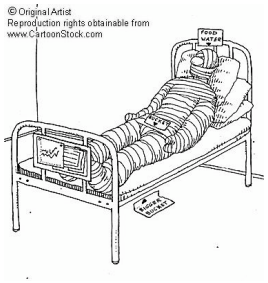
1. General information on bedridden patients

1.1. Definition

A bedridden patient is a patient that, for some reason, as to stay in bed for a long period of time. Such patient might quickly develop serious complications that are not directly linked with the reason why he has to stay in bed. Some of those complications might be life threatening, most of them might be disabling (leading to a disability even if the first problem wouldn't have lead to disability), and all of them will make the treatment more difficult (the patient will need more time to recover –because the complications will also have to be addressed during the treatment- and/or he might not recover as well as he would have without complications).



Most of those complications can be very easily prevented using simple exercises and teaching the patient or the caretaker. Therefore, adapted exercises have to be done to prevent the complications from appearing

1.2. Reasons for which a patient has to stay in bed

The reason why a patient has to stay in bed can be various: multiple trauma, fracture of the spine, paralysis, severe disease, coma, surgery, head injury…

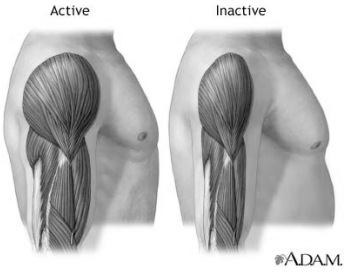
1.3. Common complications

The most common complications of bedridden patients are:

- Muscles weakness/atrophy (a)
- Muscle shortness (b)
- Pressure sores (bed ulcerations) (c)
- Respiratory problems (lung infection) (d)
- Blood circulation problems (e)
- Bone demineralization (f)

Physiotherapy exercises will aim to prevent to complications from appearing.

(a) Muscle weakness/atrophy



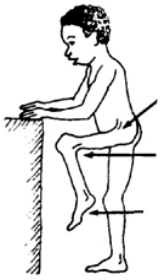
Description: A patient that has to stay in bed won't use much (or won't use at all) his muscles. Muscles that are not used regularly will quickly become weaker. Indeed, regular use of the muscle is needed to maintain proper and functional muscle strength. This weakening process is due to the fact that, when not usd, muscles will loose part of their cells (the less cell there is, the weaker the muscle becomes) and the remaining cell will become thinner and, therefore, less strong. The result is a thinner and weaker muscle (this process is also called muscle atrophy).

Consequences: Muscle weakness would make it more difficult later on for the patient to stand (weakness in the muscles of the legs) or even to sit (weakness of the muscles of the trunk) or to use the hands (weakness of the muscles of the upper limbs).

(b) Muscle shortness

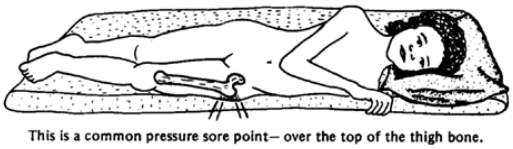
Description: If the patient always remains in the same position (lying or sitting), some of his muscles will stay in a short position (a position in which those muscles are relaxed). The muscles quickly adapt their length to the position in which they remain. This means that if a muscle remains in a short position for a certain time, it will become shorter. Once the muscle is shorter, it cannot be stretched as usual. This will result in decreased possibilities of movements in the joint (decrease of Range Of Motion –or ROM). A classical example is the knee and hip flexors that become shorter when the patent remains in sitting position. Or the plantar flexors (calf muscle) that becomes shorter when the patient is in lying position (with drop foot).

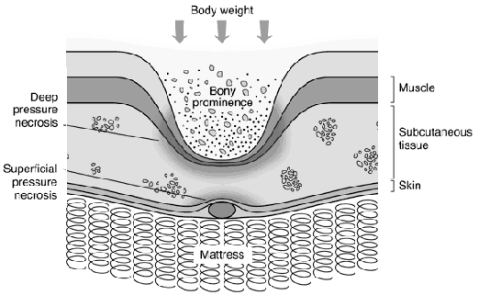
Consequences: Short muscles and consequent decreased ROM will lead to functional difficulties such as standing, walking or using the upper limbs. Indeed, if the knee flexors became shorter, the patient won't be able to extend the knee. Without knee extension, standing and walking is very hard.



