HRCT in Diagnosis of Bronchiectasis

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SUMMARY. In order to analyze possibilities of HRCT and its contribution in the diagnosis of bronchiectasis on existing material from everyday clinical practice, we prospectively analyzed the CT scans of 35 patients with suspicion on this disease. The results of comparison of quality in displaying pathological changes in standard radiography and HRCT confirmed the HRCT superiority and showed significant differences in favor of the images obtained by HRCT. This applies to all specific image features: localization, form, size, distribution and relationship to surrounding parenchyma. Accuracy analysis of HRCT method findings with the final diagnosis was in high degree (99%). It was concluded that HRCT is a valuable radiological diagnostic method as imaging option for visualization of bronchiectasis in almost all cases (99%).

Keywords: HRCT, bronchiectasis, accuracy

1. INTRODUCTION

Bronchiectasis are irreversible enlargements mostly of small and medium-sized bronchi with destruction of their walls. They appear as a separate disorder or part of some diseases and congenital syndromes or specific nature (1). Usually they are in bag form or cylindrical expansions of bronchi that may be frequently associated with pneumonia or atelectasis.

Pathological anatomic diagnosis of bronchiectasis is based on destruction, or anomalies in the structure of the bronchus and consecutive enlargement of its lumen. If this anomaly is combined with the destruction caused by infection, then we will get the clinical picture of bronchiectasis. Although the pathological anatomic images of bronchiectasis are fully described by many authors, among the first to describe was Laennec, which clinically proven bronchiectasis with all its variations by bronchography testing methods (2).

Native chest X-ray can only indicate suspicion of bronchiectasis existence (3).

Etiology and pathogenesis of all of its forms is not fully clarified. The cause of this should be sought in variability and the emergence of the same changes in many acute diseases of chronic nature that simultaneously attack pulmonary parenchyma and bronchi. With etiopathogenetic point bronchiectasis are divided into congenital and acquired.

Thanks to modern diagnostic with appearance of high resolution CT (HRCT) disease can be detected at an early stage or already in early childhood when it is possible to accurately differentiate these changes. Bronchiectasis can be associated with other anomalies of development. We can find them syndromes like Kartagener one. It includes Triassic: bronchiectasis, situs viscerum inverzus and sinusitis (3).

Among the classifications which are based on morphological characteristics of bronchiectasis, most acceptable is the division into cylindrical, varicose and sacular because they are forms that clinicians often face. According to the pathohistological characteristics of the bronchi wall bronchiectasis can be atrophic and hyperplastic. Clinical classification is important for correct therapeutic approach and includes:

“Dry” bronchiectasis, classic bronchiectasis (bronchiectasis disease), bleeding bronchiectasis, bronchiectasis associated with COPD and bronchiectasis within certain syndrome. There are segments, lobar generalized, unilateral and bilateral ones. Method of determining bronchiectasis and the degree of their spreading still represent a complex diagnostic problem, because anamnESIS data and physical findings are insufficient. Classical clinical picture of inflammatory bronchiectasis with cough and purulent products today, in the era of antibiotics, somewhat changed and is rarely found as purrid apscendent form of disease.

Standard chest X-ray rarely could point to the existence of bronchiectasis, and even more rarely on their shape and arrangement. Only in the case of round walls with the enlightenement of thin walls, with or without a level, we can only say that there is a certain likelihood of cystic or sacular bronchiectasis. Once was used also classical tomography lung (air bronchogram).

The method of choice in diagnosing bronchiectasis is computerized tomography (CT) with high resolution program for pulmonary parenchyma (HRCT), which can indicate with great accuracy the existence of bronchiectasis, or to point to the cylindrical, varicose or cystic expansion of bronchus, and clearly differentiate them from intrapulmonary cysts, emizematous bullas or other changes within the lung parenchyma, and gives a clear view of secondary bronchiectasis that cause obstructive...
changes that led to inflammatory or atelectasis changes (4, 5, 6). To obtain a better insight into the etiology of disease bronchoscopy is sometimes needed. Usually they are localized in the lower, second, and lingual lobes. The preoperative preparation plan applies to the operation and analyzes the shape, size and distribution of bronchiectasis or HRCT gives us insight into the possibility of surgery, and analyzes the quality assessment of lung parenchyma in both lungs (7).

Surgical treatment is the only way to cure bronchiectasis. Surgically can be treated only localized bronchiectasis, either unilateral or bilateral, as well as bronchiectasis prone to bleeding. In remaining, majority of cases, a good effect is achieved by a combination of antimicrobrial and physical therapy to treat conditions that led to the formation of bronchiectasis. Conclusion can be brought only on the basis of quality examination of pulmonary parenchyma technique—HRCT (8).

1.1. Technical aspects of the computer assisted tomography

Since the introduction of CT in 1973, this method is continuously develops. Although the basic elements remained the same in the CT system (comprised of gantry containing the rotating X-ray tube and detectors, the patient table, computer units and operating consoles), many improvements have contributed that the current review and obtained scans are incomparable with those from earlier periods.

Introduction of spiral CT, which was introduced in 1989, movements of the table and the rotation of X-ray tubes are taking place at the same time (5, 6), which had the effect of reducing the flow of views where the view can be done by retaining a patient’s breath (breath hold acquisition). Modern CT with the software has the option of presenting the volume of agreeing individual scan with other. In this manner is made reconstruction of one part of the body that was recorded. New MSCT- mutly slice machines with the introduction of 4-slice, 16-slice, 32 and 64slices significantly advance the spatial resolution of the z-axis, with the increase in scanning speed and thinner layers of the patient are able to scan from the head to heal in less than 35 seconds (12).

