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Case report
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CONGENITAL PULMONARY AIRWAY MALFORMATION IN ADULTS – A CASE SERIES

KONGENITALNA MALFORMACIJA PLUĆNIH DISAJNIH PUTEVA KOD ODRASNIH – PRIKAZ SERIJE SLUČAJEVA

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Summary

Introduction. Two-thirds of patients with congenital pulmonary airway malformation are asymptomatic at birth, but during life they may develop symptoms such as recurrent respiratory infections. The purpose of this paper is to present three cases of adult patients in whom congenital pulmonary airway malformation was diagnosed and treated at the Institute for Lung Diseases of Vojvodina, along with the clinical course of the disease and the therapeutic procedure. **Case Report 1.** A 24-year-old female with a medical history of asthma and recurrent signs of lower respiratory tract infections was referred to a thoracic surgeon. Computed tomography of the chest and clinical features were consistent with a congenital lung disease. A left lower video-assisted thoracoscopic lobectomy was performed. Histopathological analysis confirmed type II congenital pulmonary airway malformation with pulmonary sequestration. **Case Report 2.** A 41-year-old male with a history of left-sided spontaneous pneumothorax at the age of 16 was referred to a thoracic surgeon due to moderate hemoptysis, one month after hospital treatment of left-sided bronchopneumonia. On chest computed tomography, multiple cystic lesions were found in the left lower lung lobe. Thoracotomy and left lower lobectomy were performed. Histopathological analysis confirmed type I congenital pulmonary airway malformation. **Case Report 3.** The third patient was a 16-year-old male with a history of juvenile asthma and recurrent right-sided bronchopneumonia. Sings of necrotizing pneumonia, lung abscess, and mediastinal lymphadenomegaly were found in the affected lobe. Thoracotomy and right lower lobectomy were performed. Histopathological analysis confirmed type II congenital pulmonary airway malformation. **Conclusion.** In children and young adults with recurrent small airway inflammation, congenital lung malformation should be considered in the differential diagnosis.

Key words: Respiratory System Abnormalities; Congenital Abnormalities; Adult; Cystic Adenomatoid Malformation of Lung, Congenital; Thoracic Surgery

Sažetak

Uvod. Dve trećine pacijenata sa kongenitalnom malformacijom plućnih disajnih puteva su asimptomatski pri rođenju, ali tokom života mogu razviti simptome u vidu rekurentnih respiratornih infekcija. Svrha ovog rada je da prikaže tri slučaja odraslih pacijenata, kod kojih je dijagnostikovana i lečena kongenitalna malformacija disajnih puteva u Institutu za plućne bolesti Vojvodine, uz prikazan klinički tok bolesti i terapijski postupak. **Prikaz slučaja 1.** Žena starosti 24 godine, sa anamnezom astme i ponavljajućim znacima infekcije donjih disajnih puteva, upućena je torakalnom hirurgu. Kompjuterizovana tomografija grudnog koša i klinička slika ukazali su na kongenitalnu bolest pluća. Načinjena je leva donja video-asistirana torakoskopska lobektomija. Patohistološkom analizom potvrđena je kongenitalna malformacija disajnih puteva pluća tip II sa plućnim sekvestrom. **Prikaz slučaja 2.** Muškarac starosti 41 godine sa istorijom levostranog spontanog pneumotoraksa u uzrastu od 16 godina, upućen je torakalnom hirurgu zbog učestalih hemoptizija, mesec dana nakon hospitalnog lečenja levostrane bronhopneumonije. Na kompjuterizovanoj tomografiji grudnog koša su opisane multiple cistične lezije, locirane u levom donjem plućnom režnju. Načinjena je torakotomija i leva donja lobektomija. Histopatološki izveštaj: kongenitalna malformacija disajnih puteva pluća tip I. **Prikaz slučaja 3.** Muškarac star 16 godina, sa istorijom juvenilne astme i ponavljajuće desne bronhopneumonije. U zahvaćenom režnju opisani su znaci nekrotizirajuće pneumonije, apscesa pluća uz medijastinalnu limfadenomegaliju. Načinjena je torakotomija i desna donja lobektomija. Histopatološkom analizom potvrđena je kongenitalna malformacija disajnih puteva pluća tip II. **Zaključak.** Kod dece i odraslih u mlađem životnom dobu sa rekurentnim zapaljenjem malih disajnih puteva, treba misliti na urođene malformacije pluća, u okviru diferencijalne dijagnoze.

