Int J Legal Med (2001) 115 : 76–78

CASE REPORT

J. M. Suárez-Peñaranda · M. S. Rodríguez-Calvo
J. I. Muñoz · M. Pumarega-Vergara
M. J. Sánchez-Herrero · L. Concheiro-Carro

Sudden neonatal death from congenital cystic adenomatoid malformation

Received: 28 November 2000 / Accepted: 13 February 2001

Abstract We report a case of congenital cystic adenomatoid malformation (CCAM) of the lungs resulting in sudden death immediately after birth. The case is extremely unusual because of the diffuse bilateral involvement. The extensive involvement of both lungs could explain the abrupt onset of the symptoms and the ineffectiveness of resuscitation attempts. The presence of cartilage as a part of the malformation adds interest to the case, since it is seldom found in this malformation and to the best of our knowledge has been reported only exceptionally in a type II CCAM.

Keywords Sudden death · Neonatal death · Congenital cystic adenomatoid malformation · Lung disease

Introduction

Congenital cystic adenomatoid malformation (CCAM) is a distinct although unusual form of cystic disease of the lungs. Its recognition as a clinical entity was made by Ch'In and Tang in 1949 [1] and the microscopic criteria for diagnosis were defined by Kwittken and Reiner [2]. CCAM usually manifests itself in newborns as respiratory distress or in young children with a history of recurrent respiratory infections [3]. It is most commonly restricted to one lobe [4], but in some cases more than one lobe is involved [3, 5]. Nevertheless, bilateral disease is extremely uncommon [3, 6]. The presence of cartilage as a component of the lesion has rarely been reported in the type II variety of the classification proposed by Stocker et al. [7]. This, in combination with the bilateral involvement and the abrupt presentation immediately after birth, makes this case a highly unusual variant of CCAM.

J. M. Suárez-Peñaranda (✉) · M. S. Rodríguez-Calvo
J. I. Muñoz · L. Concheiro-Carro
Instituto de Medicina Legal, Facultad de Medicina,
C/S. Francisco s/n, 15705 Santiago de Compostela, Spain
e-mail: apimljsp@usc.es,
Tel.: +34-981-582327, Fax: +34-981-580336

J. M. Suárez-Peñaranda
Department of Pathology,
University Hospital of Santiago de Compostela, Spain

M. Pumarega-Vergara · M. J. Sánchez-Herrero
Sanatorio Nª Señora de La Esperanza,
Santiago de Compostela, Spain

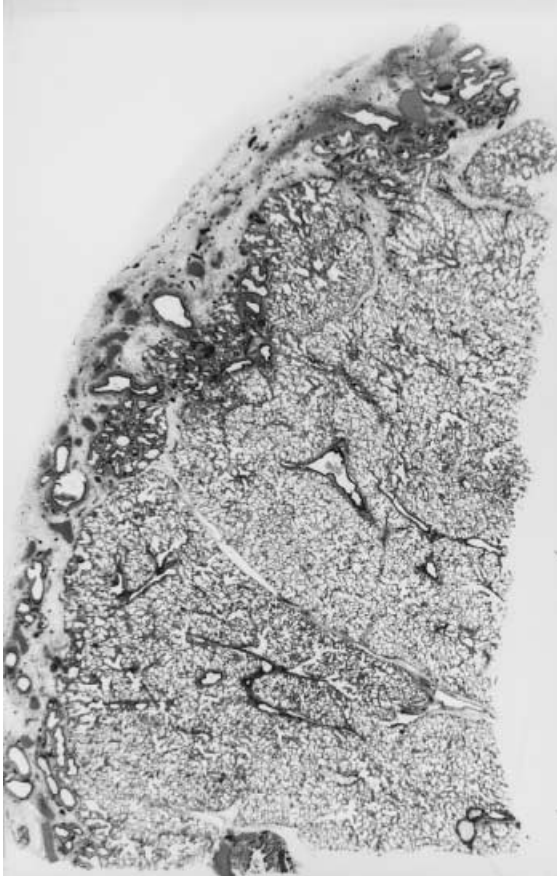

Fig. 1 Low-power view of the lesion showing a high content of mature cartilage along with small epithelial cysts. It is evident the distribution of the lesion affecting the periphery of the lung (HE × 25)

