

INTERNAL FIXATION UNDER MSF SETTINGS

- MINIMAL REQUIREMENTS AND LIMITATIONS -

1. What is internal fixation? ¹

Internal fixation is the surgical implantation of mechanical devices inside the human body for the purpose of repairing a bone after fracture.

2. Types of internal fixation

Types of internal fixators include the application of:

- i. Metal plates with screws,
- ii. Pins or Kirschner wires,
- iii. And intramedullary devices such as rods and nails, with or without interlocking bolts.

2.1. Open Reduction Internal Fixation (ORIF),

Involves surgical placement of implants (mainly plates and screws) to guide the healing process of a bone, after the open reduction procedure. *Open reduction* refers to open surgery to set bones, as is necessary for displaced fractures. *Internal fixation* refers to fixation of screws and / or plates, or intramedullary bone nails (femur, tibia, and humerus) to enable or facilitate healing. The former type (plates and screws) provides rigid fixation which prevents micro-motion across the lines of fracture, enabling direct bone healing (or primary bone union). Open Reduction Internal Fixation techniques are often used in cases where the fractures are at or close to the joints, such as displaced articular fractures and forearm fractures, cases where the bone would otherwise not heal correctly with casting or splinting alone. This type of surgery should be done with great discretion under MSF settings because of the risk of introducing infection in a closed fracture.

2.2. Closed Reduction Internal Fixation (CRIF),

Aims at achieving fracture reduction without opening up the fracture site, often with the help of X-ray when available, followed by internal fixation. It is an acceptable (or sometimes a better) alternative in fractures where the shaft of long bones (humerus, femur, and tibia) is involved and accurate reduction is therefore not necessary. Flexible fixation (as compared to rigid) is provided by an intramedullary device such as a nail, and fracture healing will occur through callus formation (as in the cast of giving a splint or cast). Another example is elbow fractures in children, where pins or K-wires are used after closed reduction. This type of surgery again should be done with great discretion under MSF settings because of the risk of introducing infection to the whole medullar cavity of long bone if contamination occurs.

3. Risks and Complications of Internal Fixation

Risks and complications in performing internal fixation can include bacterial colonization of the bone, infection, stiffness and loss of range of motion, non-union, mal-union, damage to the muscles, nerve damage and palsy, arthritis, tendonitis, chronic pain associated with plates, screws, and pins, compartment syndrome, deformity, audible popping and snapping, and possible future surgeries to remove the hardware.

¹ American Academy of Orthopaedic Surgeons

Metal devices (and indeed all foreign bodies inside the human body) invite bacterial colonization if there is contamination. Because of the high risk of osteomyelitis when infection occurs after performing internal fixation, MSF will only allow the performance of internal fixation once the minimal requirements for performing it are met and maintained. Constant supervision and checking is done during the program that the conditions are met at all times. Sterile conditions and meticulous surgical techniques can reduce, but do not remove, the risk of infection when internal fixation is used. The severity of the fracture, its location, and the medical status of the patient must all be considered.

In addition, no technique is fool proof. The fracture may not heal properly, the plate or rod may break or deform, or the patient may have an allergic reaction to the implant

4. Benefits of Internal Fixation

By restoring stability to the fractured bone, performance of internal fixation allows for a shorter hospital stay, enables patients to return to function earlier and reduces the incidence of non-union or delayed union (failed or slow healing), and mal-union (healing in an improper position).

5. Indications for Internal Fixation

Not all fractures require internal fixation. Indeed most fractures can heal without it, only that it takes longer and in a bad position in case of displaced fractures. Therefore, MSF recommends that it is only performed in the following fractures with the following conditions:

- Displaced intra-articular fracture.
- Axial or angular instability which cannot be controlled by closed methods.
- Mal-reduction / failure of reduction (e.g. interposed soft tissue).
- Multiple traumas.

Early mobilization and functional recovery is desirable and possible.

MSF recommends that Internal Fixation can never be used in open fractures.

6. Requirements for Internal Fixation

MSF has identified the following minimum requirements to perform Internal Fixation and discourages its performance when the requirements are not met, in **Annexe 01**.

