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Case Report

SUCCESSFUL DETERMINATION AND DYNAMIC MONITORING OF TRACHEAL RUPTURE HEALING VIA VB AND MDCT-MEDIATED NON-INVASIVE TREATMENT

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ABSTRACT

Background: Injuries to the respiratory tract (trachea) are considered rare, but rapidly life-threatening. Prompt and accurate diagnosis, along with non-invasive monitoring during the healing process, are of critical importance in their management.

Aims: Diagnosis and monitoring of non-operative treatment of tracheal rupture after blunt trauma sustained from a bicycle fall

Methods: A case of tracheal rupture in a 16-year-old man, resulting from blunt trauma to the neck and chest as a result of a bicycle fall has been described. The diagnosis was made by applying the method of non-invasive VB with MDCT. For VB the study was performed on 64 MDCT "Siemens Definition AS". The non-operative treatment was monitored.

Results: Normal healing of the disrupted anterior wall has been established, with CT evidence of granulation tissue and resorption of the air content previously detected in the mediastinal region, as well as in the interstitial and subcutaneous tissues of the thorax and neck. The non-operative treatment led to the rapid and successful recovery of the patient.

Conclusions: VB with MDCT is an important modality for the diagnosis of post-traumatic tracheal ruptures and their dynamic monitoring.

Keywords: CT, rupture, trachea, bicycle, non-operative treatment, 16-year-old man

INTRODUCTION

Post-traumatic tracheal ruptures resulting from blunt trauma after falls have been reported primarily in young patients, and as a result of road traffic accidents in adults (1). They are characterized by high morbidity and mortality (10-14%) before treatment (2-4). In 95% of cases, patients are treated surgically (3).

MDCT-based imaging is of paramount importance for the accurate diagnosis, location and extent of injury. Multi-plane reconstructions and application of various post-processing techniques increase the accuracy of diagnosis and treatment success (5, 6). Other authors have identified chest radiography as a valuable tool because it is widely available and provides rapid diagnostic information in trauma situations, despite the high sensitivity of computed tomography (7). Chest radiography is considered a sufficient modality in paediatric blunt thoracic trauma, and the utility of chest computed tomography is considered to be maximal when applied to patients over 15 years of age and in severe conditions and allows for a comprehensive assessment of all structures within the examination volume in emergency situations (8).

The aim of the study is to describe a case of tracheal rupture in a 16-year-old man, resulting from blunt trauma to the neck and chest due to

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a fall from a bicycle, diagnosed using VB methods with MDCT and monitoring of the non-operative treatment performed.

CASE REPORT

A 16-year-old man was admitted to the Thoracic Surgery Clinic after a thoracic trauma following a fall from a bicycle, in which he hit his neck and chest on the handlebars. The patient reported severe pain in the injured area. For VB the study was performed on 64 MDCT "Siemens Definition AS". "Siemens" workstation was used with "Singovia VB60A_HF08" software, and "Siemens Definition AS" workstations with the capacity to track and match the images in the axial, coronary, sagittal planes. Multiplanar reconstructions were performed by applying MIP techniques and capabilities to archive and export images and video. After the VB performed with MDCT, traumatic injuries to the trachea were found without disruption of the integrity of the soft tissues, or without an open wound in the chest cavity. Examination of the chest revealed subcutaneous emphysema on the upper chest and neck, as well as an oval excoriation - a bicycle handlebar imprint in the jugular region, prominent during speech.

The native CT scan of the chest revealed that both lungs were normally aerated and expanded to the periphery. The lung structure showed normal vascularization. No intrapulmonary nodules or areas of parenchymal consolidation were detected. The bronchial branches were normal. The hila were of normal structure. The mediastinum was located medially. No volumetric masses or enlarged lymph nodes were detected. A significant amount of air content was recorded in the mediastinum. At the level of the upper edge of the *manubrium sterni*, an irregular oval disruption of the anterior wall of the trachea was observed with a length of 0.66 mm in the craniocaudal direction, and it was located to the left of the parasagittal line. The post-processing with the presence of multiplanar reconstructions and VB revealed a defect in the anterior left part of the trachea measuring 6.6 mm, with an irregular oval shape. It was located 33 mm cranial to the carina and 69 mm caudal to the glottis. The adjacent cartilaginous rings were regular, linear, and intact. The adjacent soft tissues were intact. The posterior membranous part of the trachea was without traumatic changes and with preserved integrity. On the axillary sections and multiplanar reconstructions we saw a large amount of air equivalent content, located bilaterally, subcutaneously and interstitially in the thorax and neck region.