(c) Pressure sores

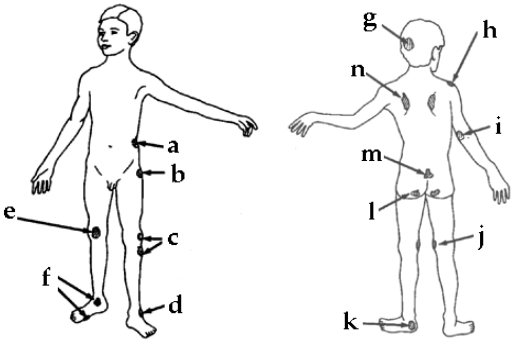
Description: Pressure sores are wounds that will appear on parts of the body where there is pressure on the skin close to a bone prominence. This is, for example the case on the side of the hip where the greater trochanter (of the femur) comes out and there's not much muscle around it. When the patient is lying on the side, the greater trochanter creates a point of pressure on the skin and stops the blood supply from reaching the skin on that particular area. Without blood supply, the skin dies and an ulcer (a wound) appear. Such wound is generally quite hard to heal.


This is a common pressure sore point– over the top of the thigh bone.



Classic locations of pressure sores:

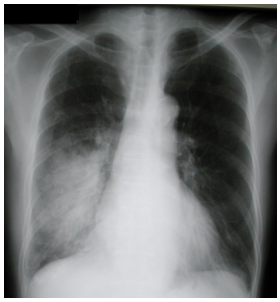
- Iliac crest (a)
- Greater trochanter (b)
- Patella and head of fibula (c)
- External malleolus (d)
- Internal condyle of femur (e)
- Internal malleolus and base of 1st toe (f)
- Back of the head (g)
- Shoulder (h)
- Elbow (i)
- Inside of the knees (j)
- Heel (k)
- Ischial tuberosity (l)
- Lower back (posterior part of sacrum) (m)
- Shoulder blades (scapula) (n)



Pressure sores can appear with any patient that stays in bed (or in a wheelchair), but patients with sensory problems (patients that can not feel), are even more likely to have pressure sores (patient that can feel will feel the pain before the pressure sore appear and they will change position automatically; but he cannot feel the pain, the patient won't change position).

Consequences: Pressure sores are difficult to heal and require heavy medical attention. This will generally increase the length of the treatment (the patient will have to stay even longer I bed). Most important, pressure sores can easily get infected and such infection can be life threatening (the patient can die from such infection if it spreads to the rest of the body).

(d) Respiratory problems



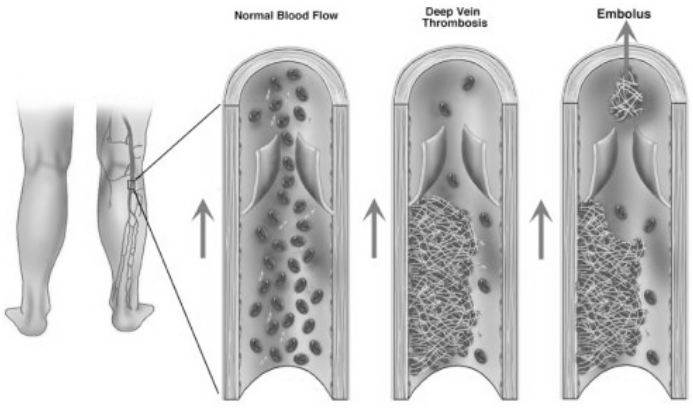
Description: Respiratory problems means that the respiratory system will get infected (lung infection such as pneumonia). With bedridden patients, lung infection will occur because the patient, when staying in bed, as a lower breathing magnitude than usual (he will do "smaller" breathing movements).

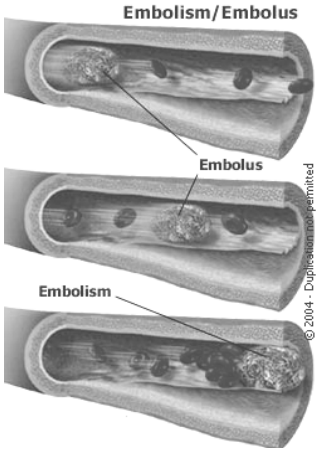
Consequences: The lower breathing results in a lower flux of air in the respiratory tracts (trachea, bronchii and bronchioles). The lower flux of air in the respiratory tracts will results in a less efficient expectoration system (the expectoration system is the system that allows the pulmonary secretions to "climb up" the respiratory tracts and to get out of the lungs). The decreased expectoration system leads to accumulation of secretions in the lungs, which can easily get infected (if the secretions stay in the lungs they will easily get infected which leads to lung infection).

