

*cancer, paraneoplastic syndrome,  
Computed Tomography,  
connective tissue disorder*

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## **THE USE OF COMPUTED TOMOGRAPHY IN THE DIAGNOSIS OF NEOPLASIA IN PATIENTS SUSPECTED OF CONNECTIVE TISSUE DISORDERS**

In this paper the usefulness of Computed Tomography (CT) in earlier diagnosis of cancers is presented. Computed Tomography can be utilized as a valuable tool in the diagnosis of malignant tumors, monitoring of therapy and during follow-up or remission phase. The images provided by CT scans depict precise location of the tumor damaged tissues and/or organs. In investigations results of 29 patients examinations were analysed. All patients were diagnosed with malignancy tumors and hospitalised in Klinika Chorób Wewnętrznych i Reumatologii (The Clinic of Internal Medicine and Rheumatology) in Katowice during 2003- 2006. Earlier examination by using CT allows to diagnose some type of cancers. Such examination is unfortunately expensive. For patients with paraneoplastic syndromes CT examination is especially recommended. For these type of patients effectiveness of proposed in this paper method is more than 80%. These results are very promising.

### **1. BACKGROUND**

Computed Tomography (CT) is a technique of radiological examination, which produces a cross-sectional or slanting view of a part of the body (a beam of X-rays is passed through a section of tissue from different directions on the detectors). Then a computer can estimate the scale of the linear attenuation coefficient in the individual tissue and construct a view of a particular layer in the screen of the monitor in the scale of grey. The grade of the linear attenuation coefficient is presented in the scale of Hounsfield. The unit used for the reconstruction of the Computed Tomography image is CTN (Computed Tomography Number). It is also called Hounsfield's unit (HU). It estimates the relative value of the tissue comparing it to the density of water. When the data is processed by a computer, the sections are presented in the monitor screen in the scale of grey level.

In the Table 1 the CTN references (patterns) are presented [6]. In many cases if cancer will be observed, such patterns (numbers) will have different values. On the basis of deformed patterns, cancer identification can be occurred. In our investigations comparisons between CTN and CT image were done.

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Table 1. The CTN patteredn values

| Tissue  | CTN        |
|---------|------------|
| Bone    | +1023      |
| Liver   | +60        |
| Blood   | +40 do +50 |
| Muscles | +45        |
| Water   | 0          |
| Fat     | - 65       |
| Lungs   | <- 400     |
| Air     | - 1023     |

Spiral CT is a method of examination routinely used in the examination of abdomen and chest. Beams of X-rays are not sent separately to each layer like in a classical Computed Tomography but only one beam of X-rays is sent. It covers completely the examined segment of the body when the table carrying the patient is moving and the computer reprocesses the data to construct the relevant layers. In a classical examination the lamp rotates around the patient, separately for each layer of the body and in the spiral CT it rotates only once in each examination.

Spiral CT in comparison with the classical CT is faster and thus more secure for the patient suffering from multiorganic trauma. Because of the speed the spiral technique enables making several examinations in short time. There are fewer artifacts connected with moving and breathing in the spiral CT. There are also greater possibilities of the reconstruction of images. Spiral CT enables making angio-CT as well as detecting diseases, which were earlier hard to detect, or even undetectable in the classical CT like: pulmonary embolism, appendicitis and urethral lithiasis.

The contrast material is also referred to as contrast agent or contrast medium. Any internally administered substance that has a different opacity from soft tissue on radiography or computed tomography includes:

- Barium or water, used to make parts of the gastrointestinal tract opaque.
- Iodine in water, used for arthrography.
- Water-soluble iodine, used to make blood vessels opaque; to demonstrate the inner structures of the urinary tract (kidneys, ureters and bladder); and to outline joints (the spaces between two bones).
- Iodine mixed with water or oil may be used to evaluate the fallopian tubes and lining of the uterus.

In Computed Tomography the contrast material is administered orally or intravenously. Oral agents can be divided into positive and negative (they can absorb radiation stronger (positive) or weaker (negative) than tissues of the alimentary canal [5].

Negative contrast agents:

- water (stomach, pancreas),
- cellulose (small intestine, colon),
- paraffin, vegetable oil (small intestine, colon),
- air (colon, stomach),

Positive contrast agents:

- BaSO<sub>4</sub> (solution) (stomach, intestines),
- iodine in water.