A mediastinotomy and drainage were performed. On control CT follow-up, normal healing of the damaged anterior wall was found with the presence of CT data for granulation tissue, resorption of the air content found by the previous examination in the mediastinum, interstitially and subcutaneously in the thoracic and cervical region **(Figures 1-6).**

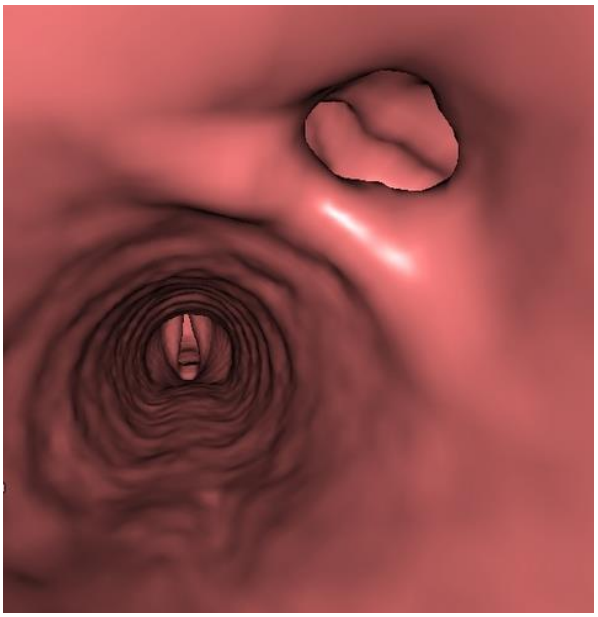

Figure 1. VB, anterior tracheal wall rupture

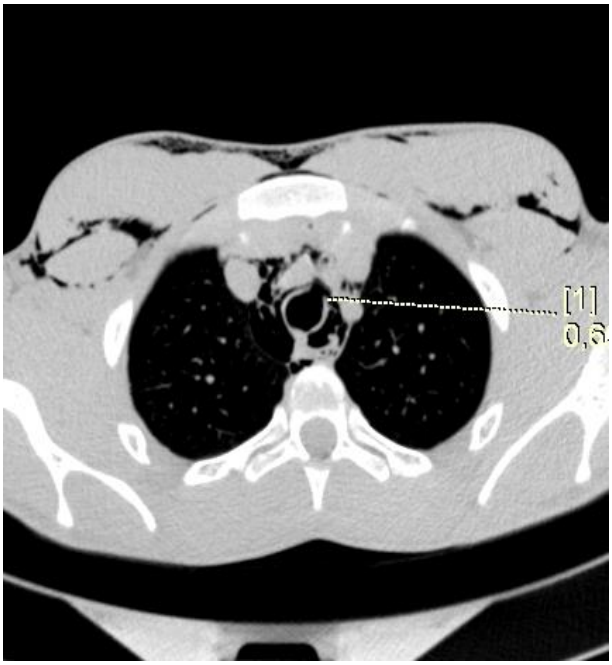

Figure 2. CT, axial projection, tracheal rupture, pneumomediastinum

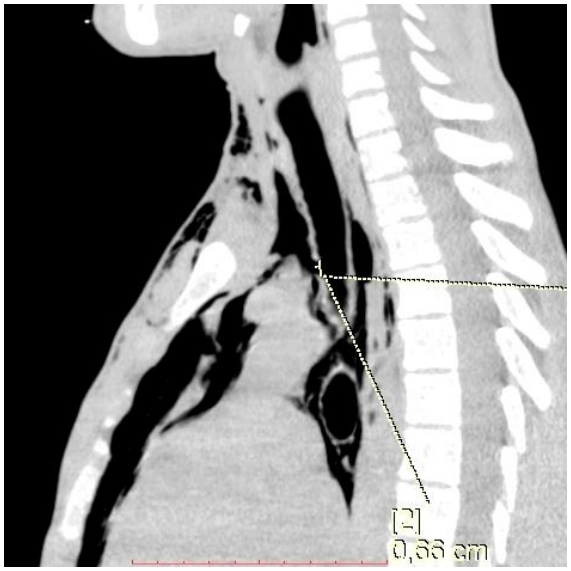

Figure 3. CT, tracheal rupture, sagittal projection, anterior wall rupture, pneumomediastinum

