	8.3 mg	0.36	27.8 mg
Hydrocodone	6	5 mg	0.6	16.67 mg
Morphine	10	3 mg	1	10 mg
Oxycodone	15-20	1.5-2 mg	1.5-2	4.5-6 mg
Morphine IV/IM	40	.75 mg	4	2.5 mg
Hydromorphone	50	.6 mg	5	2 mg
Oxymorphone	70	0.4 mg	7	1.4 mg
Levorphanol	80	0.26 mg	8	.8 mg
Buprenorphine	400	0.075 mg	40	.25 mg
Fentanyl	500-1000	0.03-0.06 mg	50-100	0.1-0.2 mg

<https://patient.azureedge.net/forums/images/upload/540852-3d3baf94-92d8-49d5-8c81-da671ceee828.jpg>

진통제의 종류

- 전신 마취제: 전신 마취를 통해 통증의 인식 과정을 낮춥니다.
- 일반적으로 모든 종류의 통증을 완화시킬 수 있습니다.
 - Propofol: IV, 통증의 인식 저해
 - Alfaxalone: IV and IM, 통증의 인식 저해
 - Ketamine: IV, IM and SC, 통증의 인식 저해, 체성통증 감소
 - Isoflurane: 흡입, 통증의 인식 저해 (연조직 수술 > 1.5%, 절골술 > 2.0%)

진통제의 종류

- 국소 마취제: 국소 부위의 통증을 줄이기 위해 사용됩니다
- 체성통을 완화하는데 추천됩니다.
- Amputation 시, ghost pain 발생율을 감소시킵니다.
- 감각 소실로 인한 외상이 발생할 수 있습니다.
 - Lidocaine 2%: < 0.4 mL/kg (8 mg/kg)
 - Bupivacaine 0.5%: < 0.4 mL/kg (2 mg/kg)

DRUG	LIDOCAINE	PRILOCAINE	BUPIVACAINE	L-BUPIVACAINE	ROPIVACAINE
Description	Amide	Amide	Amide	Amide	Amide
Relative potency	2	2	8	8	6
Onset	5-10 min	5-10 min	10-15 min	10-15 min	10-15 mins
Duration without epinephrine	1-2 hours	1-2 hours	3-12 hours	3-12 hours	3-12 hours
Duration with epinephrine	2-4 hours	2-4 hours	4-12 hours	4-12 hours	4-12 hours
Max dose without epinephrine	3 mg/kg	6 mg/kg	2 mg/kg	2.5 mg/kg *	3 mg / kg *
Max dose with epinephrine	7 mg/kg	9 mg/kg	2.5 mg/kg	3 mg/kg *	4 mg / kg *

* INDICATES PROBABLE SAFE MAXIMUM DOSE (INSUFFICIENT DATA).

https://resources.wfsahq.org/wp-content/uploads/049_table-1-768x224.jpg

진통제의 종류

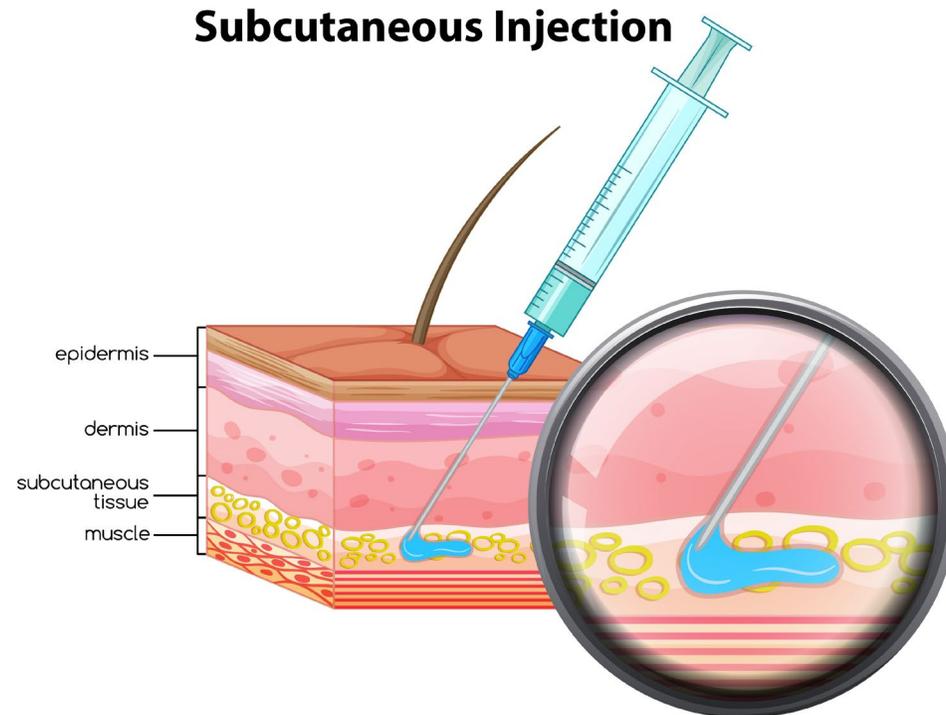
• **진정제:** 단독적인 진통 효과는 적을 수 있으나 다른 진통제의 효과를 상승시킵니다.

