

# SKELETAL TRACTION

## STANDARD OPERATING PROCEDURE INTERSECTIONAL DOCUMENT

# 2019

# MSF

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Authors: Dr Herwig Drobetz, MD, PhD, FRACS, FA(Orth)A  
Inga Osmers, MD, head of Berlin Medical Unit  
Mohana Amirtharajah, MD, OCA surgery advisor  
Martin Sosa, MD, OCBA surgery advisor

## 1. SKELETAL TRACTION STANDARD OPERATION PROCEDURE

Skeletal traction for the treatment of fractures and dislocations has been a safe and dependable way of treating fractures for over 100 years. However, the use of traction requires care in placement, vigilance in maintenance, and necessitates a long hospital stay.

Skeletal traction has the following purposes:

- reduction of fractures or dislocations
- immobilisation of fractures or joints
- preventing muscle spasm
- pain relief
- keeping the patient comfortable until definitive treatment

Skeletal traction can be used as a temporary or definitive measure of fracture treatment. The same principles that apply for skeletal traction generally also apply for skin traction. However, skin is designed to bear compression forces and not shear forces. More than 4 kg (8 lb) applied via skin traction for any length of time will inevitably cause skin damage. **Skin traction is never indicated for definitive fracture care in adults.**

The principle of fracture treatment with skeletal traction is similar to conservative or operative fracture treatment:

- reduce the broken bone in regard to length, axis, and rotation and
- keep it that way until it has healed

Reduction of length in any fracture is achieved by a pulling (distracting) force as every broken bone shortens due to muscle contraction.

In principle, skeletal traction can be used for the treatment of any long bone fracture or major joint dislocation. **The most common indication for skeletal traction, however, is for the treatment of femur (and acetabulum) fractures.** For practical purposes, this SoP will focus on femur fractures. The principles and nursing care described apply to any other fracture as well.

### 1.1. NECESSARY EQUIPMENT

- local anaesthesia, needle, syringe
- MSF traction set (KSURBTRN13-) – bowl, drill, stirrup, sharp Steinmann pin (smooth or partially threaded), scalpel
- Traction bed, ideally with wheels, with a solid bed end and bars as well as ropes, pulleys and weights
- To cut the pin (either the sharp point or for removal): wire cutting pliers, 45 cm (ESURPLIE456)

### 1.2. GENERAL PRINCIPLES

Prevention of thrombosis, pressure sores and pneumonia is critical. Please refer to the relevant MSF guidelines.

A neurovascular exam must be performed and documented around 1 hour after placing the traction. Exams should then be repeated and documented every shift change (ideally during the handoff, the incoming and outgoing staff would perform this together). Exams must be recorded for the first 24 hours after application of any traction.

Encourage the patient to move his/her unaffected joints.

Place bedside table on the healthy side. This forces the patients to lie straighter and keeps the body better aligned when they move over to reach the table (better counter-traction).

The traction setup must be checked daily and adjusted as necessary.

### 1.3. WEIGHT

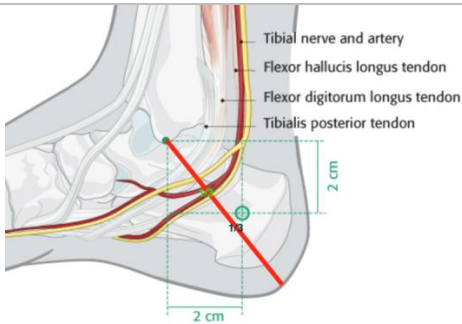
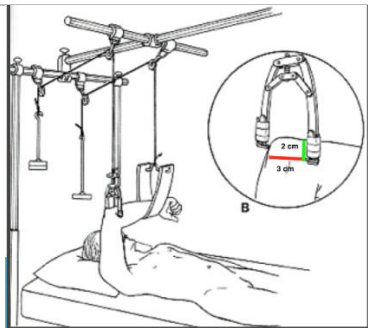
- Weights provide the constant (isotonic) force to keep the fracture/dislocation reduced.
- Pulleys maintain the constant direction necessary until healing. For this to happen, the ropes must be able to glide freely (no knots in the pulleys) and the weights must be suspended above ground.
- Prevent any friction.
- Never have a weight suspended over any body part of a patient as it can cause injury.
- Make sure that bed linens or pillows etc. are not interfering with the weight, ropes and pulley system.
- The initial weight applied should be enough to correct limb length and reduce the fracture. It will be dependent of the patient's weight and muscle status.
- For maintenance of traction:
  - Femur fractures: 10 to 15 % of the patient's body weight
  - Pelvis fractures: 15 to 20 % of body weight for longitudinal traction, 5 – 7 kg for lateral traction
  - Humerus fractures: 2.5 kg initially and then increase until scapula is just lifted off the bed
  - Tibia fractures: 3-5 kg

