Essay: The comparison of traditional and modern methods of surgery in oncological operations

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1. Introduction
The purpose of this report is to draw a comparison between different methods of operations used in oncological treatment: traditional ones and modern methods of surgery.

Oncology is the branch of medicine dealing with tumours (also known as neoplasms) - abnormal growths of tissue. We differ between: benign neoplasms, in situ neoplasms, malignant neoplasms (called cancer) and neoplasms of uncertain or unknown behavior.

Oncology is concerned with the diagnosis of a cancer, its therapy, the follow-up of cancer patients after successful treatments, palliative care of patients with terminal malignancies, ethical questions considering cancer care and its further forecasts (for populations or for the relatives of patients).

There are thousands of everyday DNA-altering, carcinogenic situations, well researched, such as (J.Smith,
p.55): 60,000 chemicals in our air, food, and water, vaccines, prescription and over-the-counter drugs, processed and genetically modified foods, tobacco, air pollution, fluoridated and contaminated water, chlorine, pesticides and herbicides on produce.

According to Wikipedia, operation is every kind of treatment on organs and tissues of body aiming to improve health condition and comfort of patient, or diagnostic proceedings conducted in this manner. Against of the alternative, misleading name of surgical treatment, operations are not only conducted by surgeons, but also belong to other specialisation doctors’ competences. As an example, Cesarean section can be mentioned – this is one of basic treatments conducted by gynecologist. Operations take place in surgical block and usually need an assistance of doctors, circulating nurses, anesthetists, and nowadays often also biomedical engineers.

There are a few types of operations. We categorize it by the time of conducting it to interim (done a few hours after appearance of symptoms), immediate (a few days after) and planned (when there is no urgent need to conduct the operation).

Although well-known traditional operating methods are mastered and still widely practised, the robotic surgery stands a promising future for modern, safe and un invasive tumour’s treatment.

The report has been divided into a few sections to introduce the reader into the topic and to collate basic information about every method. In the next part, final comparison has been done, all the advantages and drawbacks of methods have been mentioned and conclusions and recommendations have been drawn.

2. Oncological treatment

Surgery can be used to diagnose, treat, or even help prevent cancer in some cases. Most people with cancer will have some type of surgery. It often offers the greatest chance for cure, especially if the cancer has not spread to other parts of the body.

Surgical operations are the oldest methods of tumours’ treatment. Initially, operations were conducted in an advanced stage of patient’s illness. Nowadays in surgical treatments following rules are applied:

– operations are to be conducted as soon as possible, to avoid further development of tumour and metastasis,
– operations are comprehensive (neoplasmic tissue is removed with a margin of healthy tissue or with the whole organ),
– together with bump, adjoining lymph nodes are removed, if necessary.

Except of scalpel, nowadays other methods are also being used:

– in electrosurgery ‘electronic knife’ is used (an electrode plugged to the electricity source of high frequency)
– in cryosurgery, so called cryosond is used (it is chilled to -180° C using liquid nitrogen)
– in laser surgery the laser knife is used
– in endoscopic surgery endoscope is used, because it enables to operate on organs inside of the body.

2.1 Types of operations used in oncology (according to www.cancer.org)

Preventive (prophylactic) surgery is done to remove body tissue that is likely to become cancer. Sometimes preventive surgery is used to remove the whole organ when a person has an inherited condition that puts them at higher risk of having a cancer in the future.

Diagnostic surgery is often used to help diagnose cancer. In most cases, the only way to know if a person has cancer and what kind of cancer it is, is by taking out a piece of tissue (called a sample) and testing it. This is often called a biopsy. The diagnosis is made by looking at the cells of the sample under a microscope or by doing other lab tests on it.