Ključne reči: anomalije respiratornog sistema; kongenitalne anomalije; odrasli; urođena cistična adenomatozna anomalija pluća; grudna hirurgija

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Abbreviations

CPAM – congenital pulmonary airway malformation
CT – computed tomography
VATS – video-assisted thoracoscopic surgery

Introduction

Congenital pulmonary airway malformation (CPAM), formerly known as congenital cystic adenomatoid malformation is a rare developmental disorder of the fetal tracheobronchial tree [1]. Two-thirds of these patients are asymptomatic at birth, but during life they may develop symptoms such as recurrent respiratory infections and are often treated for bronchitis or asthma for years [2].

The purpose of this paper is to present three cases of adult patients in whom CPAM was diagnosed and treated at the Institute for Lung Diseases of Vojvodina in the last five years along with the clinical course of the disease and the therapeutic procedure.

Case report 1

The first patient, a 24-year-old female with a medical history of asthma and recurrent lower respiratory tract infections was referred to a thoracic surgeon after four episodes of pneumonia in the last five months. Chest computed tomography (CT) showed clustered central and peripheral cystic bronchogenic lesions of different sizes and shapes with thin or imperceptible cystic walls. The entire S8, S9, and S10 left lung segments were affected, S6 was completely spared as well as parts of S7. The largest lesion was described as a subpleural bulla in the S9/S10 measuring 9 x 4.6 cm and there was no communication with the tracheobronchial tree **(Figure 1)**. The CT imaging and clinical features were consistent with congenital lung disease. Due to recurrent respiratory infections and the lung cystic lesion, a left lower video-assisted thoracoscopic surgery (VATS) lobectomy was performed. During the VATS procedure, apart from the described bulla, the affected segments were pale and overinflated. The incidental finding was extralobar pulmonary sequestration which was resected by an endostapler. The entire vascular bundle was derived from the thoracic aorta. The patient was discharged from the hospital on the 6th postoperative day. On the routine follow-up, 3 months after surgery, the control chest X-ray was coherent with the performed surgery. There were no signs of new respiratory infections. Histopathological analysis confirmed type II CPAM and pulmonary sequestration **(Figure 2)**.

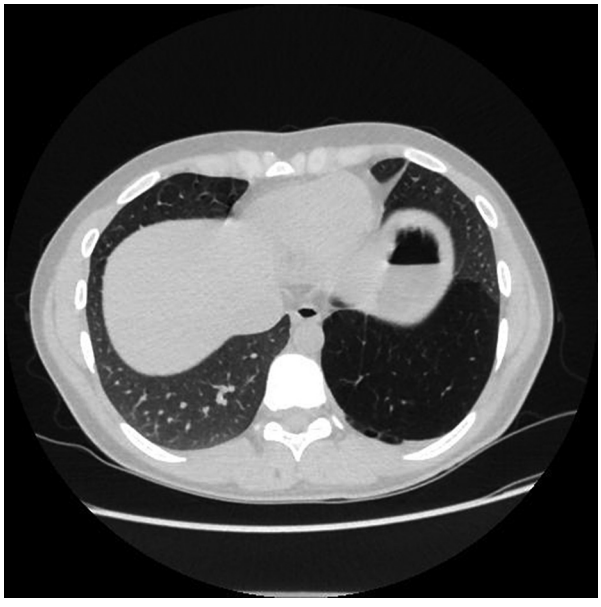

Figure 1. Computed tomography showing clustered central and peripheral cystic bronchogenic lesions of different sizes and shapes with thin or imperceptible cystic walls
Slika 1. *Kompjuterizovana tomografija: Grupisane centralne i periferne cistične lezije bronha različitih veličina i oblika, tankozidne ili sa neuočljivim zidom*

Case report 2

The second patient, a 41-year-old male with a history of left-sided spontaneous pneumothorax at the age of 16, was referred to a thoracic surgeon due to moderate hemoptysis one month after hospital treatment of left-sided bronchopneumonia. The CT of the chest showed multiple cystic lesions located in the left lower lobe with signs of pericystic inflammation. Some of the parenchymal cysts showed air-fluid levels. With a high suspicion of congenital lung disease, thoracotomy and left lower lobectomy were performed. During the initial VATS procedure, extensive pachypleuritis was found, with signs of recurrent inflammation of both left lung lobes.