To obtain transverse scans of raw data requires faster CPU. One important feature of spiral CT is that it can be retrospectively reconstructed set of scans obtained in all three planes. Each transverse scan of a certain thickness has been set for later reconstruction. In this way, overlapping reconstruction can be done by allowing a better longitudinal resolution than single layer CT that was previously used in practice. Corrections are possible in multi planes and 3D reconstruction is obtained as a continuous data set. Evaluation time is also increased because it receives more information from raw data. High resolution CT (HRCT) is not a system but CT is a technique to obtain scans. Main feature of HRCT are high resolution scans which can be achieved by reducing the thickness of the scan to 1-1.5 mm with the help of special computer algorithm to obtain high-resolution (10, 11). With spiral CT correlation must be determined before the examination. Sometimes it is impossible to scan the entire thorax in HRCT modality so it is most frequently used in evaluation only of certain segments that are suspicious on bronchiectasis. Special advantages of HRCT show the thoracic organs in transversal plain in the form of scans with superior resolution and wide dynamic range.

Transverse scan clearly separates structure that is super pointed with conventional radiography. High Definition makes it easy for analysis of individual mediastinal structures and chest wall together with the surrounding fatty tissue. Wide dynamic range covers the entire range of density of different tissues in the thoracic cavity. No other method can show details of lung parenchyma as HRCT. The development of spiral CT and MDCT is a part of continuous process improvement of CT technology. Today CT machines combine fast acquisition, fast data reconstruction and have very high spatial resolution. While earlier for interpretation available was 40-50 scans, now processes involves 200 to 500 scans, and in newer appliances double as much.

Improving technology has resulted in the appearance of new applications such as the Volume Rendering Technique (VRT), virtual bronchoscopy and Real Time imaging. Special challenge is data storage and data transfer, and a challenge for radiologists to analyze the vast amount of information available.

2. GOAL

The main aim of this study was that the existing material from everyday clinical practice analysis capabilities HRCT and his contribution to the diagnosis of bronchiectasis is in comparison to standard radiography and operative findings in surgically treated patients.

3. MATERIAL AND METHODOLOGY

Analyzed are the CT scans of 35 patients referred for CT examinations of the thorax with suspicion on bronchiectasis in the period January 2005–April 2009, (23 M, 12 W) at average age of 46 years (10–50 years). CT examinations were carried by machine Emotion Duo “Siemens” which can get two layers in one rotation and machine Volume Zoom, “Siemens” Plus 4, which uses 4 rows of detectors at the same time and can be used with 1mm detectors (4x1), 2.5 mm detectors (4x2, 5) or 5 mm detectors (4x5). Depending on the choice of parameters scans can be reconstructed in 1-10mm. Scan collimation choice can follow the scan or is selected prior obtaining the data and is not subject to changes. In this manner we combine faster obtaining of data and better spatial resolution.

Each patient in addition to the standard radiograph underwent CT of the thorax in supination position in transversal sections of the thorax from the apex level to the rear parts phenicoscostal sinuses with HRCT program. We analyzed the location, shape and degree of bronchiectasis spreading and based on certain parameters evaluated possibility of bronchiectasis therapy (conservative or surgical treatment).
HRCT criteria:
- Bronchial dilatation with absence of characteristic cone shape narrowing.
- The lack of narrowing with the bronchial wall thickening.
- The presence of cylindrical, cystic, or varicose enlargement of bronchi.
- The presence of purulent content in the expansion of bronchus.
- Atelectasis.

Correlated are X-ray findings and HRCT findings to surgically and conservatively treated patients.

4. RESULTS

From the baseline of 35 patients in 20 cases with HRCT was diagnosed bronchiectasis (10 cylindric, 10 cystic and 5 varicose). In 1 patient it was a case of cystic fibrosis, while 9 patients had a normal finding. In 7 cases surgical treatment was indicated.

Bilateral bronchiectasis was found in 4 cases, unilateral in 22, from which 14 on the right and in 8 on the left side.

Review of X-ray and HRCT findings according to surgical ones indicates that accuracy of X-ray was 30%, and HRCT in 100% of cases.

5. DISCUSSION

Findings on classical radiograph which suggest but cannot provide a definitive diagnosis of bronchiectasis are showing cystic lesions, volume loss due to the accumulation of blood vessels and infiltrate the area and atelectasis. In this manner X-ray can be sufficient for a doubt in the existence of bronchiectasis (13).

In many earlier researches, especially when HRCT appeared, mentioned are very good results of the possibilities and the application of CT in the diagnosis and evaluation of bronchiectasis with sensitivity of 87-97% and with high specificity of 92-99% (5, 6, 7, 10). It proved to be very useful and superior methods than conventional radiological methods in patients with suspect bronchiectasis, because of lack or discrete and non standard symp-
of adhesion to emphysema bullas or other with pure etiology. Analysis of reliability, or accuracy of HRCT findings trough coincidence of CT findings with the final diagnosis, showed a high level (100%).

Additional benefits include HRCT non invasively and avoidance of allergic reactions to contrast. Additionally it can be said that the CT and especially HRCT replaced bronchography as the method of choice in the definite diagnosis of bronchiectasis (17).

6. CONCLUSION

HRCT has become the first non-invasive radiological method of choice in diagnosing bronchiectasis, which greatly improved diagnostic process of bronchiectasis and completely superseded the earlier bronchography as diagnostic method, where patients were exposed to high doses of radiation and discomfort during application of the contrast media.

REFERENCES


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