

# Infection prophylaxis in treatment by External Fixation

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# External fixation

Is used in:

- Fracture healing
- Bone transplantation
- Diagnostics
- Correction of deformities
  - Bone
  - Soft tissues
- Permanent or temporary treatment

# External fixation

## Advantages

- Stability in fracture healing
- Reconstruction
- Several levels
- Care of other injuries
- Mobilisation of joints
- Early mobilisation
- High level of activity possible

# External fixation

A successful treatment needs .....

- Knowledge and experience
- Patient selection
- Avoiding complications

# External fixation

## Complications

**Pin site infection –  
the most common complication**

- Painful
- Delays mobilization
- Severe complications

# External fixation

## Complications

### Infection – Consequences

- Pin loosening
  - interrupted treatment
- Septic arthritis
- Osteomyelitis
- Low virulent infections
  - problems in future surgery

# Pin site infection

## Clinical symptoms

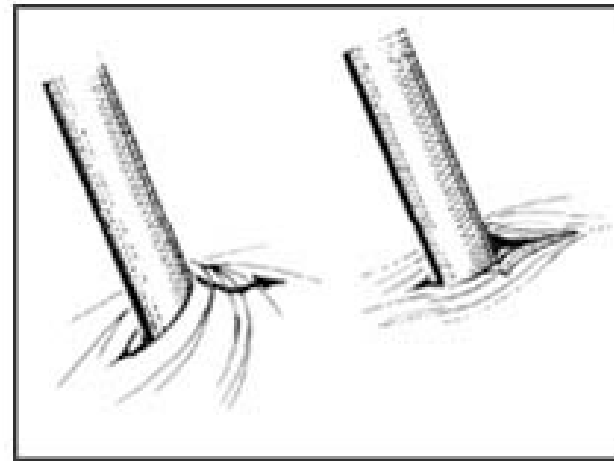
- Pain and tenderness
  - Redness and warmth
  - Leakage
  - Swelling

# Pin site infection

## Surgical technique

### Incorrect placement of a pin the most frequent cause of infection

- "Tight" skin/soft tissue incision
  - discomfort for the patient
  - limitation of the muscle function



# Pin site infection

## Pin fixation

- Choice of pin type
- Insertion technique
- Stability
  - Pin loosening
- Risk of infection

# Pin site infection

## Fixator application

- Protection of soft tissues
- Protection of the skin
- Possibility of pin site / wound care

## Localisation of pins

- More soft tissues
- Close to a joint

## Correction

- Enhanced load on:
  - Skin
  - Pins and fixator

# Pin site infection

## Weight bearing and movement

- Successively increased
  - Functional ability
  - Weight bearing
  - Joint movement
- Advantages
  - Stimulate bone healing
  - Decrease oedema
- But...overloading
  - Increases the risk of pin site infection

# **Pin site infection**

## **Antibiotics**

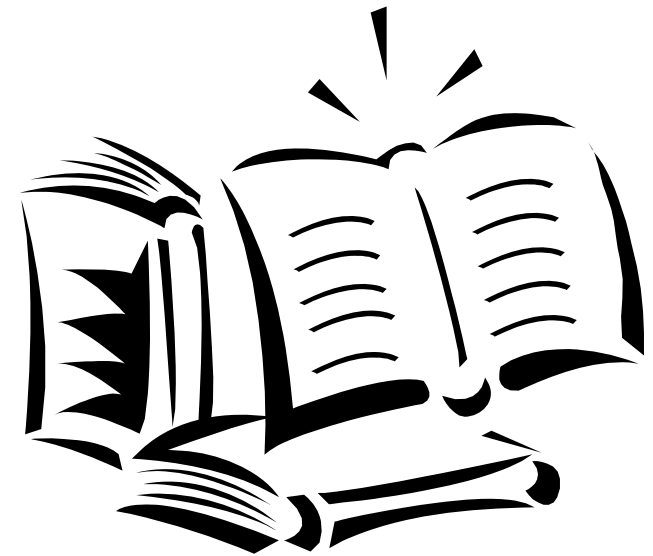
**Risk of developing resistant bacteria**

**Antibiotics, as prophylaxis and as treatment,  
should be used as little as possible**

# Pin site infection

## Presence

- De Bastiani et al. (1984)  
0.92 % of the pins
- Sims and Saleh (2002)  
71 % of the patients



# Patient information

To avoid pin site infection it is important to follow the instructions below.