- Medetomidine
- Acepromazine
- Midazolam
- Gabapetin

국소마취

침윤 마취 (Infiltration)

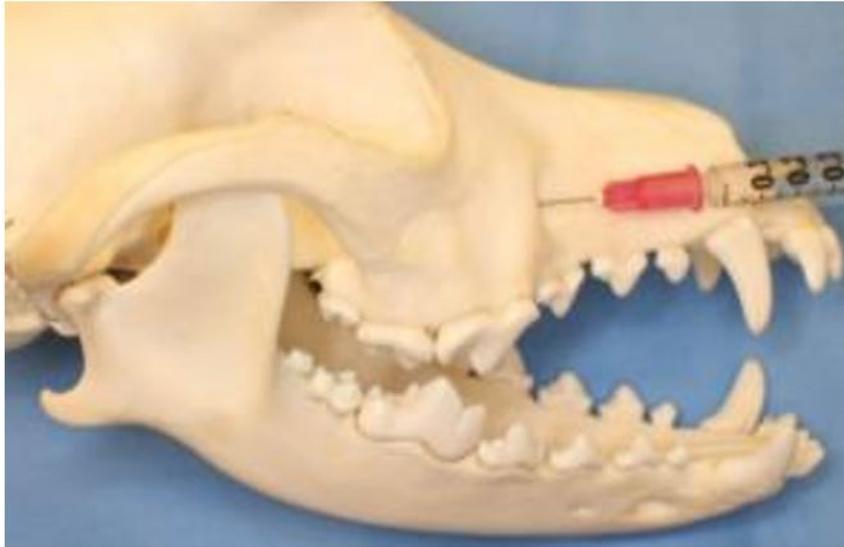
- SC 주사 (백신 주사와 동일)
- 피부 신경을 차단 한다.
- 수술 절개 상황과 입원 시 움직임으로 인한 통증 완화에 도움이 됩니다.



국소마취

치과 국소마취

- 상악 감각 차단술
- 상악 4th premolar 윗쪽 구멍을 촉진
- 국소마취제
 - 개: 0.5-1.0 mL/site
 - 고양이 : 0.25-0.5mL/site



국소마취

치과 국소마취

- 하악 앞니 감각 차단술
- 하악 1-2nd premolar 아래 구멍을 촉진
- 국소마취제
 - 개: 0.5-1.0 mL/site
 - 고양이 : 0.25-0.5mL/site



국소마취

치과 국소마취

- 하악 감각 차단술
- 하악 안쪽과 바깥쪽에 손가락을 이용해 턱뼈 안쪽의 Mandibular foramen을 촉진
- 국소마취제
 - 개: 0.5-1.0 mL/site
 - 고양이 : 0.25-0.5mL/site