### 1.4. PIN PLACEMENT

- Pin diameter for definitive fracture treatment in adults should be 5 or 6 mm
- Smooth pins are generally stronger than threaded ones of the same diameter. Threaded pins, however, have better purchase in bone – use threaded pins if traction is the definitive fracture treatment.
- Use local anaesthesia and infiltrate the periosteum generously if the patient is awake
- Placement must be under sterile conditions (as well as pin removal: pin needs to be cut at skin level on one side before removal via the opposite side).
- Use a scalpel for a stab incision as for an external fixator. Pins that impinge or put the skin under tension cause infections and become loose.

- It is very important that the traction bow (ESURBOWB) can freely move around the traction pin so prevent rotation of the pin itself. Rotating pins loosen quickly and significantly increase the risk of pin track infection.
- The direction of the pin insertion should be from the side of the known “at risk” neurovascular structures (see the table below). The entry point is easier to control then the exit point of the pin so this technique minimises risk to vulnerable neurovascular structures.
- The pin must be inserted perpendicular to the bone and parallel to the ground in a supine patient. The person who inserts the pin can easily monitor if the pin is perpendicular (i.e. whether the pin needs to be moved towards the head or the foot). A second person can be used to ensure that the pin is parallel to the ground (i.e. whether the pin has to be raised or lowered) as this is more difficult to judge.
- After skin incision, insert the pin by hand to the bone and feel the anterior and posterior cortex with the tip of the pin to make sure to find the ideal entry point (not too anterior or posterior).
- Place protective caps over the sharp pin ends

| <i>PIN<br/>LOCATION</i>               | <i>INDICATION</i>                | <i>TECHNIQUE</i>                                                                                                                                                                                                                                                      | <i>DIAGRAM</i> |
|---------------------------------------|----------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|
| <b>Femur</b>                          | Femur and acetabular fractures   | Insertion in line with upper patella border just above the femoral epicondyle (at the transition metaphysis and diaphysis) to avoid intra-articular placement. MEDIAL TO LATERAL insertion.                                                                           |                |
| <b>Lateral greater trochanter pin</b> | Acetabular fractures             | A proximal pin is sometimes used to pull the hip joint laterally. Entry point is below the greater trochanter parallel to the femoral neck. This pin must be threaded as the pulling force is not perpendicular to the pin but parallel (otherwise will loosen fast). |                |
| <b>Tibia</b>                          | Femur fractures (second choice)* | Palpate the tuberosity and make sure that the pin is placed 2 cm posterior of the cortex. This ensures bi-cortical anchorage of the pin and reduces risk of cut-out and loosening. LATERAL TO MEDIAL insertion.                                                       |                |

|                  |                 |                                                                                                                                                                                                                                                                                                                                                                   |                                                                                    |
|------------------|-----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|
| <b>Calcaneus</b> | Tibia fractures | Insert 2 cm below and 2 cm behind the medial malleolus. Alternatively divide the distance between medial malleolus and skin in thirds and insert at the border 1 <sup>st</sup> and 2 <sup>nd</sup> third (red line).<br>MEDIAL to LATERAL insertion.                                                                                                              |  |
| <b>Olecranon</b> | Humerus         | Insert 3 cm from the olecranon tip and 2 cm from the cortex. Palpate the ulnar nerve next to the medial humeral epicondyle to avoid injuring the nerve. Also flexing the elbow during pin insertion moves the nerve further out of the insertion area. Insert the pin about 1 cm from the cortex to achieve bi-cortical anchorage<br>MEDIAL TO LATERAL insertion. |  |

**\*(For definitive treatment of femur fractures using traction, use distal femur pin if possible for better fracture control and knee movement)**

### 1.5. TRACTION BED

The following setup is for femur fractures but the principles apply to any other traction setup as well.