6.1. Human Resources:

- Qualified Orthopaedic Surgeon: a medical doctor trained in specialized in orthopaedics, after formal and training and accreditation.
- Operating Theatre Head Nurse: in MSF context, the nurse who oversees the organization and functioning of the Operative department, often including sterilization.
- Anaesthetist: medical doctor specialized in anaesthesiology, after formal training and accreditation.

- Infection Control Officer: usually a high level nurse supervising the infection control: hygiene in care (IPD, OPD, OD, etc.), surface cleaning, sterilization, laundry, kitchen, waste management.
- C-arm operator: a radiographer to operate the X-ray Image Intensifier (C-arm) and control radiation exposure. When a radiographer is not available, the C-arm operator should be a nurse trained by MSF in C-arm use and radiation protection, and the surgeon should then be the one to control X-ray exposure using the foot-pedal. A radiographer consultant should come to the field for a short visit (2-3 weeks) to do training of OD staff (this is organized by the intersectional radiographer). This should be mandatory when installing and /or using a C-arm and conventional X-ray.
- Surgical Ward Nurse: nurse working in the surgical ward and having specific experience, training or qualification regarding pre and post-operative care.
- Rehabilitation ward nurse: nurse working in the rehabilitation ward and having specific experience, training and qualification in nursing and rehabilitation care.
- Physiotherapist: working in post-surgery and rehabilitation; paramedical professional trained in supervising patients in functional rehabilitation after the internal fixation surgery

6.1. Operating Theatre

Infrastructure

The Operating department complex should follow strictly the standards set by MSF ² and should provide:

- Electricity – 24/7
- Air quality:
 - Closed doors, closed windows to prevent from insects and dust.
 - Air filters of 10 micron (type G4 / 55) on air conditioners.
- Quality water supply (water filters).
- Water – 100 litres per operation (not including laundry and sterilization).

Materials and Equipment

- Electrosurgical unit.
- Tourniquet.
- Operating table plus:
 - Ortho-accessory table.
 - C-arm with single use protection cover.
 - Orthopaedic traction system (radiolucent for C-arm use).
- Radiation shielding of OT to surrounding areas (=1 mm lead or equivalent).
- Single use sheets / drapes.
- It is suggested to have a minimum of two sterilised sets of internal fixation material at all time.

Dress code

- Surgical scrub suite.
- Gloves 2 pairs.
- Single use gowns for the operation team ³.

² Guideline for Planning and Design of Health Facilities, MSF, 2010

³ Operation team: surgeon, assistant surgeon, scrub nurse

- Surgical caps for the operation team: the forehead needs to be covered:
 - First choice: head protection “astronaut” type
 - Or 2 single use regular caps.
 - Or thick reusable cap (locally made).
- Mask.
- Beard mask if necessary, for all staff present in the operating room.
- Protective glasses for the operation team.
- Specific protective shoes.



OT Infection Control

- Surgical hands rub with hydro-alcoholic solutions (gel).
- Surfanios cleaning for surfaces (equipment, floors).
- Povidone iodine (Betadine®) skin preparation (to follow MSF protocols).
- Minimum once per month an Infection Control supervision ⁴.

6.2. Sterilisation

- Clear clean and dirty circuit (MSF protocols and infrastructure).
- Autoclave: minimum 90 litres, 134°C sterilization cycle, traceability.
- Dry sets at the end of the sterilization cycle.
- Hexanios for pre-disinfection and cleaning.
- Double crepe draping for instruments.
- Sterilisation indicators (inside the set and in the autoclave) and traceability sheet.
- Minimum once per month Infection Control supervision.
- Air gun compressor ⁵ for drying hollow tubes and instruments.

6.3. Diagnostic Imaging

- X-ray for pre and post-surgery imaging.
- X-ray image available in the Operating room – hard copy in the chart or digital image. If use of film: to provide X-ray viewing box in OR.
- C-arm for intra-operative fluoroscopic guidance.
- Radiation protective equipment.

6.4. Laboratory

- Blood bank.
- Antibiotic: culture and sensitivity available.