(e) Blood circulation problems

Description: The two main blood circulation problems that bedridden patients might suffer from are thrombosis and embolism. Both of them are caused by callus (clot of blood) that will form in the blood vessels.

Normally, the blood stays liquid unless it is in contact with air (like when you cut yourself). When the blood is in contact with air, it start to form a clot to close the wound. But if the blood circulation is decreased in some part of the body, the blood might also form clot inside the vessel (a callus or a thrombus). This callus will decrease and eventually stop the blood circulation (the callus forms an obstacle to the blood) creating thrombosis (a stop of blood circulation). In other cases, the callus will get loose in the blood circulation. We then call it an embolus. This embolus will then reach smaller blood vessels, get stuck and stop the blood circulation there. We call that an embolism.





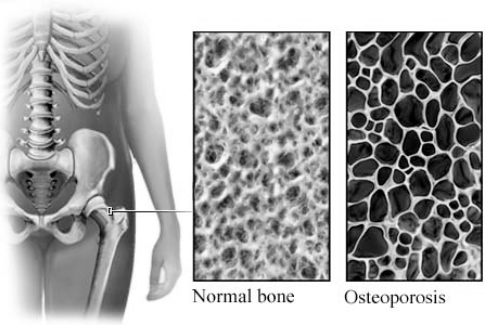
Blood clots will form faster when the blood circulation decreases (the speed of the blood circulating in the vessels decreases). This is the case with bedridden patients (indeed, blood circulation is stimulated by movements and bedridden patients don't move much so their blood circulation decreases).

Consequences: Thrombosis and embolism will lead to tissue damages (the tissues that won't receive blood supply will die). Depending on where the thrombosis or the embolism is located, it can have huge consequences. For example, if an embolus gets stuck in a vessel that supplies a part of the heart in blood, it will

lead to a heart attack. Another common type of embolism is called pulmonary embolism and it is caused by an embolus that gets stuck in a pulmonary artery. This will lead to breathing difficulties and in some case to death.

(f) Bone demineralization

Description: Bone demineralization (also called bone mineral density loss or disuse osteoporosis) means that the bone become weaker (it looses too much minerals and minerals make the bone strong). This happens when the bones are not simulated enough. Bones are "stimulated" when constraints are applied on them (for example, when walking, constraints –the body weight- are applied on the bones. Those constraints help the bone to remain strong. That's why astronauts also suffer from bone demineralization when they come back on earth). When a patients stays in bed, there are less constraints applied on the bones; this results in bone demineralization.



Consequences: a demineralised bone is more fragile and would break quite easily. This might be a serious problem when the patient starts to stand after a long period in bed. If the bones of the legs are too weak, they might be able to bear the body weight.

2. PT protocol for bedridden patients

2.1. Assessment

Before setting up a treatment plan for bedridden patient, it is important to collect some information on the patient, on his/her history and on the complications.

Beside the general information on the patient (name, age, sex…), here is a non-exhaustive list of the main pieces of information that need to be collected:

(a) History

Why does the patient have to stay in bed? What pathology does is suffer from?

Since when is in bed? For how will he/she have to stay in bed?

Since he/she is in bed, did the patient receive medical care?

Since he/she is in bed, did the patient receive rehabilitation care? What kind? For how long? What did it consist in?

(b) Assessment of the main reason why the patient is in bed

Depending on why the patient is in bed in the first place (the primary problem), specific information will have to be collected on that problem. For example, if the patient is in bed because of spinal cord injury, specific information needs to be collected, specific questions have to be asked and specific test have to be done.

(c) Assessment of the complications

Besides the problems due to the primary problem (the main reason why the patient has to stay in bed), is there any other complications linked to the fact that he/she has to stay in bed?

How is the muscle strength? Which muscles are strong, which are weak?

How are the Range of Motion? Is there limitation? In which joint? With which movement? What cause those limitations? Muscle shortness or bone deformity?

Is there bedsores? Where? Since when? How do they look?

Is there respiratory problem?

2.2. Treatment in the hospital (early rehabilitation)

Early rehabilitation will take place in the hospital, starting as soon as possible after the patient has been hospitalized. The main purpose of the treatment will be to prevent complications from appearing or to treat complications that are already present.

In order to do so, and according to the information collected during the assessment, the following exercises should be done with the patient:

(a) Starting right after the hospitalization/surgery (day 1)

➔ **Passive mobilization**: Passive mobilization aims to prevent muscle retraction and decrease of ROM as well as other complications such as bedsores and blood circulation problems. As many joints as possible should be mobilized depending on the patient's situation (if there's a traction or if the patient just had surgery, some joint cannot be mobilized). For details, refer to the "passive mobilization protocol".

