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## **Tracheal stenosis as a late complication of cardiac arrest- a case report**

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### **Abstract**

A sudden cardiac arrest (SCA) and cardiopulmonary resuscitation (CPR) could be associated with numerous acute complications, including rib fractures, sternal fractures, bleeding in the anterior mediastinum. Some of late complications are associated with mechanical ventilation. They include: stenosis, tracheomalacia or tracheoinnominate-artery fistula. These complications can be subclinical or may present as failure to wean from the ventilator, failure to decannulate, or may manifest as upper-airway obstruction with respiratory failure.

## **Introduction**

SCA is a condition when acute hemodynamic dysfunction of myocardium occurs leading to follow-respiratory arrest and consequently hypoxia all over the body.

CPR is defined as the actions that are used for an injured person, who experienced cardiac arrest (cessation heart function with the loss of consciousness and apnea) [1] The aim of CPR is to maintain blood flow through the brain and the heart muscle and the restoration of one's own circulatory system. Successful resuscitation is only the beginning of restoring of patient's health, because the next step is to restore the normal function of the brain, a stable heart rhythm and normal haemodynamic parameters. The actions which will be taken at this stage determine the outcome of cardiac arrest.

SCA is associated with numerous complications. Even properly performed CPR and proper post-resuscitation care do not guarantee the absence of complications. They can be divided into early complications, which include rib fractures, sternal fractures, bleeding in the anterior mediastinum or heart contusion and they are caused by CPR. Some late complications are associated with mechanical ventilation. They include: stenosis, or tracheomalacia, tracheoinnominate-artery fistula. Those complications can be subclinical or small present as failure to wean from the ventilator, failure to decannulate, or small manifesto as upper-airway obstruction with respiratory failure. One of the most serious, distant consequence of SCA is a damage of the upper respiratory tract as a result of mechanical ventilation. Due to the increasing in use of mechanical airway management methods over the years, there is a greater proportion of patients with iatrogenic stenosis of the trachea. The main cause of those complications is the mechanical trauma caused by the endotracheal tube. Pressure on the mucous membrane induces necrosis, giving rise to erosions and ulcers, and wound healing may result in the formation of granulomas, adhesions of the glottis or larynx and trachea lesions [2,3,4]. They can be cause of shortness of breath in extubated patients. Necrosis can reach the cartilage, causing malacia and thus distortion of the larynx or trachea. In other cases, there is observed a formation of hematomas or swelling of the mucous membrane within the vocal folds, which are absorbed with fibrosis, causing thickening of the vocal cords and the change of voice. In Colic et al. researches [2], demonstrated that more frequently moderate and severe laryngeal complications in chronic intubated patients who had tracheotomy have been reported. This phenomenon was explained by superinfection of the larynx, ascending from the tracheostomy [5].

## Case report

A 51-year old woman was admitted to vascular surgery department in January 2016 with serious condition, due this extensive foot phlegmon with sepsis. Concurrent diseases: diabetes mellitus type 2, hypertension, asthma, and depression. Based on clinical picture and additional studies, patient was qualified to the immediate amputation of the left shin. Postoperative period was complicated by acute respiratory failure with asthma and pneumonia, and then cardiac arrest. The patient was transported to the intensive care unit. For the next 40 days, the patient was kept in a pharmacological coma, in which mechanical ventilation has been used in the form of prolonged intubation and tracheostomy. At the time of hospital discharge, the patient was conscious, in logical contact, with cardiovascular and respiratory stable, during rehabilitation. After 10 days, the patient was admitted to the internal ward due to cough and shortness of breath. Physical examination showed a loud inspiratory stridor at the level of the trachea. Additionally pneumonia was diagnosed and antibiotic treatment compatible with antibiogram has been incorporated, and rehabilitation has been continued. In the next few months, the patient was hospitalized several times because of shortness of breath, respiratory disorders, and recurrent pneumonia. During hospital stays, computed tomography of the neck was performed, which confirmed segmental stenosis of trachea to 5,5 mm diameter, 6 mm in length.



Ryc. 1 Tracheal stenosis. 5,5 mm x 6 mm. Coronal section.



Ryc. 2 Tracheal stenosis, 5,5 mm x 6 mm. Cross section.

