

Antimicrobial Selection and Therapy for Equine Musculoskeletal Trauma

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Surgical site infections (SSI)

- Microbial contamination unavoidable
- Infection results from interplay between quantity of bacteria, virulence, immune status of the patient
- Presence of foreign material (sutures, implants)



Risk factors for SSI

■ Host related

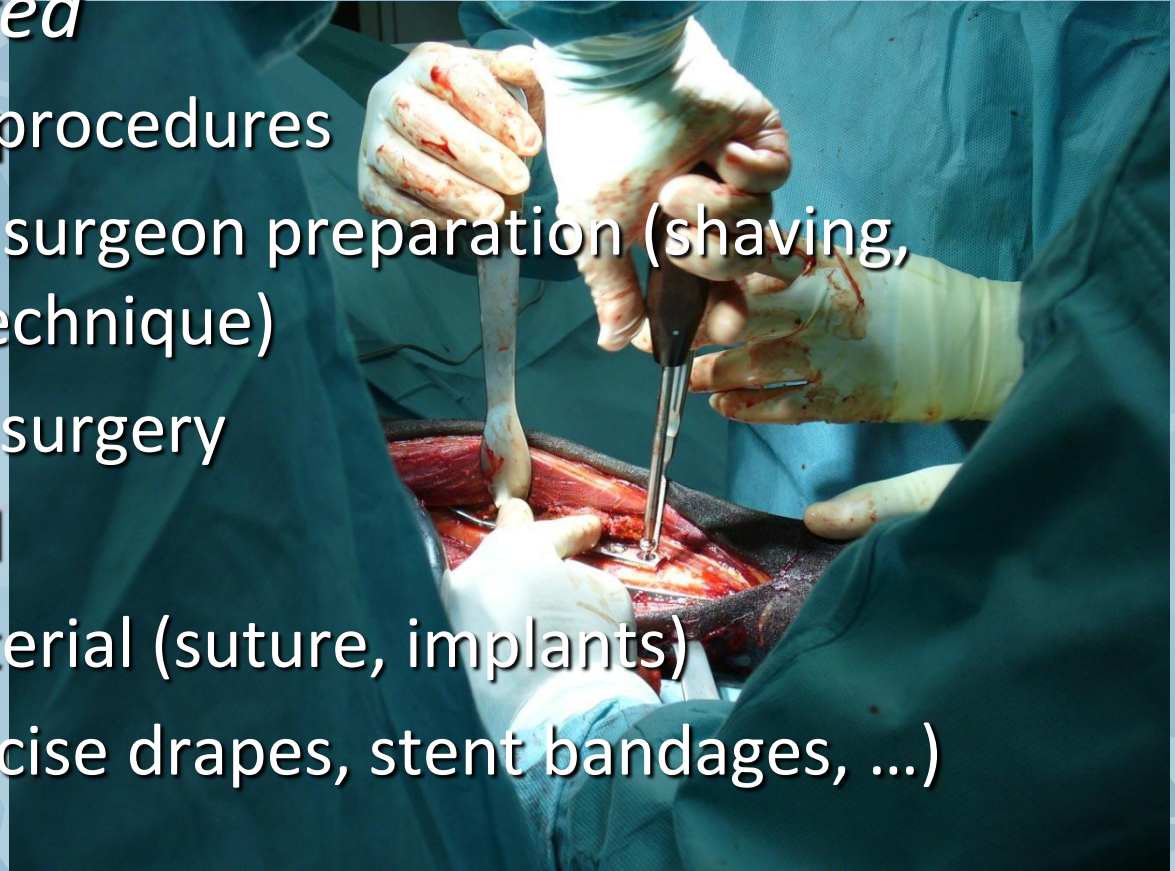
- Extremity of age
- Gender (female)
- Immunocompromise (steroids, failure colostrum)
- Weight (> 300-325 kg)
- Other sites of infection
- Hypoxia (general and local)
- Foreign material (dirt, clay ...)



Risk factors for SSI

■ *Surgery related*

- Emergency procedures
- Patient and surgeon preparation (shaving, scrubbing technique)
- Duration of surgery
- Surgical skill
- Foreign material (suture, implants)
- Bandage (incise drapes, stent bandages, ...)