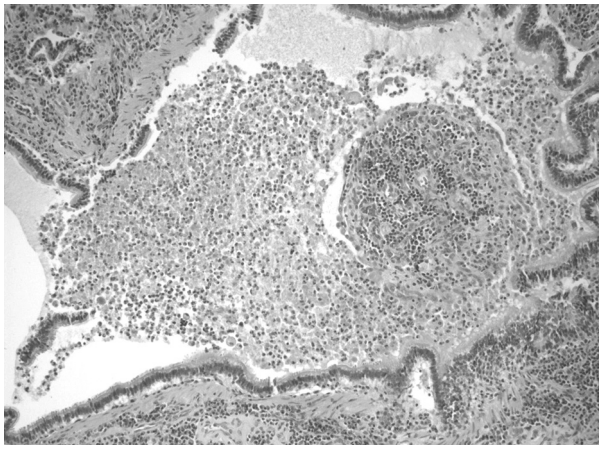

Figure 2. CPAM type 2 - Small cysts resemble dilated bronchioles, without cartilage and filled with mucus mixed with inflammatory cells and macrophages, H&E x 100
Slika 2. *CPAM tip 2 - Male ciste koje svojim izgledom podsećaju na dilatirane bronhiole, bez hrskavice ili ispunjene mukoznim sadržajem pomešanim sa inflamatornim ćelijama i makrofagima, H & E x 100*

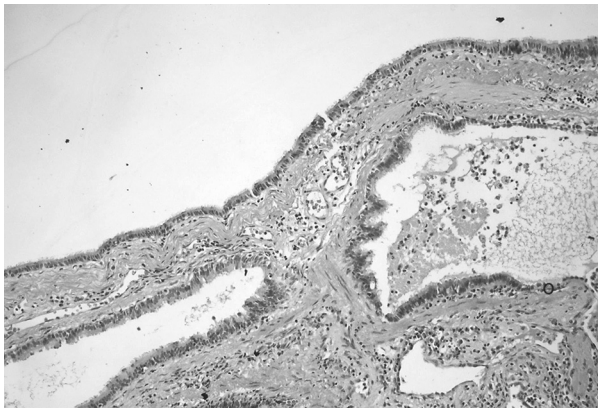

Figure 3. CPAM type 1 - Large cyst wall lined by pseudostratified ciliated cells without cartilage, H&E x 50
Slika 3. *CPAM tip 2 – velike ciste obložene pseudostratifikovanim cilijarnim ćelijama, bez prisustva hrskavice, H & E x 50*

Due to plural deficit after lobectomy, artificial pneumoperitoneum was created, but a prolonged air leak was present on the chest drain. The patient was discharged one month after surgery. On the routine follow-up, 3 mounts after surgery, complete obliteration of the pleural deficit was achieved. Histopathological analysis confirmed type I CPAM **(Figure 3)**.

Case report 3

The third patient, a 16-year-old male with a history of asthma and recurrent right-sided bronchopneumonia, was referred to a thoracic surgeon with high radiological suspicion of congenital lung disease. Chest CT showed extensive alveolar-interstitial lung lesions in the right lower lobe, manifesting as cystic lesions measuring up to 16 mm with bronchiectasis. Signs of necrotizing pneumonia, lung abscess, and mediastinal lymphadenomegaly were found in the affected lobe. During the VAST procedure, extensive mediastinal and hilar inflammation was observed, so thoracotomy, right lower lobectomy, and mediastinal lymphadenectomy were performed. The patient was discharged on the 8th postoperative day. On the routine follow-up, 3 months after surgery, control chest X-ray was coherent with the performed operation. Histopathological analysis confirmed type II CPAM.