6.5. IPD: postoperative care

- Defined area in the ward for internal fixation patient.
- High level of compliance to standard precautions: Minimum once per month supervision through the Infection Control Checklist.
- Ward showers and toilet available
- Post-operative care with high quality nursing.
- Dressings: aseptic care, right use of antiseptics.

⁴ Infection Control Monitoring checklists

⁵ Present model of air gun compressor stills to be finalized.

6.6. Medical protocols and drugs available

- MSF Orthopaedic antibiotic protocol: prophylaxis and treatment.
- MSF Thromboprophylaxis protocol.
- MSF Post-operative pain management protocol.
- MSF Good orthopaedic practices protocol.

6.7. Physiotherapy and rehabilitation

- Availability of specialist in physiotherapy.
- Rehabilitation follow-up (hospitalisation ward, out-patient department).

6.8. Data Collection in the OT and for orthopaedics

- Standard MSF OT data collection.
- Specific data collection for Internal Fixation.
- Post-operative wound infection data collection.
- Follow up of post-operative infections by a special committee.

7. **Validation by referents**

Before to start with internal fixation in a MSF setting, validation is needed of the following referents:

- SAGE unit.
- Infection control + nursing care.
- Laboratory.

Annexe 01

Minimal requirements for internal fixation

1	Human Resources	
1.1	Qualified orthopaedic surgeons	
1.2	OT Nurse	
1.3	Anaesthetist	
1.4	Surgical ward nurse	
1.5	Physiotherapist	
1.6	Rehabilitation ward nurse	
1.7	C-arm operator	
2	Operating department	
2.1	Electricity 24/7	
2.2	Air filters G4, 10 microns	
2.3	Water 100 litres / operation	
2.4	Water filters	
2.5	X-ray or image intensifiers when available	
3	Materials and Equipment	
3.1	Electrosurgical unit	
3.2	Tourniquet	
3.3	Radiolucent orthopaedic accessory table appropriate for use with C-arm	
3.4	Orthopaedic traction system	
3.5	Internal Fixation set	
3.6	Single use sheets	
4	Sterilization	
4.1	Clean / dirty circuit (protocols)	
4.2	Autoclave and traceability (protocols)	
4.3	Dry sets at end of sterilization	
4.4	Hexanios cleaning	
4.5	Double crepe draping for instruments	
4.6	Sterilisation witness	
4.7	Minimum 2 sterile sets to be stored in the OT	
4.8	Air gun compressor	
5	Operating department Dress Code	
5.1	Scrub suit	
5.2	Gloves, 2 pairs	
5.3	Single use gowns	
5.4	Thick cap or head protection "astronaut type"	
5.5	Beard mask	
5.6	Mask for all staff present	
6	Laboratory	
6.1	Quality assessed and validated	
6.2	Blood bank	
6.3	Antibiotics: culture and sensitivity available	
7	Diagnostic Imaging	
7.1	X-ray for pre-operative and post-surgery imaging	

7.2	C-arm for intra-operative fluoroscopic guidance	
7.3	Radiation protective equipment: lead aprons, thyroid collars	
8	Infection Control	
8.1	Clear separation between infected patients and not	
8.2	Surgical hand rub with hydro-alcoholic solution (gel)	
8.3	Surfanios for cleaning surfaces (equipment, floors)	
8.4	Povidone iodine skin preparation (protocol)	
8.5	High level of compliance to standard precautions	
8.6	Personal protective equipment for laundry, sterilisation and waste management	
8.7	Reusable medical devices and linen protocol followed	
8.8	Waste disposable following MSF standards (protocol)	
8.9	Ward cleaning following MSF standards (protocol)	
8.10	Ward showers and toilet available	
8.11	Quality pre-operative and post-operative care (protocol)	
8.12	Dressing following aseptic rules (protocol)	
9	Physiotherapy	
9.1	Supervised physiotherapist	
9.2	Prosthesis	
10	Protocols	
10.1	Orthopaedic antibiotic prophylaxis and therapy	
10.2	Post-operative pain management	
10.3	Orthopaedic good practices	
10.4	Thromboprophylaxis	
11	Data collection	
11.1	Standard MSF Operating department	
11.2	Internal fixation	
11.3	Post-operative wound infection	
11.4	Hospital infection committee	