국소마취

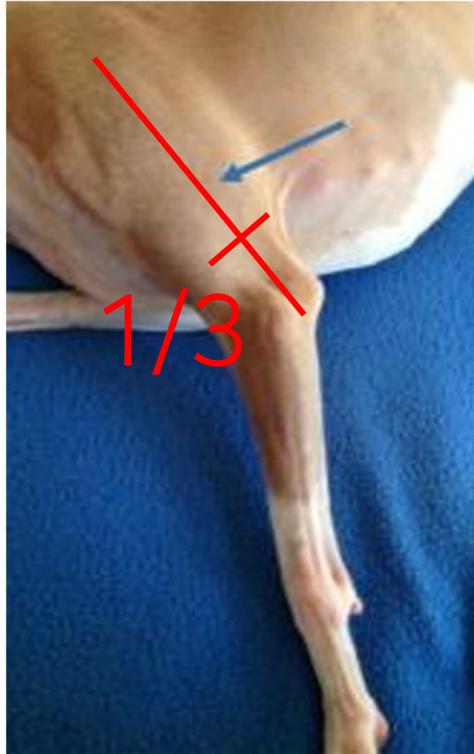
앞다리 국소마취

- Radial, ulnar, median, musculocutaneous 신경을 차단
- 앞다리가 수술 부위일 때 사용가능 (연조직 수술, 절골술)
- 국소마취제
 - 개
 - Lidocaine 2%: 0.4 mL/kg
 - Bupivacaine 0.5%: 0.4 mL/kg
 - Lidocaine + Bupivacaine: 0.2 + 0.2 mL/kg
 - 고양이 : 0.25-0.5mL/site
 - Lidocaine 2%: 0.2 mL/kg
 - Bupivacaine 0.5%: 0.2 mL/kg
 - Lidocaine + Bupivacaine: 0.1 + 0.1 mL/kg

국소마취

앞다리 국소마취

- Radial, ulnar, median, musculocutaneous 신경을 차단
- 앞다리가 수술 부위일 때 사용가능 (연조직 수술, 절골술)



국소마취

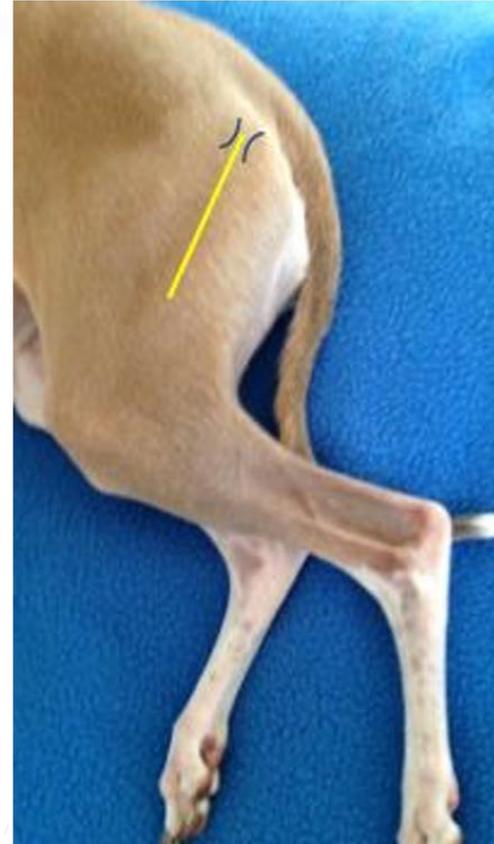
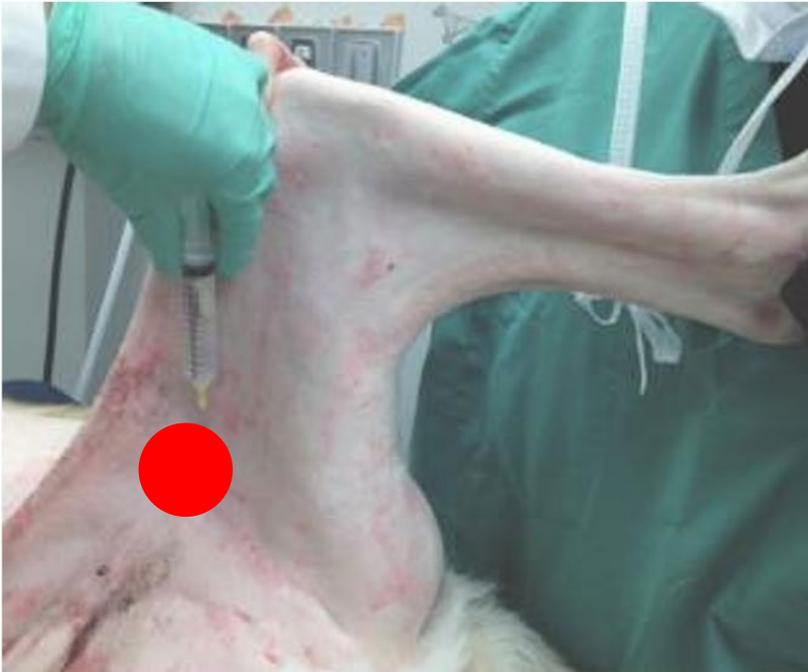
뒷다리 국소마취