Staging surgery is done to find out how much cancer there is and how far it has spread. The physical exam and the results of lab and imaging tests are used to figure out the clinical stage of the cancer. But the
surgical stage is usually a more exact measure of how far the cancer has spread. Curative surgery is usually done when cancer is found in only one part of the body, and it is likely that all of the cancer can be removed. In this case, curative surgery can be the main treatment. It may be used alone or along with other treatments like chemotherapy or radiation therapy, which can be given before or after the operation.
Palliative surgery is used to treat problems caused by advanced cancer. It can be used to correct a problem that is causing discomfort or disability. Palliative surgery may also be used to treat pain when the it is hard to control by other means. It helps ease problems caused by cancer and helps people feel better, but it is not done to treat or cure the cancer itself.
Debulking surgery is used to remove some, but not all, of the cancer. It is sometimes done when taking out all of the tumor would cause too much damage to nearby organs or tissues.
Supportive surgery is done to help make it easier for people to get other types of treatment. For example, there are vascular access device which are thin, flexible tubes that can be surgically placed into a large vein and connected to a small drum-like device that is placed under the skin. A needle is put into the drum of the port to give treatments and draw blood, instead of putting needles in the hands and arms each time.
Restorative (reconstructive) surgery is used to improve the physical appearance of a patient after major cancer surgery. It is also used to restore the function of an organ or body part after surgery.
3. Comparison of biopsy methods (according to National Institutes of Health)
When it comes to biopsy, we distinguish between fine needle aspiration, core needle, excisional and incisional biopsy:
Fine needle aspiration biopsy
In this technique, a thin, hollow needle is inserted into the mass for sampling of cells that, after being stained, will be examined under a microscope. There could be cytology exam of aspirate or histological examination. Fine-needle aspiration biopsies are very safe, minor surgical procedures. Often, a major surgical (excisional or open) biopsy can be avoided by performing a needle aspiration biopsy instead. (www.wikipedia.com)
Core needle biopsy
This type of biopsy uses a larger needle to take out a thin core of tissue. Core biopsies can be guided by imaging tests (like an ultrasound or CT scan) if the tumor is too deep to feel through the skin. (www.cancer.org)
Excisional or incisional biopsy
Incisional biopsy is in which only a sample of the suspicious tissue is cut from a mass and removed for purposes of diagnosis. A incisional biopsy is in contrast to an excisional biopsy in which an entire lesion, usually a tumor, is removed and subjected to examination. (www.medicinenet.com)
Table 1. Comparison of biopsy methods
FNA biopsy
Core needle biopsy
Excisional, incisional biopsy
+ It is safe, minimally invasive, non-traumatic.
– There is a risk that due to the small size of biopsy (only a few cells), the problematic cells will be missed, resulting in a false negative result.
– There is also a risk that the cells taken will not enable a definitive diagnosis.
– This takes longer than an FNAB
+ It is more likely to give a clear result because more tissue is taken to be checked.
– A CNB can cause some bruising.
+ It usually does not leave scars inside or outside.
– It is much more invasive than a FNA or a CN biopsy.
– Stitches are often needed so it leaves a scar. The more tissue removed, the more likely it is that shape of body will be changed. It can also cause bleeding and swelling.
+ It is the most precise type of biopsy, allowing to make the most accurate examination.
4. Traditional methods
4.1 Open surgery
According to Wikipedia, open surgery is any surgical technique where the incision is sufficient of itself to
permit the surgical procedure to take place under the direct vision of the surgeon (although magnifying aids such as loupes or microscopes may play a role in certain types of procedures).

In open surgery, cancerous tissue or organ is removed after full-cut opening of body. Operation is conducted by the surgeon with use of his hands and manual devices.

Practically every type of cancer of any tissue or organ can be treated with open surgery.

4.2 Electrosurgery and radiofrequency ablation

In case of electrosurgery, cells or tissues are cut, destroyed, coagulated, desiccated, or fulgurated with use of a high-frequency electrical current. Usually this method is used in case of cancers of the skin and mouth. Electrosurgical devices are frequently used during surgical operations helping to prevent blood loss in hospital operating rooms or in outpatient procedures.

In radiofrequency ablation, or RFA, high-energy radio waves are sent through a needle to heat and destroy cancer cells. RFA may be used to treat cancer tumors in the liver, lungs, kidney, and other organs.

4.3 Laparoscopic and thoracoscopic surgery

According to Britannica, laparoscopy, also called peritoneoscopy, is a procedure that enables visual examination of the abdominal cavity with an optical instrument called a laparoscope, which is inserted through a small incision made in the abdominal wall. The laparoscope is a type of endoscope – a device similar to a small telescope, equipped with a light source.

Modern laparoscopes have been fitted with fibre-optic lights and small video cameras that allow a surgeon to view the abdominal tissues and organs on a monitor. These improvements have expanded the applications of laparoscopy.

Today the technique is not only used to obtain diagnostic information but employed in a variety of surgeries, including removal of cancerous tumours.