## Daily

1. Rinse the skin and fixator with lukewarm water **in the shower**
2. Wash the skin around the pins with **soap and water**
3. **Remove the scabs** around the pin sites. Use a cotton bud or compress.
4. Shower and dry with a clean towel. Let the skin air-dry.
5. **Cover the pin sites** with dry, clean compresses.

## In general

**Do not use alcohol and iodine solutions**

Avoid thick bandages and let the skin air-dry often.

Clean, dry skin around the pins is the best protection against pin site infection.

# Pin site care

## Aims

- Minimize
  - Infection problems
  - Use of antibiotics
  - Complications
- Frequency of pin site care
- Cleansing agent
- Dressings
- Prophylactic antibiotics
- Complications

# Pin site care

- Extends from:
  - The theatre dressing
  - To removal of the pins
  - And complete wound healing

# Method

**In all of the studies the patients .....**

- Came once a week to the outpatient clinic
  - Start and follow up of the correction
  - Pin site care
- Were prescribed
  - Flucloxacillin 1g x 3 for 7 days in case of pin site infection
- Had full access to the treatment team

# Outcomes

- Clinical pin site infection *Weekly*
  - Checketts-Otterburns classification
- Bacterial cultures *Post operative week 1, 6 and 10  
and from the pin tips at removal*
- Use of antibiotics *Weekly*
- Complications *Weekly*
- Pain *Weekly*
  - Visual Analog Scale (VAS)
- Use of analgesics *Weekly*

# Pin site care

## Frequency

50 patients

### Pin site care

- **Daily** by the district nurse  
or **weekly** at the out-patient clinic
- **Saline** as cleansing agent + dry dressing
- **Removed** scabs
- **14 days** of prophylactic antibiotics

# Pin site care

## Daily or Weekly

### No differences

- clinical infections 15%
- positive bacterial cultures 30%
- *Staphylococcus aureus* 3%
- use of antibiotics 47 days/patient

- Complications
- Pain
- Use of analgesics
- Tendency of more pin site problems close to the joint
  - *positive bacterial cultures*  $p < 0.0001$

*“The bacterial flora of the patient’s skin is an important source of postoperative wound infection”* Bruun 1970, Cruse 1970

## Chlorhexidine:

- Achieves rapid reduction of the skin flora
  - bactericidal effects
- Ability to accumulate on the skin
  - preventing regrowth
- Bound to younger cells
  - sticks to the body surface for longer periods
  - antibacterial effect for many days
  - the bacterial recolonization will be delayed
- Shows no development of resistance

Brandberg 1989

# Pin site care

## Cleansing solution

49 patients

### Pin site care

- Once a week
- Theatre dressing undisturbed during the first week
- Saline or Chlorhexidine solution 0.2 %
- No removal of scabs
- Prophylactic antibiotics for 3 days

# Pin site care

## Cleansing solution

	Saline n=19	Chlorhexidine (solution 0.2%) n=30	
Clinical Infection	17 %	9 %	NS
Positive cultures	50 %	23 %	RR 1.7 (95% CI 1.4–2.1), P<0.0001
Staph aureus	28 %	8 %	RR 3.3 (95% CI 2.2–4.9), P<0.0001
Use of antibiotics	22 <sub>±</sub> 4	9 <sub>±</sub> 2 day/pat	P=0.002

# Pin site care

## Prophylactic antibiotics

Chlorhexidine 0.5 % (70 % alcohol)

