Drainage

Drainage is used to remove substances from the body (blood, secretions, bile, air, etc.) after surgery or injury. Its goal is to prevent the accumulation of fluids or air in the area, which results in complications of healing. The principle is drainage using a drainage tube. The secretion itself accumulates in the reservoir.


redon bottle

[1]**Drain requirements:**

- **Biostability**– property of synthetic materials consisting in maintaining stability even after introduction into the body.
- **Biocompatibility**[2] – compatibility of substances, materials in the biological environment. Biocompatible material is assessed according to the interaction with the environment, the impact on infectious processes, the extent and quality of biodegradation.

Drain Division

- **According to the ways of creation** - natural and artificial
- **According to the mechanism of action** - gravitational, vacuum, free.
- **By material** - altered natural materials, synthetic artificial materials, fabrics.
- **According to the method of sampling** - passive (gravitational, free drainage) and active (vacuum drainage).
- **By time aspect** - temporary and permanent (eg for bile ducts).
- **Depending on the environment** - open and closed.

Division according to the method of creation

- **Natural** - in superficial wounds, it is created by loosening the suture in the wound and the secretion is absorbed by the bandage (= free drainage).
- **Artificial** - used for deep cavities, bearings, organs

Division according to the mechanism of action

- **Gravitational** (gradient).
- **Suction** (vacuum).
- **Free** (uplifting, capillary).

Gravitational drainage

The principle is to aspirate the secretion in the direction of the natural direction of the fall. Due to gravity, the fluid drains into a collection bag, which must be placed lower than the wound. It is used, for example, after abdominal operations.

Suction drainage

This is a drainage using the vacuum in the vacuum cylinders, active suction of fluids takes place. Suction is continuous and prevents infection from entering the wound. The vacuum is created by a water pump or suction device. The possibility of drainage is with low (7–15 kPa) or high (80–90 kPa) vacuum. A specific example of vacuum drainage is Redon drainage (there is negative pressure in the vessel), Bülau drainage (sucking air and secretion from the thoracic cavity).

Free(raising, capillary) drainage

A glove, mule or Penrose drain is inserted into the wound, which leads the secretion into a bandage. With higher viscosity and more secretion, drainage efficiency is limited.

extracellular fluid drainage in biceps femoris

Dividing by material

- **Modified natural materials** - rubbers, latex soft rubber.
  - Rubber drain - made of any sterile tube.
  - Glove drain = latex - made of surgical glove, used for superficial wounds.
- **Synthetic plastics** - PVC, silicone, polyurethane - can be left longer, it is used for drainage of organs.
- ***fabrics***.

Division according to the method of consumption

- ***Passive*** - the only force that acts on the outflow of fluids is gravity, capillarity (the result of surface tension, forces acting between fluid molecules), or different pressure.
- **Active** - the content is actively aspirated by a vacuum device.

types of drainage during surgery

Jackson-Pratt (JP Drain)

It consists of a perforated tube and a negative pressure collection device (usually a compressed rubber balloon that causes the negative pressure to return to its original shape). The balloon is emptied and the amount of fluid trapped can be measured.

Kehr drainage(T-drain)

It is a tubular, gradient (passive) drain. It is used to drain bile, shorter arms are introduced into the bile ducts, the longer arm is brought to the surface and connected to a collection bag.

Robinson Drainage

Tubular, gradient (passive) drain. It has a larger diameter than the T-drain and therefore the tube must be filled with fluid or contain a non-return valve.

Redon's Drainage

Active, connected to a bottle with permanent vacuum. It contains a vacuum value indicator when it drops, it needs to be replaced or the drain is not working.

Flush Drainage

It contains a flushing solution at one end of the wound and a suction tube at the other. It is used for purulent wounds to remove secretions, it can be open or closed. The lavage solution is Betadine, Saline, Prontosan or Hydrogen Peroxide.

Bülau drainage

The end of the air or fluid outlet tube is immersed 3 to 5 cm below the level of the antiseptic solution, thereby creating a one-way water valve. It is used, for example, to extract air from the pleural cavity. With each exhalation, the air is expelled, but the forces acting on the inhale are not enough to suck in air again. Depth of immersion indicates negative pressure in the pleural cavity.