➔ **Active mobilization**: Active mobilization aims to prevent muscle weakness and muscle retraction, as well as blood circulation problems. It also helps to prevent respiratory problem and bedsores. As many joints as possible should be mobilized depending on the patient situation (traction, immobilization, surgery) and abilities (severe weakness, paralyses). In case of paralyses or severe weakness, passive-assisted mobilization can be used (the PT does the mobilization, but the patient helps as much as possible). For details, refer to the "active mobilization and strengthening protocol".

➔ **Chest therapy**: Chest therapy aims to prevent respiratory problems. It is very important to do with patients that are more likely to develop lung infection (older patients, smokers, patient that have already been in bed for a long period, patients that will probably have to stay in bed for a long time). For details, refer to the "chest therapy protocol".

➔ **Strengthening exercises**: Strengthening exercises aim to prevent muscle weakness. As many muscles as possible should be strengthen, depending on the patient situation (traction, immobilization, surgery) and the patient abilities (severe weakness, paralyses). In case of paralyses or severe weakness, passive-assisted mobilization can be used (the PT does the mobilization, but the patient helps as much as possible). Importance should be given to strengthen lower limb's muscles important for walking (hip extensors, hip abductors and knee extensors) and to the upper limb muscles important for walking with crutches and transfers (shoulder adductors shoulder abductors, elbow extensors). For details, refer to the "active mobilization and strengthening protocol".

➔ **Massage**: Deep massages aim to prevent blood circulation problems. Superficial massages help relaxing tensed and painful muscles as well as preventing pressure sores. Deep massages should be mainly done on limbs extremities (calf muscle). Superficial massage should be done on the whole body, especially on tense or painful parts (shoulder, back…).

➔ **Prevention of bedsores**: For details, refer to the "prevention of bedsores protocol".

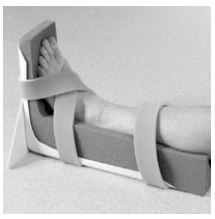
➔ **Muscle stretching**: If limitations of range of motion is already present, stretching exercises can be done to stretch the muscles or, at least, to prevent the muscle shorter from becoming worse. For details, refer to the "muscle stretching protocol".

➔ **Positioning**: Positioning means to put the patient in a good position. For any bedridden patient, a good position will be a position that helps preventing muscle shortness and to decrease possible swelling. Depending on the primary problem of the patients, other rules will have to be followed as well for deciding which position is the best for the patient. Also, the therapist and the family should always keep in mind that any position, if it is kept for two long, will lead to complications (such as bedsores and muscle contracture). That is why, even if a position, for some specific reason, is good for a patient, the position has to be changed every two hours.

Here are some rules that can be followed for good positioning of bedridden patients:

When lying on the back, the patient should keep his/her head straight. If the patient always keeps the head on the side, he/she should be reminded to keep it straight.

Attention should be given to the general position of the patient. On the drawings above are two examples: on the left, the wrong position and on the side the right one.



To prevent muscle contracture of the calf muscle (because of drop foot), special pillows can be used to hold the leg and the foot in neutral position. If such pillows are not available, normal pillows can also be used as shown on the above drawing.

In order to decrease or prevent swelling of the limbs, it is always better to try to keep the extremities of the limbs (hand and foot) a little bit higher than the rest of the body (elevation). This helps blood circulation and, therefore, help preventing and decreasing swelling.

Besides those rules, it should always be recommended (when possible) that the patient try to sit up in bed as soon as possible. If the sitting position leads to dizziness, the patient should be asked to only stay in the

position for as long as he can hold, then go back in lying position. Then the next day, he/she tries to hold the position a little bit longer.

➔ **Patient information and training**: Information on the patient's situation, his/her needs and his/her future should be provided to the patient or to his/her family. Information brochures can be used to do that. Also, when possible, the patient or his/her family should be taught how to do basic exercises by themselves. Material is also available to ease the teaching. For details, refer to the "Teaching and informing the patient and his/her family members protocol".

2.3. Treatment in the rehabilitation centre and in the community (long-term rehabilitation)

Long-term rehabilitation will take place in a rehabilitation centre (or in a rehabilitation department in a hospital) and in the community.

Note: For details on long-term rehabilitation, institution-based rehabilitation and community based rehabilitation, refer to the information brochure ("Information on rehabilitation").

The needs in term of long-term rehabilitation will depend on the patient primary pathology. For details, refer to the corresponding PT protocol.