An intravenous access is achieved by the use of caniuila with appropriate diameter. The elbows veins are preferred. The intravenous application of contrast is quite safe although there can occur complications like:

Table 2. Said effect of contrast agent

| Light            | Moderate               | Serious               |
|------------------|------------------------|-----------------------|
| Nausea           | Fainting               | Convulsions           |
| Vomiting         | Intense vomiting       | Swelling of the lungs |
| Nettle rash      | Extensive nettle rash  | Shock                 |
| Pruritus         | Swelling of the face   | Respiratory arrest    |
| Hoarseness       | Swelling of the larynx | Circulatory arrest    |
| Cough            | Cramp in the bronchi   |                       |
| Sneezing         |                        |                       |
| Massive sweating |                        |                       |

Mentioned complications do not depend on the dose and can always occur, in spite of the caution of the doctor. During the examination patients are in radiologist and anesthesiologist care. The hospital X-ray-office is adapted to instant help.

There is always a slight chance of cancer from radiation. However, the benefit of an accurate diagnosis far outweighs the risk. Women should always inform their physician or x-ray technologist if there is any possibility that they are pregnant. CT scanning is, in general, not recommended for pregnant women because of the potential risk to the baby.

Using specialized equipment and the expertise to create and interpret CT scans of the body radiologists can more easily diagnose problems such as cancers, cardiovascular disease, infectious disease, trauma and muskuloskeletal disorders.

## 2. INVESTIGATION PURPOSE

The aim of our study was a retrospective analysis of laboratory results, imaging studies and abnormal findings of physical diagnosis in patients with cancers suspected of connective tissue disorder and evaluation of their usefulness in earlier diagnosis of cancers (by using Computed Tomography). Malignant tumors are associated with numerous, unspecific symptoms described as Paraneoplastic Syndromes. Similar multiple, diverse symptoms have been observed in patients diagnosed with rheumatic diseases.

It has been theorized that a paraneoplastic syndrome is a disease or symptom that is the consequence of the presence of cancer in the body, but is not due to the local presence of cancer cells. These phenomena are mediated by humoral factors (by hormones or cytokines) excreted by tumor cells or by an immune response against the tumor. Sometimes the symptoms of paraneoplastic syndromes show even before the diagnosis of a malignancy. These syndromes may occur in up to 10–15% of malignancies, and they may be the first or most prominent manifestation. However, this incidence could be underestimated. Unfortunately, the etiology of these symptoms have not currently been established.

The diagnosis of paraneoplastic syndromes is very important because it can be the first syndrome of cancer. It can be used for monitoring of cancer progress because the symptoms can decrease or disappear by radical treatment. The symptoms can also appear again with the relapse of cancer [1].

The paraneoplastic syndrome the most often accompanies lung cancer (especially the small cell lung cancer). Neurological paraneoplastic syndromes accompany 5% cases of that kind of cancer [1]. Paraneoplastic syndromes may or may not be characteristic of a specific system. Usually, the paraneoplastic syndromes are divided into the following categories: (1) miscellaneous (nonspecific) as fever, dysgeusia, anorexia, and cachexia, (2) rheumatologic, (3) renal, (4) gastrointestinal, (5) hematologic, (6) cutaneous, (7) endocrine, and (8) neuromuscular.

Establishing the proper diagnosis depends on the ability to make allowances for cutaneous changes in the systemic disease because cutaneous changes can coexist with neoplasms of the organs. The course of the disease is usually hard and can be accompanied by abnormal findings in laboratory results. The treatment of the symptoms is ineffective. Only eliminating neoplasm causes the remission or upturn of the cutaneous changes.

The most common paraneoplastic syndromes with cutaneous changes are erythema necrolytic migrans called also glucagonoma syndromes which accompany in 80% cancer of pancreas [2].

The paraneoplastic syndrome can also manifest rheumatologic symptoms. There are characteristics which can simplify establishing the diagnosis of a paraneoplastic nature of the rheumatologic symptoms like: abrupt beginning, age over 50, sudden progress of the illness, no response to the treatment. The most common paraneoplastic syndrome with rheumatologic symptoms is inflammatory myopathy which accompanies cancer of ovary and cancer of the lungs and neoplastic polyarthritis [3].

### 3. MATERIALS AND METHODS

This research included 29 in-patient data from patients diagnosed with malignancy tumors hospitalised in The Clinic of Internal Medicine and Rheumatology in Katowice during 2003-2006. The following type of examinations were used: CT, NMR or HRCT.