A thoracoscope is a thin tube with a tiny video camera on the end that can be put through a small cut into the chest after the lung is collapsed. This allows the doctor to see inside the chest. Tissue samples of any areas of concern on the lining of the chest wall can be taken out, fluid can be drained, and small tumors on the surface of the lung can be removed. (www.cancer.org)

4.4 Mohs surgery

Developed by Dr. Frederick Mohs in the 1930s, Mohs surgery is one of the most precise methods used to treat skin cancers. During Mohs surgery, layers of cancer containing skin are progressively removed and examined until only cancer-free tissue remains. Mohs surgery is also known as Mohs micrographic surgery.

The goal of Mohs surgery is to remove as much of the skin cancer as possible, while doing minimal damage to surrounding healthy tissue. Mohs surgery is usually done on an outpatient basis using a local anesthetic.

5. Modern methods

5.1 Laser surgery

Laser light can be used to remove cancer or precancerous growths or to relieve symptoms of cancer. It is used most often to treat cancers on the surface of the body or the lining of internal organs. Laser therapy is often given through a thin tube called an endoscope, which can be inserted in openings in the body to treat cancer or precancerous growths inside the trachea (windpipe), esophagus, stomach or colon.

Laser therapy causes less bleeding and damage to normal tissue than standard surgical tools do, and there is a lower risk of infection.

However, the effects of laser surgery may not be permanent, so the surgery may have to be repeated. (www.cancer.gov / National Cancer Institute)

5.2 Cryosurgery

Refering to Wikipedia, cryosurgery is the use of extreme cold in surgery to destroy abnormal or diseased tissue. It has been historically used to treat a number of diseases and disorders, especially a variety of benign and malignant skin conditions. Small skin cancers are candidates for cryosurgical treatment. Several internal disorders are also treated with cryosurgery, including liver cancer, prostate cancer, lung cancer, oral cancers or cervical disorders. Generally, all tumors that can be reached by the cryoprobes used during an operation are treatable. Although found to be effective, this method of treatment is only appropriate for use against localized disease, and solid tumors larger than 1 cm. Tiny, diffuse metastases that often coincide with cancers are usually not affected by cryotherapy.

Substances used for cryosurgical treatment are liquid nitrogen, carbon dioxide, argon and dimethyl ether-
5.3 Robotic surgery
Robotic surgery is a type of laparoscopic (or thoracoscopic) surgery where the doctor sits at control panel and uses precise robotic arms to control the scope and other special instruments. The advantages of this type of surgery are largely the same as laparoscopic and thoracoscopic surgery: it can help reduce blood loss during surgery and pain afterward. It can also shorten hospital stays and let people heal faster.
Robotic surgery is sometimes used to treat cancers of the colon, prostate, and uterus, and its use in operating on other organs is also being studied. It’s not yet clear if robotic surgery leads to better long-term results than operations where the surgeon holds the instruments directly. (www.cancer.org)

5.4 Other, alternative methods
Doctors are always looking for new ways to remove or destroy cancer cells. Some of these methods are blurring the line between what we commonly think of as surgery and other forms of treatment.
Researchers are testing many new techniques, like using high-intensity focused ultrasound, microwaves, and even high-powered magnets to try to get rid of unwanted tissue. These techniques are promising, but still largely experimental.
As doctors have learned how to better control the energy waves used in radiation therapy, some newer radiation techniques that work almost as well as surgery have been found. By using radiation sources from different angles, stereotactic radiation therapy delivers a large precise radiation dose to a small tumor area. The process is so exact that this is sometimes called stereotactic surgery, even though no cut is actually made. In fact, the machines used to deliver this treatment have names like Gamma Knife and CyberKnife??, but no knife is involved. The brain is the most common site that can be treated using this technique, but it’s also used on some head, neck, lung, spine, and other tumors. Researchers are looking for ways to use it to treat other types of cancer, too. (www.cancer.org)

6. Comparison of methods
Due to this significant volume, Table 2. ‘Final comparison of traditional and modern surgery methods has been placed in Appendix number 1.

7. Conclusions and recommendations
When it comes to biopsy, it is not possible to choose its one, unambiguously the best method. Every type of biopsy has its advantages and drawbacks and it appertains to doctor to judge which one is suitable for particular examined case.
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8. References
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In-text citation:
Corrosion is defined as a ‘chemical action which harms the properties of a metal’ (Glendinning 1973, p.12). Because corrosion reduces the life of the material and protection procedures are expensive, special corrosion-resistant metals have been developed, including Monel metals which are particularly suited to marine applications (Glendinning 1973). Reference list entry: Glendinning, E.H. 1973 English in mechanical engineering, Oxford, Oxford University Press.

6.0 References
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