Two-bottle drainage system

It is a system of two bottles, one of which is used to collect secretions and the other is connected to an active suction system. The use of back suction prevention is the water valve in the first bottle.

Three-bottle drainage system

The first bottle has a collecting function, the second contains a water valve (the hose is immersed 2 cm below the level of the solution), the third is connected to a vacuum source.

Chest Drainage

We introduce the drain into the pleural cavity for long-term suction of air or fluid.

Reasons for drainage

- pathological contents in the pleural cavity (if chest puncture is not sufficient);
- spontaneous pneumothorax
- post-traumatic pneumothorax (eg in case of a broken rib);
- massive or recurrent non-inflammatory effusion (unresponsive to puncture);
- effusion of tumor origin before administration of cytostatics to the pleural cavity;
- purulent effusion (emphysema);
- bloody effusion (hemothorax).

Method

.We perform the procedure under local anesthesia, under sterile conditions

- We use company-manufactured disposable drainage kits, containing drainage of various widths and other aids and tools needed to perform the procedure.

- We choose the place of insertion of the drain according to the same rules as for chest puncture.
- We make the access path for the drain with a short cut of the skin, we penetrate other layers of the chest wall with a bluntly hard trocar (spike) from the drainage set. We insert a soft plastic drain into the pleural cavity through the trocar and then pull the trocar out.
- We fix the drain to the chest wall with a skin suture and cover the place of insertion of the drain with a sterile bandage.
- We connect the drain to the suction device.
- After the insertion of the drain, we perform a control X-ray examination of the chest to verify the position and function of the drain;
- If the lungs are permanently dilated and no more fluid is formed in the pleural cavity, drainage is removed.
- If the reason for drainage was pneumothorax, we leave the drain closed for a few hours before removal and perform a chest X-ray to make sure that no more air enters the pleural cavity and restores pneumothorax before removing the drain.

complication

- **Early (<24h)** - bleeding from injured blood vessels, organs, diaphragmatic injury, intestinal injury, lung parenchymal injury with air leakage.
- **Late (> 24h)** - incomplete re-expansion of the lung (it is necessary to increase the vacuum, or replace the drain, pull the drain), persistent lung collapse, blockage of the drain (eg clot), subcutaneous emphysema.

Size of chest drains

It is given in French units (F).

- Small caliber drains: 8-14 F.
- Medium caliber drains: 16-24 F.
- Large caliber drains:> 24 F.

Controversial chest drainage issues

1. ACTIVE SUCTION

- Immediately after insertion of the thoracic drain.
- In case of insufficient drainage effect (low secretion from the drain, unexpanded lungs, air leakage) after 48 hours from the introduction of the drain high-volume / low-pressure drainage system (volume 15–20 l / min, negative pressure 10–20 cm of water = 0.98–1 , 96 kPa).

2. Extraction rate of lung effluents

single suction at a maximum of 1.5 liters or at a rate of 0.5 liters / hour. (If you experience shortness of breath, chest pain, irritating cough or vasovagal symptoms: stop sucking - CAVE !!! There is a risk of re-expanding pulmonary edema.)

3. Drain flushes

If the drain is clogged, rinse with 20-50 ml of saline. Preventive flushing of small caliber drains.

4. Drain clipping in pneumothorax

Before pulling out the drain, about half of the experts recommend that the drain be clipped with a chest check chart after 4-24 hours to rule out a small air leak. Under no circumstances should the drain with a visible air leak be clipped.

5. Drain removal

- **Pneumothorax**: with a negative chest skiagram 4-24 hours after the last evidence of air leakage or drain clipping.
- **Malignant effusion**: 12-72 hours after pleurodesis if drainage from the drain is <250 ml / day.

Links

Drainage topics

- Drenáž interpleurální tekutiny (pediatrie)

Reference

1. VEJTEČKOVÁ, Renata, Ústav ošetřovatelství 3. LF, Drény a drenážní systémy, <http://nas.lf3.cuni.cz/materialy/CNS002P2/drenaze(5087d2542eb3f).pdf>
2. http://lekarske.slovniky.cz/pojem/biokompatibilita