The role of spiral computer tomography in anatomic structures value and possibilities in diagnostic of throat cancer

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"What would become today with phtysiopulmonology and urology, gynecology and otolaryngology, neurology and oncology, surgery and orthopedy, ophthalmology and traumatology if to deprive it what has given rentgenology in the field of diagnostics and treatment?"

N.N. Priorov, 1946
Computer tomography (CT) - the level-by-level radiological research based on the computer reconstruction of the image during circular scanning of object by a narrow beam of X-ray radiation.
The CT - principle

The scheme of X-ray computer tomography
1 - the tube; 2 - the circular detector; 3 - the computer; 4 - system of processing the image
Stages of computer tomography

1. Generating radiation
2. Scanning the object
3. Reconstruction of tomograms
4. The images analysis
5. 2-D, 3-D transformations
6. Saving the information
Step-by-step scanning

Spiral scanning
Spiral scanning

Step of spiral = \textit{pitch} = \frac{\text{Table feed per rotation (mm)}}{\text{Slice collimation (mm)}}
The Hounsfield scale

Bone
+1000

+100

+75

+50

+25

0

-25

-50

-75

-100

Air
-1000

Water

liver
kidneys
pancreas
spleen
blood

Fat
tissue

lungs

«window»
Pulmonary window

Soft-tissue window
The CT- technologies

- Traditional CT 1972
- High-resolutional CT 1985
- Spiral CT 1989
- Multispiral CT 1999
The modern spiral computer tomograph
Spiral computer tomography

- High speed of research
- 3-D reformation
- CT-angiography
- Great opportunities of image processing

Continious tube rotation
Continious moving a table with the patient
# The comparison TR and CT

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Traditional roentgenography</th>
<th>Computer tomography</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sensitivity</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Brain tumor</td>
<td>≈ 10-20%</td>
<td>≈ 95%</td>
</tr>
<tr>
<td>Lung cancer</td>
<td>≈ 60-80%</td>
<td>≈ 95%</td>
</tr>
<tr>
<td><strong>Specificity</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Brain tumor</td>
<td>≈ 1%</td>
<td>≈ 70%</td>
</tr>
<tr>
<td>Lung cancer</td>
<td>≈ 70%</td>
<td>≈ 95%</td>
</tr>
<tr>
<td><strong>Resolution</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>≈ 3 - 5 mm</td>
<td>≈ 1.0 mm</td>
</tr>
<tr>
<td><strong>Ray’s loading</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>≈ 0.5 mZv</td>
<td>≈ 5 mZv</td>
</tr>
</tbody>
</table>
Methods of image transformation

- Multiplanar Reformation, MPR
- Three-dimensional transformation (three dimensional rendering, 3-D)
  - Shaded Surface Display, SSD
  - Volume rendering
Image reconstruction and multiplanar reformation

Axial plane

Frontal plane

Sagittal plane
Shaded Surface Display, SSD
Shaded Surface Display, SSD
Shaded Surface Display, SSD
Shaded Surface Display, SSD
Volume rendering
Volume rendering
Volume rendering
SCT-angiography, volume rendering
Virtual 3-D endoscopy
Virtual 3-D endoscopy
Virtual 3-D endoscopy (view from inside)
The diagnostic opportunities of modern CT

Summary

- Trauma
- Tumors
- Infection
- Anomalies
- Degenerative lesion
- Inflammation processes
The throat cancer makes 1 - 4 % of all malignant tumors

Frequency of throat cancer through all malignant tumors of otolaryngological organs makes 50 - 60 %

In oncological disease structure at men takes 5-th place
Clinical symptoms of throat cancer are:

- Hoarseness, continuous and increasing (87% patients). It may be the first symptom.
- Breathing defect, down to asphyxia - later symptom.
- Specifying slow narrowing by tumor.
- Bloody cough, a smell from a mouth (the tumor’s disintegration), reduction of weight of a body.
- Painful swallowing an intoxication, change of mentality - latest symptoms of illness.
Throat cartilages structure

In front

Lateroview

Behind
Sagittal throat plane and ways of cancer distribution (→)
With the purpose of studying the computer tomography opportunities in diagnostic and an estimation of throat cancer computer tomograms of 45 patients were analyzed.
Parameters of throat scanning

• Prone patient’s position on a back side
• Axial scanning parallel vocal cords
• Optimum layer thickness – 3 – 5mm
• Spiral step 1,5
Normal throat CT (upper part)

- Hypoglossal bone
- Cervical vertebrae
- Spinal cord
- The skin and hypodermic fat
- Back group of neck muscles
- Epiglottis
- Submaxillary salivary gland
- The big horns of hypoglossal bone
- Carotid artery
Normal throat CT (middle part)

- Plate of thyroid cartilage
- Vocal cords
- Small throat cartilages
Normal throat CT (lower part)

Plate of thyroid cartilage

Small throat cartilages
Distribution the throat cancer depending of patient’s age

- > 70 years: 14.29%
- < 50 years: 10.71%
- 50-60 years: 32.14%
- 60-70 years: 42.86%
Distribution the throat cancer depending of anatomical localization

- Lower part: 14.29%
- Middle part: 60.71%
- Upper part: 25%
Distribution the throat cancer depending of disease stage

- IV stage: 28.60%
- I-II stages: 21.40%
- III stage: 50%
Throat cancer (upper part)

- Soft tissue increasing
- Regional lymph nodes lesion
Throat cancer

Volume increasing of right vocal cord

Perylaryngeal fatty tissue lesion

Lesion (calcinosis) of thyroid plate and small throat cartilages
Lesion of soft neck tissues
Throat cancer
68-years-old patient
radiation therapy

before

half month later
Throat cancer

Condition after operative and radiation treatment
Throat cancer

Condition after operative and radiation treatment
Throat cancer: the lymph nodes lesion
The stages of PET-examination

Entering into patient’s body the short-living isotopes

Scanning of radiation

Image reception and its analysis

PET + CT = \text{PET-CT}
PET-CT – the summary image of the “molecular” + X-ray tomography
Throat cancer: combined PET-CT
Conclusion

CT allows to reveal presence of a tumor, its localization and the sizes.

CT would allow to estimate of fatty spaces condition and surrounding soft tissues.

CT would allow to estimate of cartilages lesion and presence of metastases in regional lymph nodes.

CT is necessary for definition of treatment tactics, volume of surgical intervention, a choice of radiotherapy fields.

PET-CT allows to reveal presence of tumoral growth, would serve for the control and estimation of efficiency radio- and chemotherapy.

PET-CT allows for the revealing remote metastasis.
Thanks for attention!