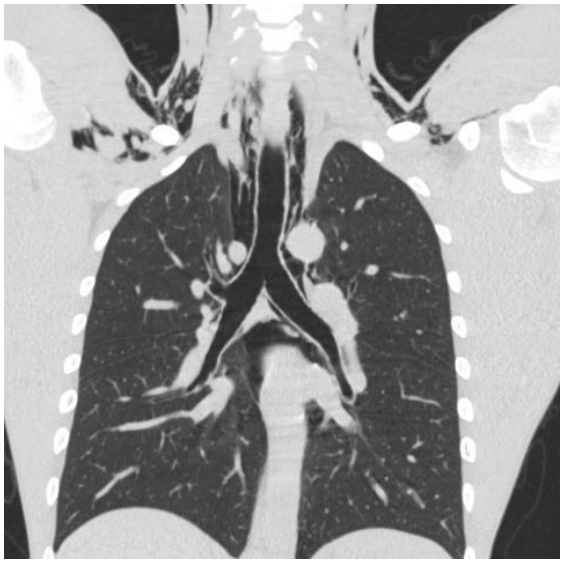

Figure 4. CT, tracheal rupture, coronal projection, pneumomediastinum

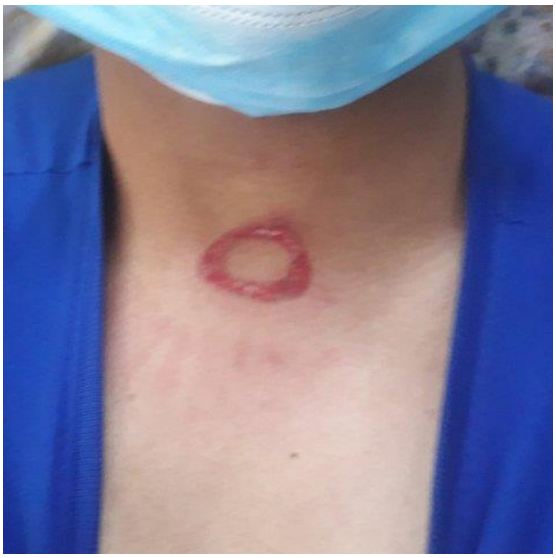

Figure 5. Photograph of the cervical region, skin bulge in the rupture area during speech and expiration

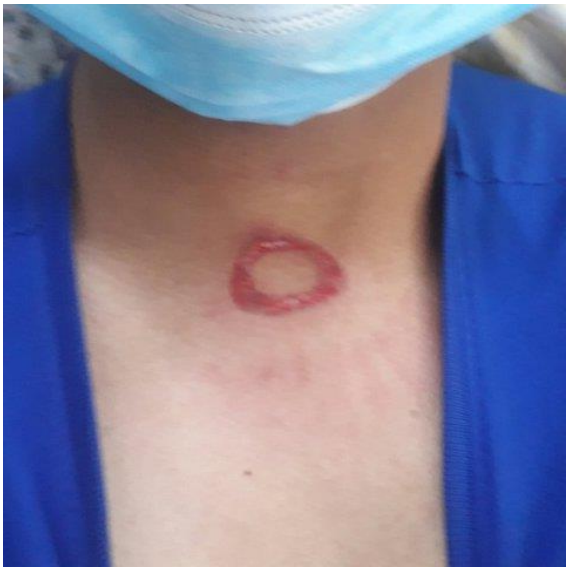

Figure 6. Photograph of the cervical region, skin indentation in the rupture area during speech and inspiration

DISCUSSION

A case of tracheal rupture after a fall from a bicycle in a 16-year-old patient is presented. The identification and dynamic monitoring of the healing process was performed by applying the VB modality with MDCT. The patient was treated non-operatively, associated with a rapid and successful recovery.

Respiratory tract injuries are defined as rare but rapidly life-threatening. Accurate diagnosis represents the most difficult aspect in cases of tracheal rupture, while follow-up has been highlighted as being of particular importance in tracheal tears (9). MDCT, according to modern research, is the basis of their diagnosis, and multi-plane reconstructions and the use of various techniques for post-processing of images increase the rate of their detection, follow-up and treatment (5, 10, 6). VB is used as a non-invasive method in the follow-up of blunt, non-penetrating tracheal injuries (9). In 0.4-3% of cases, they are associated with tracheal damage (9, 3, 5, 10). In 95% of patients, especially in elderly patients, tracheal lacerations are treated conservatively (surgically) (11, 12, 3). In young patients in stable condition, as well as in patients with iatrogenic injuries to the posterior membranous wall of the trachea, other authors discourage, or avoid invasive procedures, or open surgical treatment (9, 13). VB is considered a newer diagnostic method, including three-dimensional reconstruction of the tracheobronchial tree based on images generated by computed tomography. They believe that VB is applicable primarily in non-traumatic tracheobronchial

pathology with a sensitivity of 84% and specificity of 75% (13).

CONCLUSIONS

The used atraumatic VB with MDCT is an important modality for proving the lesion in the described part of the trachea with subsequent dynamic monitoring of the healing process and successful non-operative treatment.

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