- The direction of any traction has to be in line with the fractured bone's longitudinal axis.
- The traction setup needs counter-traction so there is a balance between pulling forces and resisting forces in order to keep the fracture at length and reduced.
- Counter-traction is the resistance of the body to move towards the pulling force (the weights). If the patient gets pulled towards the end of the bed and the weights touch the ground or the rope knot hits the pulley, the traction is not effective anymore.
  - Counter-traction can be achieved by various means that can be used at the same time:
  - Elevation of the distal end of bed (foot side)
  - A pillow or blanket at the end of the bed for the healthy limb to push against
  - Less upright upper body (do not sit the patient up more than 20 degrees)
- See figure 1 for reduction
- See figure 2 for control of rotation
- Assessment of the quality of the reduction should be clinical (limb length, alignment, rotation). If in doubt and x-ray is available, obtain an x-ray of the fractured bone under traction (make sure traction is properly applied when taking the image).
- Length and rotation must be checked daily.
- As soon as pain allows, exercises should be started.
- The femur can rest on a pillow or Boehler / Brown / Pearson's frame. Which system you use is of secondary importance as long as the fracture is reduced and the patient is comfortable

- Use pillows under the fracture to fine adjust reduction.

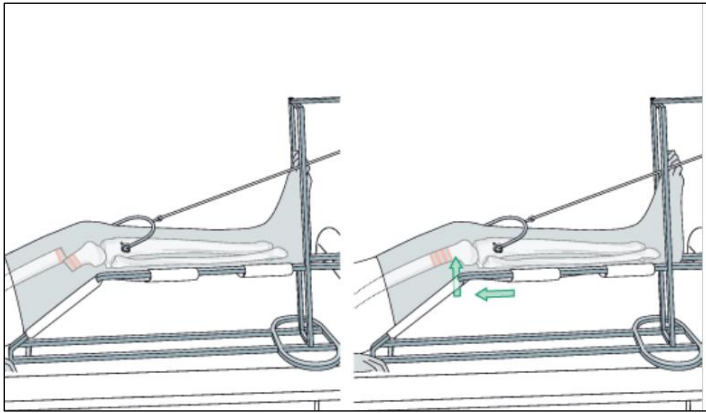


**Figure 1. Reduction.** In order to prevent posterior displacement of the distal fragment, the angle of the padded frame is pushed proximally to support the distal fragment, with appropriate padding.

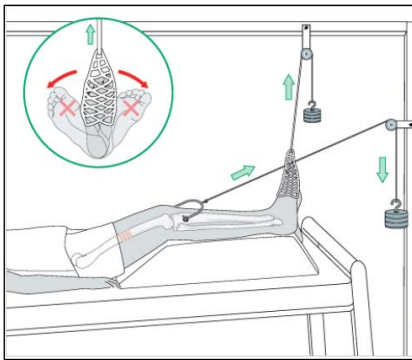


**Figure 2. Control of rotation via pulleys.** Rotation and maintenance of dorsiflexion in the ankle can be achieved by applying an adhesive sock to the forefoot with a cord over a pulley on the overhead beam. This pulley should be adjustable from side to side to control rotation. The weight at the end of the bed must be able to be mounted higher or lower so it can be in line with the femur axis. On the picture on the right side, rotation is controlled with ropes to the frame. Note that the heel does not touch the pillow to prevent pressure sores.