Risk factors for SSI

- Germ related
 - Virulence (*Staphylococcus aureus*, *Enterobacter spp*, *Pseudomonas*, anaerobs)
 - Biofilm
 - Concentration



Preventive measures for SSI

■ Preoperative

- Preoperative exams (underlying diseases)
- Remove gross contamination (grooming)
- Clip hair just before induction (no shaving)
- Strict aseptic preparation and surgery
- Minimize surgical time (careful planning)
- Instruments adequate, available and sterile
- Appropriate perioperative antimicrobials

Preventive measures for SSI

- Intraoperative (some)
 - Double gloving for draping - Orthopedic gloves
 - Administer antimicrobials if appropriate
 - Strict scrubbing and sterile preparation
 - Appropriate draping
 - Lavage or debride contaminated sites
 - Minimize foreign material (suture)
 - Drain exit far from surgical wound
 - Change gloves and gowns after 2 hrs

Preventive measures for SSI

- Postoperative

- Protect surgical site (bandages)
- Therapeutic antimicrobials if appropriate
- Minimize hospitalization
- Accurate discharge instructions (wound care, suture removal, exercise regimen)



Antimicrobial regimen

■ Prophylactic antibiotics

- Short period of time
- Reduce concentration of bacteria at the surgical site
- Prevent SSI

■ Therapeutic antibiotics

- In case of established infections
- Overcome for 48 h resolution of signs
- Choice of AB after antibiogram
- Drain pus, remove devitalized tissue



Prophylactic antibiotics

■ Rules:

- (1) when a clinical trial has demonstrated positive effect or the occurrence of SSI would have catastrophic effects
- (2) a safe, inexpensive, bactericidal, broad spectrum antimicrobial active on the most common contaminant bacteria, is used;
- (3) optimal tissue concentration during surgery;
- (4) adequate tissue levels are maintained throughout all the procedure.

Therapeutic antibiotics

- Contaminated surgeries, open fractures, use of implants
- At least five days, or even longer according to postoperative evolution and evaluations
- Should overcome for at least 48 hrs the resolution of signs (pain, fever, discharge, leukocytosis, neutrophilia)

Antimicrobials

Antimicrobial	Route	Dosage	Spectrum of Activity
PENICILLINS			
Penicillin G (Na or K)	IV	22,000-40,000 UI/kg q 6 hr	Gram+ incl. <i>Streptococci</i> , and some <i>Staphylococcus</i> spp
Ticarcillin	IV IM	50-100 mg/kg q 6 hr	Also <i>Pseudomonas</i>
CEPHALOSPORINS			
Cefazolin (1 st generation)	IV IM	20 mg/kg q 8 hr	<i>Streptococcus</i> , <i>Staphylococcus</i> (including penicillinase producers), <i>Echerichia Coli</i> , <i>Klebsiella</i> , <i>Proteus mirabilis</i>
Ceftiofur (3 rd generation)	IV IM	2.2 mg/kg q 12 hr	Gram +, expanded to Gram – and anaerobs
AMINOGLYCOSIDS			
Gentamicin	IV IM	6.6 mg/kg q 24 hr	Gram- aerobs
Amikacin	IV IM	7 mg/kg q 24 hr	Expanded Gram- spectrum
SULFONAMIDES			
Trimethoprim-sulfamethoxazole	PO	15 mg/kg q 12-24 hr	Gram+ and Gram- aerobs, some anaerobs

Routes of administration

Systemic

- Oral, IV, IM
- Simple administration
- Does not require contention nor sedation
- High quantities, costs
- Side effects

Local

- Expose the pathogen to very high concentrations of the drug
- Avoid side and toxic effects of systemic high dose antimicrobials
- Reduce the total amount of drug used for therapy reducing costs

Local delivery

- PMMA or POP impregnated
- Collagen impregnated
- Regional Limb Perfusion
 - Intravenous
 - Intraosseous

Always appropriate selection of antimicrobial, based on culture and sensitivity results



PMMA impregnated



- High levels of antimicrobials
- Biocompatible and elution profile known
- Gentamicin, amikacin, tobramycin, cephalosporins and enrofloxacin
- Not absorbable
- Liquid or solid form
- Exothermic reaction

POP impregnated

- Biocompatible
- Slow degradation
- Does not need removal
- Very low cost
- About 80% of the antibiotic is eluted in the first 48 hrs