	3 days n=60	1 dose n=46		
<b>Clinical infection</b> <i>(patients)</i>				
Grade I	17/60	20/46	RR 0.7 (0.4–1.2)	NS
Grade II	5/60	5/46	RR 0.9 (0.3–3.2)	NS
Positive culture <i>(patients)</i>	41/60	25/46	RR 0.8 (0.6–1.2)	NS
Staph aureus <i>(patients)</i>	18/60	25/46	RR 1.3 (0.7–2.4)	NS
Use of antibiotics <i>(days/pat)</i>	13±14	11±11	$p=0.4$	

# Pin site care

## Undisturbed theatre dressing for 7 days – A cohort study

	Undisturbed dressing	Disturbed dressing	
Positive bacterial culture ( <i>patients</i> )	3/90	9/11	RR 24.5 (95% CI 9.3-50) $p < 0.0001$
Patients with antibiotic treatment	32/90	8/11	RR 2.0 (95% CI 1.6-2.7) $p = 0.02$
Antibiotic treatment days/treated patient	12 (SD 11)	28 (SD 23)	$p < 0.0007$
Complication ( <i>knees</i> )	12/104	5/14	RR 3.1 (95% CI 1.2-6.7) $p = 0.03$

# External fixation

## Complications

- Delayed bone healing
- Non-union

*..... increased risk of further complications*

# Cigarette smoking

## Complications

200 patients

- Smokers had:
  - More complications RR 2.5 (95% CI 1.5-3.9)
  - Longer time in external fixation 16 days (p<0.0001)
  - Delayed healing RR 2.7 (95% CI 1.5-4.7)
  - Increased risk of non-union RR 8.1 (95% CI 1.8-42.0)
- *Single greatest preoperative risk factor*

# What the studies have shown:

- Pin site care once a week is OK
- Chlorhexidine offers benefits compared to saline
- Prolonged prophylactic antibiotics are of no benefit
- Undisturbed theatre dressing for 7 days is a benefit
- Smoking increase the risk of complications

# Pin site care

## Theatre dressing

- Compresses moistened by chlorhexidine 5 mg/ml in alcohol (70%) placed at each pin site

## During the first postoperative week

- Change dressing only if:
  - Major leakage
  - Suspicion of infection
- When discharged
  - Information
  - Access to the team responsible for treatment

# Pin site care

- Aseptic technique – nursing ward
- Clean technique – out patient clinic / home
- Remove the bandages
- Inspect
- Listen to the patient
- If suspicion of infection
  - Cleans the pin site with saline
  - Take a bacterial culture

# Pin site care

- Clean the pin site, pins and fixator with Chlorhexidine 5 mg/ml in alcohol (70%)
- Use a new compress for each pin site
- Do not remove scabs – except in case of signs of infection
- Moisten compresses with Chlorhexidine 5 mg/ml in alcohol (70%)
- Place them “fluffy” at each pin site
- Wrap a dressing around each group of pins/wires with a clean soft bandage
- Pin site care once a week

# Pin site care

## Hygiene

- Showering with soap and water **increases risk of contamination by bacteria**
  - due to spreading organisms from the more densely colonized sites (face, perineum, axillae etc.) to the rest of the body surface

Kaiser 1988 Brandberg 1989

- 17-fold increase in release of particles carrying viable bacteria

Meer 1978

# Nicotine

- Acts as a direct stimulant of bone cell metabolic activity

Gullihorn et al J Orthop Trauma 2005

- Impairs not the mechanical strength of fracture healing

Skøtt et al J Orthop Res 2006

# Snuff

## Complications

175 male patients

	Snuffers	Smokers	Non snuffer/smoker
Time in external fixation (days)	87±11	100±25	93±11
	<i>p</i> <0.03		
Complications (patients)	1/21	12/41	22/113
	<i>RR</i> 6.1 (95 % <i>CI</i> 1.2-36.4) <i>p</i> <0.025		
Non-union (patients)	0/21	8/41	10/113
	<i>p</i> <0.03		