Patients were admitted to hospital because of various reasons. Most of them (27,5%) were admitted because of the symptoms suggesting connective tissue disorder. In the second place (20,6%) were the patients admitted because of a particular rheumatic disease. 13,7% of the patients were urgent cases, while only 10,3% patients were admitted with the diagnosis of neoplasia.

### 4. OBTAINED RESULTS

80% of the patients who had images (CT, NMR, HCTR) and had cancer diagnosed in these images had reported paraneoplastic symptoms earlier (loss of weight, articular pain and morning stiffness, fever, swelling of the body, cutaneous changes).

The most often mentioned paraneoplastic syndrome was articular pain and morning stiffness (10 patients), loss of weight (9 patients), fever (6 patients), swelling and cutaneous changes (3 patients).

Unspecific paraneoplastic syndromes are accompanied by the neoplasms with various location. Most patients had at least one symptom suggesting the connective tissue

disorder, like: cutaneous changes, swelling, fever, loss of weight, articular pain and morning stiffness.

Table 3 presents results of laboratory tests of patients with malignant neoplasms. The attention was paid to the following parameters:

Table 3. Laboratory tests of patients with malignant neoplasms diagnosed

| Parameter               | Norm   | Result  | Mean value                   |
|-------------------------|--|---|------------------------------|
| RBC                     | (W): 3,5-5,2 ml/ul;<br>(M): 4,2-5,4 ml/ul20  | 6% of patients below norm                                       | 4,05                         |
| HCT                     | (W):37-47%;<br>(M): 40-54%   | 79,3% of the patients below norm                                | 33,6                         |
| MCH                     | (W):12-16 g/dl;<br>(M):14-18 g/dl  | 68,9% of patients below norm                                    | 11,8                         |
| WBC                     | (W,M):4,0-10,0 x 103/ml  | 37,9% of patients above norm                                    | 9,02                         |
| PLT                     | (W,M):135-350x 103/ul  | 34,4% patients above norm<br>6,8% of patients below norm        | 316                          |
| AF                      | (W,M):80-280 U/l   | 42,8% patients (p=21) above<br>23,8% patients (p=39) below norm | 339,2                        |
| Total protein           | (W,M) 60-80 g/l  | 33,3% of patients (p=27) below norm                             | 6,3                          |
| ESR                     | after 1h norm:<br>(W): 3-5 mm/h; (M): 4-7 mm/h<br>after 2h norm:<br>(W): 7-15 mm/h (M): 12-17 mm/h | 100% of patients increased                                      | 45,7 after 1h; 74,5 after 2h |
| Alanine transaminase    | 0-40 U/l   | 20,6% of patients above norm                                    | 30,6                         |
| Asparagine transaminase | 0-37 U/l   | 13,7% patients above norm                                       | 28,4                         |

Note: W- woman, M- men

## 5. CONCLUSIONS

The Computed tomography (CT) is a useful tool for a non-invasive pathology evaluation. It provides precision in illuminating the location of malignant tumors, which will facilitate accurate and rapid diagnosis and treatment, ultimately, improving mortality in this patient population. By using Computed Tomography the faster and more precisely diagnosis can be done. It gives great hopes for future for all of us because thanks to that a human's life can be effectively protected and safe. From our investigations follows that patients with paraneoplastic syndromes are should be especially diagnosed by means of the CT method because 82,7% of them have finally cancer disease. Mentioned dependences by Fig.1 are depicted.

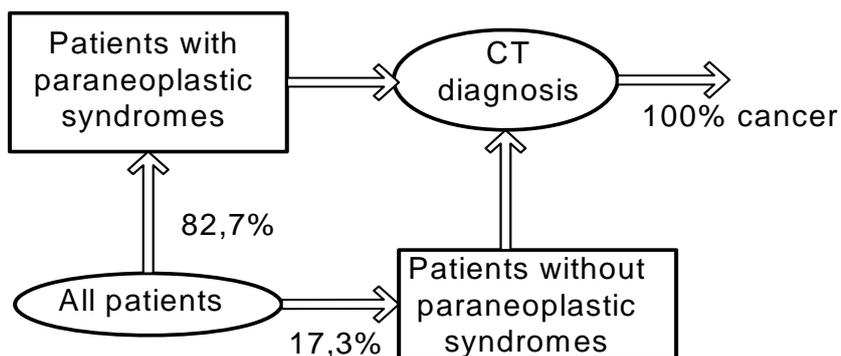


Fig.1. Dependences between frequency of paraneoplastic syndromes and cancer diseases.

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