Collagen

- Gentamicin impregnated
- Absorbable
- Commercially available



Intravenous regional perfusion

- ✓ To treat infections or contaminated conditions distal to a large peripheral vessel
- ✓ Under sedation or general anaesthesia
- ✓ Apply a tourniquet proximally and possibly distally
- ✓ Use a butterfly or an over the needle catheter
- ✓ Better large veins (radial or saphena)
- ✓ Preserve the vein (repeated treatments)
- ✓ Volume of 30-60 ml over 15 minutes
- ✓ Leave for 30-40 minutes

Intraosseus regional perfusion

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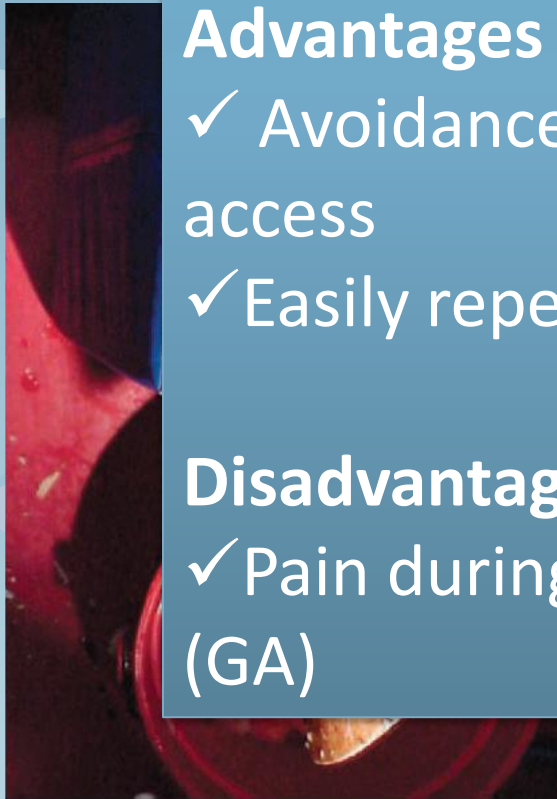
Intraosseus vs Intravenous regional perfusion

Advantages of RIOP

- ✓ Avoidance of direct venous access
- ✓ Easily repeated even daily

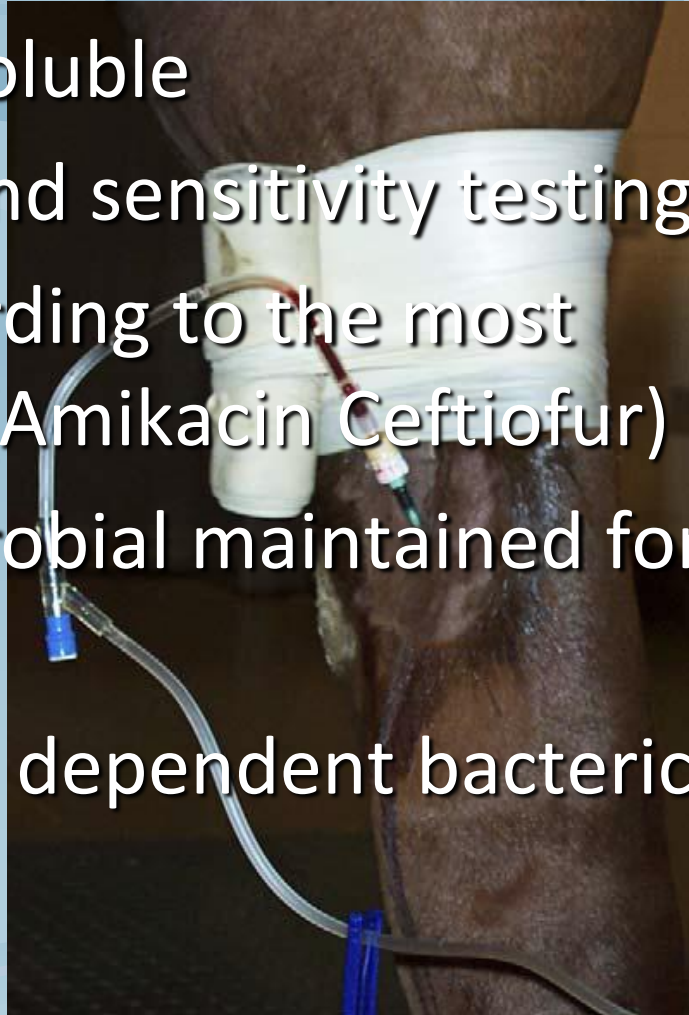
Disadvantages

- ✓ Pain during drilling and infusion (GA)