- Femoral, Sciatic 신경을 차단
- 뒷다리가 수술 부위일 때 사용가능 (연조직 수술, 절골술)
- 국소마취제
 - 개
 - Lidocaine 2%: 0.4 mL/kg
 - Bupivacaine 0.5%: 0.4 mL/kg
 - Lidocaine + Bupivacaine: 0.2 + 0.2 mL/kg
 - 고양이 : 0.25-0.5mL/site
 - Lidocaine 2%: 0.2 mL/kg
 - Bupivacaine 0.5%: 0.2 mL/kg
 - Lidocaine + Bupivacaine: 0.1 + 0.1 mL/kg

국소마취

뒷다리 국소마취

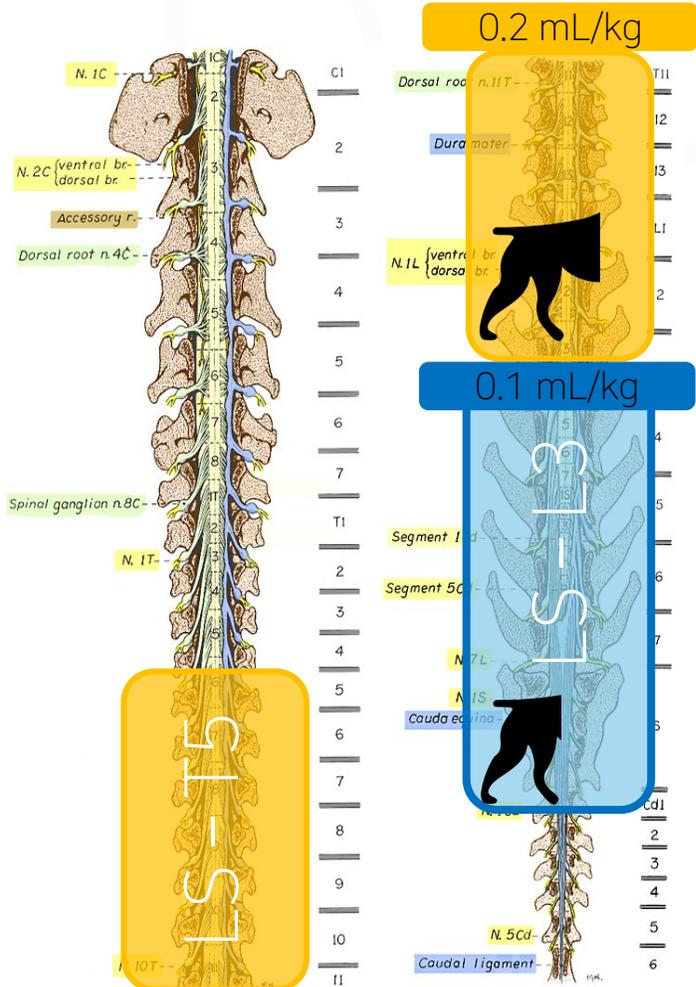
- Femoral, Sciatic 신경을 차단
- 뒷다리가 수술 부위일 때 사용가능 (연조직 수술, 절골술)