## 1.6. COMPLICATIONS

Fracture treatment with traction can achieve excellent results, but it is very involved and needs constant care and adjustment. The most common complications for skeletal traction are (in decreasing frequency):

- Mal-alignment
- Joint stiffness
- Pin site infection
- Pressure sores
- Nerve damage
- Wire breakage
- Skin damage – this is the most common complication in skin traction

## 1.7. CONTRAINDICATIONS

- For skeletal traction: Bone or soft tissue infection or damaged skin at pin site
- For skin traction: Skin lacerations, skin infections, varicose veins, frail/brittle skin (diabetes, elderly patients)

### 1.8. DAILY CHECKLIST

- General check – DVT, Pneumonia
- Check for pressure sores at all bony prominences
- Check pin sites
- Neurovascular status
- Check traction setup – no friction, ropes properly resting in the pulleys, weights off the ground
- Check alignment and rotation of the fracture and adjust if necessary
- Check weights
- Exercise joints

### 1.9. A FEW WORDS ON SKIN TRACTION

A common and well-established treatment for femur fractures in toddlers under 15 kg bodyweight and who cannot yet walk independently (12 to 24 months) is via overhead or gallows skin traction (see figure 3).

If the surgeon decides to use skin traction, please note the following:

- Adhesive skin traction can cause skin reactions. Apply a test patch to the skin before applying traction. If the adhesive skin traction causes a reaction, apply non-adhesive skin extensions (i.e. - bandages used to hold the traction in place).
- **Do not shave the skin.** The superficial skin layers have a protective function and tape on shaved skin causes irritation and discomfort.
- **Do not** apply substances that increase adhesion to the skin such as Tincture benzoin, as they may increase the risk of skin tear on removal.
- The skin extensions should be applied just below the fracture site, not over it.
- Foam protection should be placed to cover medial and lateral malleoli (bony prominences on ankle) on all traction involving lower limbs
- Document skin condition before, during, and after treatment

**Figure 3: Overhead traction.** Both legs are flexed at the hips to 90 degrees.

The baby's buttocks have to be slightly off the mattress – you should be able to fit the palm of your hand between skin and mattress.

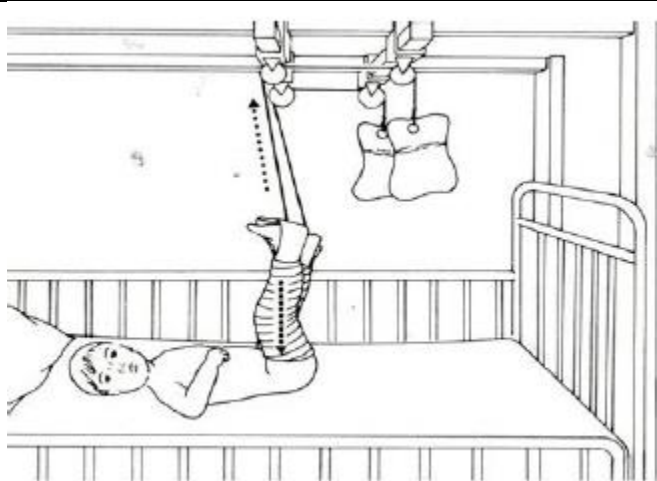
Adjust weights to achieve slightly flexed knees.

Do not pick up child at any time – traction must be continuous.

Bandages for the skin extensions must be non-constrictive, wrinkle free and changed daily. Apply from distal to proximal and from lateral to medial

Healing time is about 4 weeks.

Rule out non-accidental fracture!



## 1.10. NURSING CARE POINTS FOR PATIENTS IN TRACTION

### PATIENT HYGIENE

Patient should have a daily personal hygiene in the bed. Nurses should assist those in needs of support and teach/educate those who have the strength and the capacity to do it with the help of caregiver.

### PRESSURE ULCERS

#### PREVENTION

- All patient in traction should evaluated regularly for pressure ulcers risk (for example, using Braden scale)
- Examine the skin daily, with attention for all bones prominences (Figure 4) and all the specific contact points between the patient limb and the traction frame. Document the assessment in the patient file.