Regional limb perfusion

- Antimicrobial hydro-soluble
- Selection on culture and sensitivity testing
- Initial treatment according to the most common pathogens (Amikacin Ceftiofur)
- High doses of antimicrobial maintained for at least 24 hrs
- Time vs concentration dependent bactericidal antibiotics



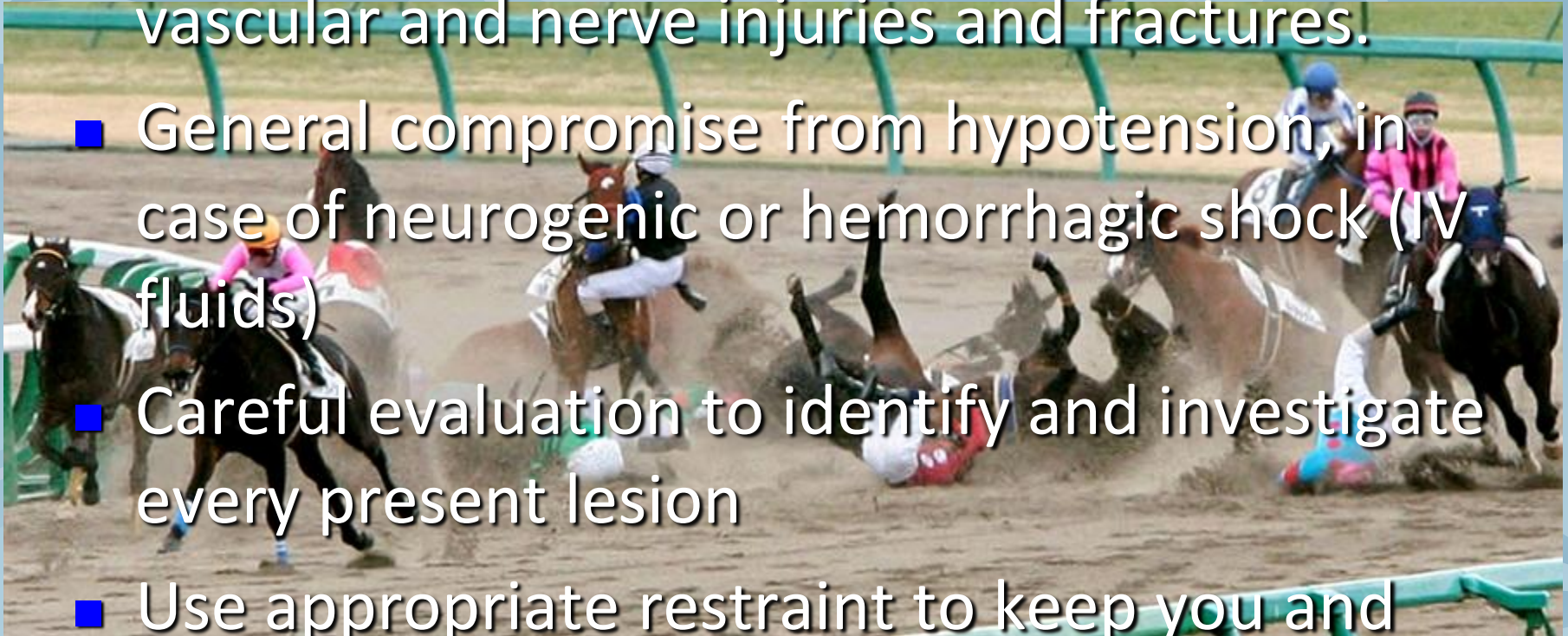
Regional limb perfusion

- Choice of antimicrobial
- Specific pharmaco-dynamic particularities
- Antimicrobial association in the same solution
- Optimal dosage
- RLP performed daily, or even every 2-3 days



