# General case description based on the available literature

The process of treating arm-related fractures takes place in the emergency and orthopedic department of a hospital. The process entails the registration, diagnosis and treatment phases for patients with suspected fractures of a finger, hand, wrist, forearm, upper arm, shoulder, and/or collarbone.

The process starts when a patient is registered at the reception of the emergency department. Alternatively, in acute emergency situations, the registration can be done at a later time. The next step will usually be to take a medical history (e.g., previous injuries and medication) and perform a clinical examination of the patient. During this the doctor will make enquiries as to the current symptoms (e.g., excessive pain and deformation) of the patient and perform a hands-on examination. Based on these symptoms the doctor will make a preliminary diagnosis. Normally, this diagnosis is checked by making X-rays, which in turn always results in a new doctor-patient consultation to evaluate the X-rays and make the actual diagnosis. In some situations the doctor can make the final diagnosis without X-rays (e.g., clearly no fracture). In some cases, a complementary CT-scan will be used to get even more information.

The next phase involves the treatment the patient will receive. Of course, a treatment is only possible after a preliminary clinical examination by a doctor. There are 9 possible treatments: prescribing rest (=no treatment), applying ice, managing pain with pain medication, applying a bandage, applying a splint, providing support with a sling, fixating the fracture, applying a cast or performing surgery. Choosing one does not eliminate other treatments, as some treatment strategies combine two or more treatments. It is also possible that ice, a sling, some bandages and/or a splint is applied at any time during the process in order to make the patient as comfortable as possible, no matter the diagnosis.

When we look at the case on a more detailed level we can identify several different variations. These represent the classes of fractures that can occur. Each has a specific flow and different characteristics to be taken into account. One common characteristic is that all fractures require surgery if the fracture is open or displaced. Also, if there is no emergency situation, a fracture diagnosis will need to be confirmed by an X-ray (usually also in emergency situations depending on the type of injury).

- A fractured finger or a fractured bone in his hand: in most cases a simple fixation is enough to let it heal. The patient will receive a sling before being sent home.
- A fractured wrist: a cast will be applied, possibly after performing surgery. Surgery is required if the patient is a child (less than 15 years old) and has a damaged periosteum. For adults, surgery is only performed when dealing with open or complex fractures. Afterwards a follow-up X-ray will be taken to confirm that the bone is positioned correctly to start the healing process. The patient will receive a sling before being sent home.
- A fractured forearm: usually this requires no more than a cast. Only when the bone parts are too far apart, surgery is required. To support the cast, the patient receives a sling before being sent home.
- A fractured upper arm: is commonly treated by applying a fixation. The patient will receive a sling before being sent home.
- A fractured shoulder: usually the conservative treatment is enough, letting the shoulder heal while wearing a sling. In the other cases, surgery is required. Physiotherapy

is also needed, because the shoulder joint will be inactive for an extended period during either of both treatments.
- A fractured collarbone: is treated in most cases by resting it while wearing a figure of eight bandage. Surgery is only required when dealing with open or complex fractures or extensive damage to the arteries or nerves.

Additionally, if surgery is required for a broken wrist or forearm, but the OR is unavailable, a temporary cast will be applied to bridge the time until surgery can be performed.

Another aspect is the prescription of medication. There is a general policy that states that no medication can be prescribed without being preceded by an actual doctor's examination. For pain medication it also requires the doctor or surgeon to agree that the patient is in pain or could be in pain in the nearby future. After surgery patients will be prescribed anticoagulants and a painkiller as precaution. In many cases an additional stomach protecting drug is given to counteract possible detrimental side effects of the other two prescriptions. Furthermore, patients that received a cast could be prescribed anticoagulants. Because there exist strong painkillers that do not mix well with anticoagulants, a distinction is made between classes of painkillers:

- Painkillers A: should not be taken while on anticoagulants, but are preferred in other cases.
- Painkillers B: can be taken while on anticoagulants.

Additionally, we also need to consider that some activities require the availability of certain resources, which in turn are limited in number. Also, they are not only used for this process, but rather represent a pool of resources shared among multiple independent processes of the hospital. The inventory of the material resources as used during the process goes as follows:

- Reception desks
- Exam rooms
- X-ray rooms with an X-ray machine
- CT-scan room with an CT-scanner
- Operating rooms
- Recovery room beds
- Patient rooms
- Patient beds
- Physiotherapy room

Furthermore, there is also a list of human resources available:

- Receptionists
- Nurses
- Doctors
    - Anesthesiologist
    - Orthopedic surgeon
    - Emergency doctors
- Surgical assistant
- Physiotherapist

Some of the assumptions made:

- Patients do not go home until the process instance in completely finished
- Other medical issues are out of scope
- Patients do not refuse the recommended treatments