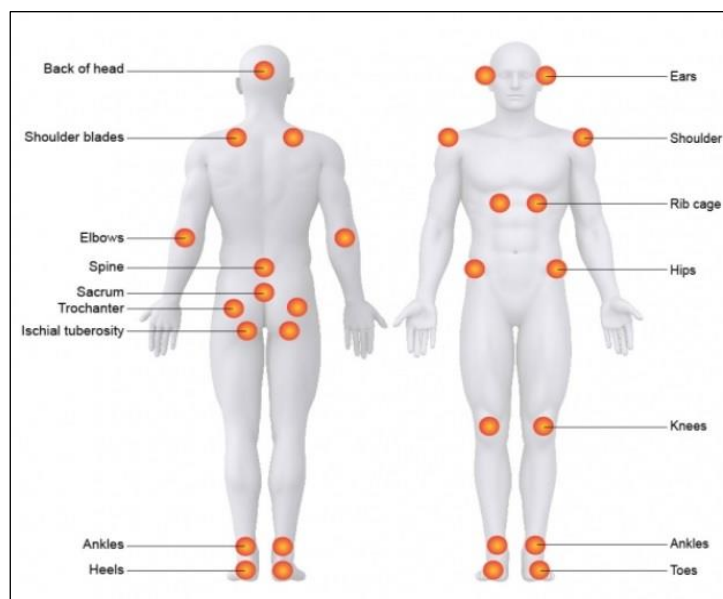


Figure 4: bony prominences

- For patients with higher risk for developing pressure ulcers always consider the possibility to use special mattress or specific positioning items:

| CATALOGUE CODE | DESCRIPTION                                               |
|----------------|-----------------------------------------------------------|
| EHOEMATTF1-    | MATRESS, 80x194x14.5cm, HD foam+memory foam + cover + zip |
| EEMDMAFE1--    | ALTERNATING-PRESSURE MATTRESS OVERLAY SYSTEM (L839+L803)  |
| EPHYCUSGBW15   | BED WEDGE CUSHION, 15° + cover                            |
| EPHYCUSGBW30   | BED WEDGE CUSHION, 30° + cover                            |
| EPHYCUSGL01    | POSITIONING CUSHION, lateral, + cover, 30 x 190cm         |
| EPHYCUSGU1L    | POSITIONING CUSHION, universal, + cover, large            |
| EPHYCUSGU1M    | POSITIONING CUSHION, universal, + cover, medium           |
| EPHYCUSGU1S    | POSITIONING CUSHION, universal, + cover, small            |

- Regarding femoral traction, the heel is a high-risk site and should be constantly evaluated and protected by removing any pressure from it.
- Promote good skin hygiene and hydration
- Consider urine drainage devices (indwelling urinary catheter / condom catheter) if patient has urinary incontinence to keep the skin dry.

- Routinely check the bedsheets to avoid any fold that may cause skin damage.
- Educate the patient to change their position slightly on a regular basis without sliding in the bed or changing their position too drastically (as it may affect the correct effect of the traction).

#### TREATMENT OF PRESSURE ULCERS

- As by wound care protocol
- Consider, if not done previously, the use of special mattress or specific positioning items.

#### ELIMINATION

- Urinary elimination:
  - Consider urine drainage devices (indwelling urinary catheter / condom catheter)
- Faecal elimination:
  - Assure appropriate diet and oral intake of fluids to prevent constipation
  - Treat constipation with laxatives as needed by medical prescription

#### PIN SITE CARE

- As by wound care protocol (technical sheet n°8 page 139)

#### ACTIVITY / DAILY LIFE

- Make sure that everything the patient needs is within reach (water, food, urinal, etc...)
- Place bedside table on the healthy side. This forces the patients to lie straighter and keeps the body better aligned when they move over to reach the table (better counter-traction).
- As these patients are confined to bed for a long period of time, special activities should be considered, such as reading or drawing. The bed can also be moved outside the room for periods of time.

#### RECOMMENDED LITERATURE:

- Zimmer Traction Handbook 2006 <http://dl.icdst.org/pdfs/files/0257acaa982f0f0b2e7294a80a41d032.pdf>
- AO foundation [https://www.aofoundation.org/Structure/search-center/Pages/AOSearchResults.aspx?start=20&logic=sl\\_surgery&k=skeletal+traction](https://www.aofoundation.org/Structure/search-center/Pages/AOSearchResults.aspx?start=20&logic=sl_surgery&k=skeletal+traction)

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