Discussion

More than a half of the cases of CPAM are congenital airway malformations with a prevalence of 1 - 4/100,000 [1]. Other congenital lung malformations include pulmonary sequestration, bronchial atresia, lobar agenesis, bronchogenic cysts, congenital lobar emphysema, and polyalveolar lobe. By definition, CPAM is a developmental disorder of small airways of unknown etiology that occurs between 5th and 6th week of gestation, when instead of alveolar tissue there is an expansive growth of terminal respiratory bronchioles and formation of a multicystic mass [3]. So far, no association of this disease with race, sex, birth weight, or with exposure to certain substances in pregnancy has been observed [4]. Our patients are Caucasian, the sex distribution is 2 : 1 in favor of the male sex and the medical histories showed that the pregnancies went smoothly, Apgar score was 10/10.

Back in 1962, CPAM was classified by Stocker into 5 subtypes according to the number and size of cysts and histology:

0 - all lobes are cystically altered, incompatible with life;

I - the most common type (60 - 65%), consists of a single or multiple large cysts with ciliated pseudostratified and columnar epithelium;

II - (20%) consists of multiple smaller cysts and may be associated with other congenital anomalies;

III - consists of large, pseudo-glandular lesions that usually involve the entire lobe;

IV - is composed of large thin-walled cysts that have a malignant potential [1].

Anomalies that may be associated with CPAM are extralobar sequestration, congenital diaphragmatic hernia, pulmonary hypoplasia, hydrocephalus, cardiovascular malformations, esophageal or gastric atresia, and bilateral renal agenesis/dysgenesis [2].

Our two patients had type II and one had type I CPAM. In a patient with type II CPAM, another anomaly was observed - extralobar pulmonary sequestration, which was also operated on.

In developed countries, this anomaly is diagnosed prenatally, during the 18 - 20th week of gestation, after which more frequent ultrasound examinations are required, and in the absence of symptoms after birth, elective surgery is considered. Mon et al. recommend fetal magnetic resonance imaging as well as early postnatal CT of the chest for clearer visualization of blood vessels [5]. On the other hand, Yousef et al. first mentioned the use of postnatal lung ultrasound, which is a faster and cheaper method, without radiation, for monitoring children with suspected CPAM [6]. The question of when it is the right time to operate on asymptomatic children is still debatable and recommendations range from 6 - 7 months [7] to 2 years of age [8]. Spontaneous resolution in some patients, both prenatal and postnatal [9], has been known for some time, so elective surgery is not recommended in the first months of life.

Considering that Serbia is a developing country, there are several possible reasons why our patients have not been prenatally diagnosed. One of the reasons is their age (patient No. 1 is 24 years old, while patient No. 2 is 41 years old), because although ultrasound has been used in gynecology since the 1980s, modern ultrasonography that gives more detailed views of the fetus has developed in the last two decades. Another possible reason is the unavailability of a modern ultrasound machine in all areas, since the youngest patient (aged 16) comes from a smaller town. Training and experience of health

personnel should always be taken into account, because ultrasound is a subjective method.

At birth, people with CPAM are symptomatic or asymptomatic. No predictive factor has been established to indicate when a person will become symptomatic. The severity of symptoms certainly depends on the location of lesions, type of CPAM, association with other congenital anomalies, so the clinical features are diverse - from neonatal hydrops, respiratory distress syndrome, recurrent pneumonia, shortness of breath to pneumothorax [10]. Other congenital anomalies (pulmonary sequestration, lobar emphysema, and bronchogenic cysts), acquired respiratory infections, as well as iatrogenic or traumatic emphysema and atelectasis [2] are considered in the differential diagnosis. Our two patients experienced first symptoms at the age of 16 (spontaneous pneumothorax and pneumonia), they were previously treated for asthma, while the third patient reported "frequent bronchitis" or recurrence of small airway inflammation since childhood.

Surgery is the definitive diagnostic and therapeutic procedure in patients with CPAM. Depending on the size of the lesion, lobectomy, bilobectomy or pneumonectomy is performed. Segmental resection is not recommended, because it is difficult to isolate cysts intraoperatively and identify the final border of the lesion. All three of our patients underwent VATS lobectomy, and the postoperative course was without complications.

Conclusion

In children and adolescents with recurrent small airway inflammation, congenital pulmonary airway malformation should be considered in the differential diagnosis. All three of our patients had a good prognosis since the lesions were confined to one lobe, they were not associated with more serious congenital anomalies, and the patients had no other associated diseases.

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