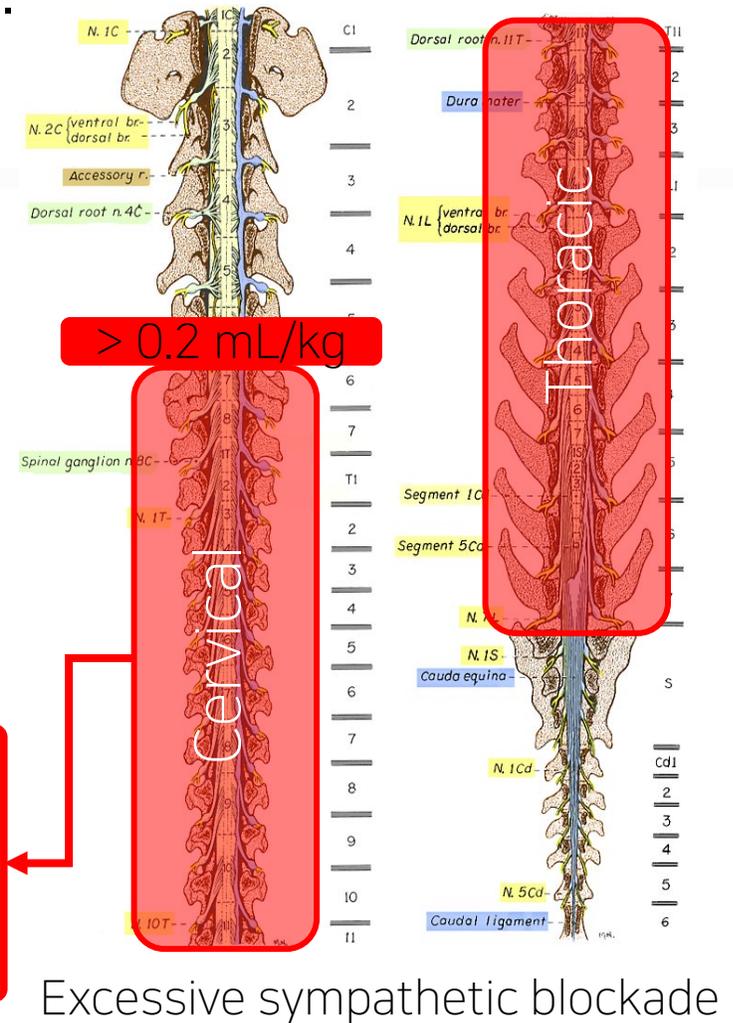
국소마취

경막외마취

- 척수의 감각 차단을 유도해 하반신의 전반적인 진통효과를 기대한다.
- 투여하는 용량에 따라서 진통 효과가 나타나는 범위가 달라진다.



Cardiovascular depression,
Horner's syndrome, ataxia,
paraplegia, depression, stupor,
and intermittent cough



국소마취

경막외마취

- 척수의 감각 차단을 유도해 하반신의 전반적인 진통효과를 기대한다.
- 투여하는 용량에 따라서 진통 효과가 나타나는 범위가 달라진다.



국소마취제 사용의 주의점

- 혈관 주입을 막기 위해 “Suction” 과정을 필수적으로 진행한다.
- 신경 내 주입을 막기 위해 주사 과정 중 압력이 발생한다면 바늘을 살짝 빼고 주입을 시도한다.
- 주사를 하는 부위에 다른 위험 요소 (흉강, 방광, 장, 등)을 찌를 우려가 있는 경우 주의한다.
- 종양 환자의 경우 국소마취를 시행하는 부위는 종양 Margin을 고려해야 한다.

국소마취제 사용의 보조도구

- 신경근 자극기
- 운동 신경이 포함된 신경을 탐색하는데 도움이 된다.
- Blind technique 보다 성공률이 높고 편하다.



국소마취제 사용의 보조제

- 약물전달체



Product Information

Product Name

ez:AP

Model Name

P5 (For mixing 5 mL)

Appearance

Lyophilized Powder in Vial

Medical Device Name

Name : Wound Dressing

APQA Approval Number

Veterinary Medical Device 380-001

Purpose of Use

Drug Delivery Device to Relieve Surgical-site Pain for over 24 Hours

- Use mixed with a local anesthetic.
- Surgical site pain relief for over 24 hours.
- Related Articles :

College of Veterinary Medicine, Seoul National University, Prof. Inhyung Lee, Prof. Won-Gyun Son.

J.Y. Kim, D.H. Kim, D.H. Shin, T.H. Sung, S.H. Rhee, Minha Kim, Changhun Nam(2022).

Effect of temperature-responsive hydrogel on femoral and sciatic nerve block using bupivacaine in Beagle dogs :

Veterinary Medicine and Science(VetMed Sci. 2022;1-7).

<https://doi.org/10.1002/vms3.1049>

Kim, D.H. Kim, D.H. Shin, T.H. Sung, S.H. Rhee, Minha Kim, Changhun Nam(2022).

국소마취제 사용의 보조제

- 에피네프린
- 주사 부위의 혈관을 수축 시켜 약물의 전신 흡수를 줄여 더 많은 용량을 사용할 수 있다.
- 1:200,000 희석된 에피네프린+국소마취제를 사용한다.



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