After laryngological consulting, reconstructive operations of tracheal stenosis was offered, but the patient refused the consent for the operation. In August of the same year, woman with serious condition, unconscious, was admitted to intensive care unit with a diagnosis of respiratory failure and left ventricular failure in the form of pulmonary edema. The patient was intubated with difficulties due to stenosis of the trachea. Therapeutic infusion of catecholamines and extensive pharmacotherapy have been applied. Again reconstruction of the trachea surgery was proposed, but the patient once again refused. In October of the same year, the patient was hospitalized in the intensive cardiac care unit, due to respiratory failure, which was re-intubated, sedative and she breathed with a respirator for 6 days. After this period there was propose of using a tracheostomy on which the patient did not consent. The woman was informed about the possible threat to health and life, and then was discharged from the hospital in good general stable. After 20 days, the woman went to the Emergency Room because of dyspnoea, she was

conscious, in logical contact. In physical examination there was loud, exhaust stridor of the trachea, over both lung fields could hear crackling and wheezing. Venous blood gas analysis was performed, which showed respiratory acidosis: 7.138 pH, pO<sub>2</sub> 21.3, pCO<sub>2</sub> 82.9. Endotracheal intubation for the patient was proposed, on which she agreed. A few minutes after the intubation bradycardia and cardiac arrest in PEA mechanism appeared. After 10 minutes of resuscitation return hemodynamic heart returned. After an episode of secondary cardiac arrest, the patient has consented to treatment and reconstruction of the trachea and she was transported to the ENT ward for further treatment.

## **Discussion**

Properly performed CPR during cardiac arrest does not guarantee the success of the treatment. Restore full health to the patient is dependent on the proper post-resuscitation care. Where a patient requires mechanical ventilation, method of choice is the endotracheal intubation. In Poland, the percentage of patients admitted to intensive care and requiring mechanical ventilation reaches 74%, of which approximately 41% of patients required tracheostomy due to prolonged ventilation [6]. But you must remember that prolonged use of mechanical ventilation is associated with the risk of many complications.

It is commonly accepted that prolonged intubation is the primary cause of iatrogenic subglottal lesions. It is believed that with duration of intubation increases the probability of stenosis. This correlation was presented by Whited: intubation for 6 days carries a risk 2%, 6-10 days - 5%, and more than 10 days - 12% [7]. Meanwhile, in the literature there are studies indicating tracheotomy as the primary cause of stenosis of larynx and trachea. In addition, it is difficult to determine the impact of prolonged intubation in the etiology of these disorders, because there is no uniform definition of "prolonged intubation." In the latest research, tracheotomy adult patients requiring mechanical ventilation and intubation day 7. adopted as the criterion for the cut-off defining the early and late tracheotomy [8,9]. It should therefore be regarded as prolonged intubation, if it lasts longer than 7 days.

To conclude, the incidence of postintubation tracheal stenosis ranges from 1-11%, and the essential factors are: the intubation time, the size of the tracheal tube, the need for re-intubation and the presence of infection [10]. Since the 80s of the last century claims in the literature role of gastroesophageal reflux in the pathogenesis of stenosis of larynx and trachea [11], therefore, it seems reasonable to enable prevention of proton pump inhibitors in patients receiving chronic intubation, regardless of the presence or absence of clinical signs of reflux. Tracheal stenosis is

associated with a number of complications, including recurrent lower respiratory tract infections, respiratory distress, and even, as in the cited case, the secondary cardiac arrest.

In treatment and then in the assessment its results detailed diagnosis and proper classification of lesions is important. The assessment of the methods of stenosis that form the basis for the classification are endoscopy and imaging methods. The study of choice of documented value is computed tomography. The advantage is the ability to assess airway constriction below, identification of cartilage damage and multiple lesions, length measurement of stenosis in all cases, including assessment of critical stenoses.

Tracheal stenosis is late complication of cardiac arrest, associated with mechanical ventilation. It can be asymptomatic or present as dyspnea that is connected with considerable morbidity and mortality. Prevention of stenosis starts with limiting the size of the tracheal defect created during surgery. It is important to avoid excess mechanical irritation and placement of tubes of proper size. Prevention of stomal infection is likely to be important, because infection may impair tissue healing.

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