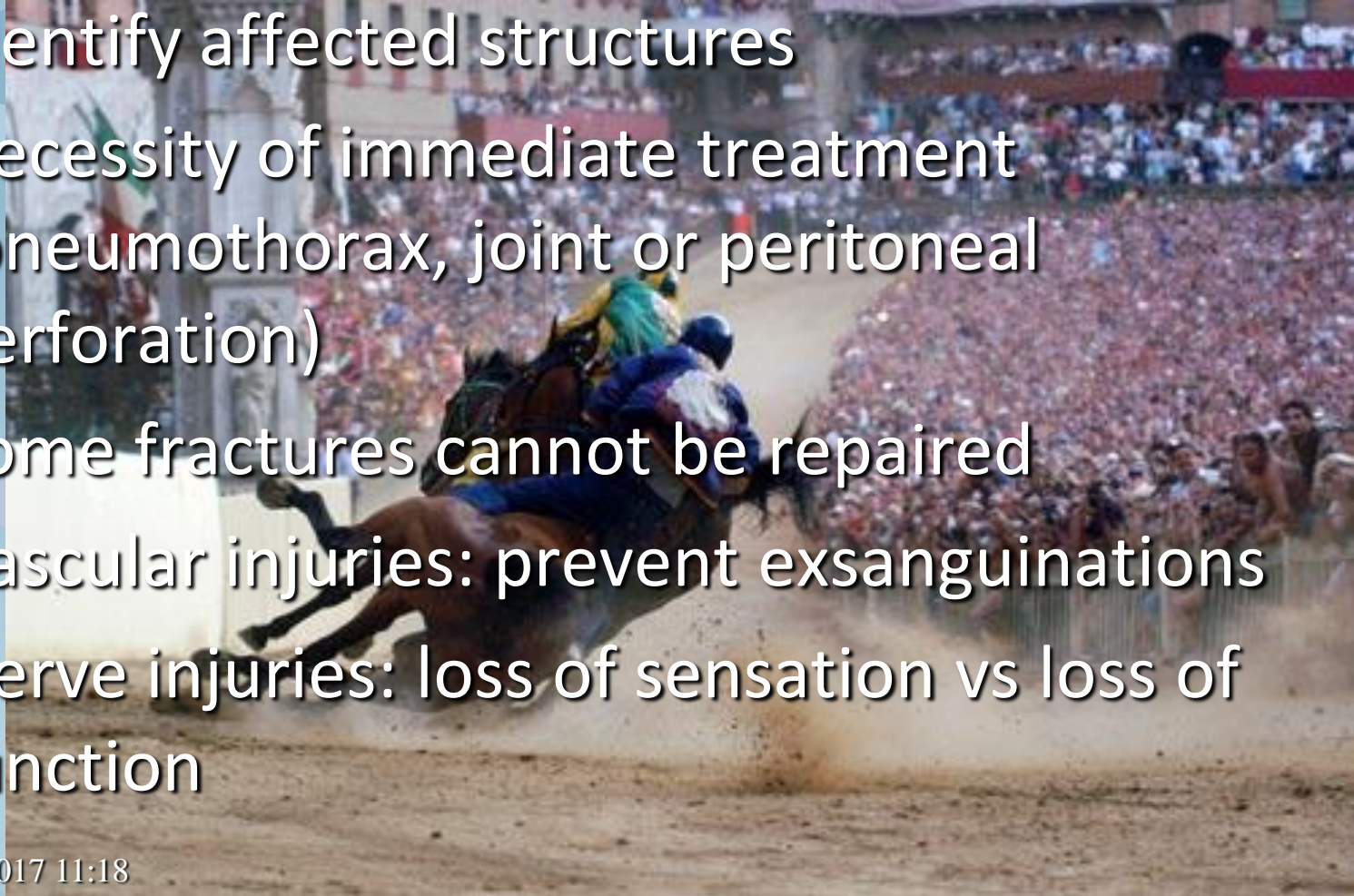
Therapy for equine musculoskeletal trauma

- The types of lesions: wounds and lacerations, vascular and nerve injuries and fractures.
- General compromise from hypotension, in case of neurogenic or hemorrhagic shock (IV fluids)
- Careful evaluation to identify and investigate every present lesion
- Use appropriate restraint to keep you and your patient safe during assessment



Therapy for equine musculoskeletal trauma

- Identify affected structures
- Necessity of immediate treatment (pneumothorax, joint or peritoneal perforation)
- Some fractures cannot be repaired
- Vascular injuries: prevent exsanguinations
- Nerve injuries: loss of sensation vs loss of function



Therapy for equine musculoskeletal trauma

- Optimal treatment includes:
 - further sedation and eventually anesthesia
 - wound management
 - stabilization of the fracture
 - administration of proper analgesia and anti-inflammatory medications
 - prophylaxis for infections (antimicrobials)
 - intravenous fluid therapy
 - proper transportation to a specialized clinic