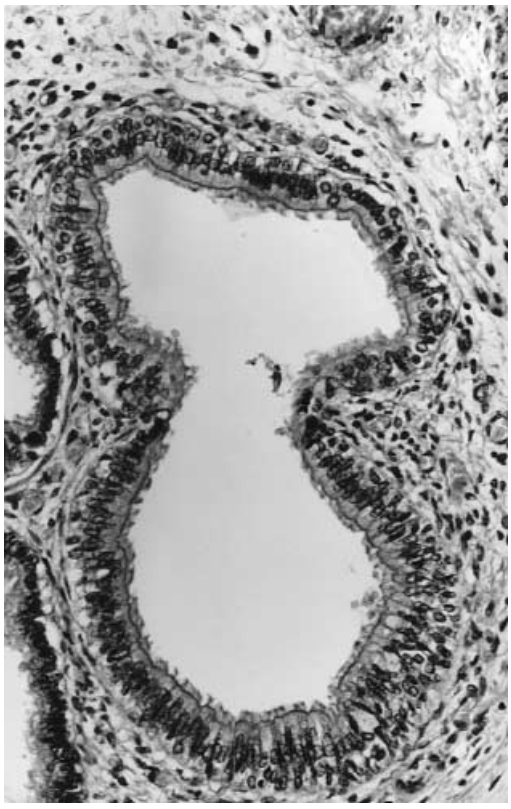

Fig. 2 Closer view of a cyst in which the ciliated respiratory epithelium is clearly demonstrated (HE × 200)

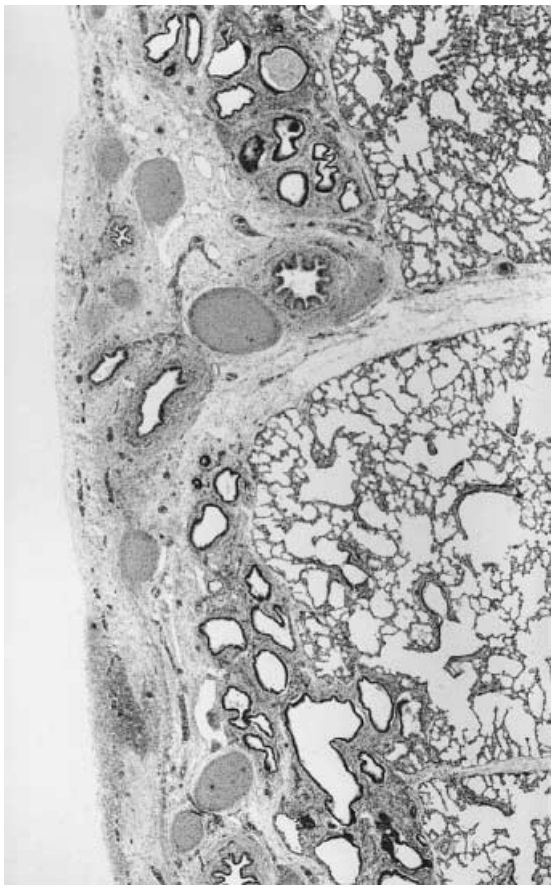

Fig. 3 Mature cartilaginous tissue was a significant component of the lesion and was present intermingled with the epithelial cysts (HE × 40)

Case report

A full-term newborn male, the second pregnancy of a 37-year-old woman, collapsed and died immediately after birth. The labour and delivery were exempt from complications, with the fetus in longitudinal lie and cephalic presentation. The fetal heart rate monitoring was normal. Spontaneous membrane rupture took place 4 days before the onset of labour and antibiotic therapy was immediately initiated to prevent amnionitis. Polyhydramnios was not detected throughout pregnancy and at birth the child presented a low cardiac rate (< 100/min), weak spontaneous weeping and bluish discoloration. According to the gynaecologist, the child's attempts to start breathing seemed to be unsuccessful. Resuscitation attempts were started immediately, including O_2 administration and as the outcome was unfavourable, intracardiac adrenaline was given. However the cardiac rate remained very low and after 45 min the child was declared dead.

A complete post-mortem examination was performed. The body weight was 2970 g, the crown-to-heel length was 50 cm and the foot length 7 cm. External examination revealed no abnormalities. Internally, the organs were in situs solitus and no fluid was found in the pleural or abdominal cavities. Both lungs appeared to be diffusely enlarged and the consistence was firmer than usual. Externally, a greyish discoloration was noted with small white dots hardly discernible on the outer surface, regularly distributed in every lobe. The cut surface was solid and the lungs had collapsed. The combined weight of the lungs (39 g) was slightly below normal.

The histopathology examination of both lungs revealed a diffuse lesion affecting every lobe which was mainly located in the subpleural area and in the fibrous septa (Fig. 1). The subpleural involvement was prominent, encircling both lungs as a shell and consisted of irregular, cystic small bronchiole-like structures interspersed between normal areas of lung tissue. The cysts were lined by cuboidal to tall columnar ciliated epithelium (Fig. 2). Mucous-producing cells were occasionally seen in some of the many sections studied and in some places, the mucosa was thrown up into small papillary folds. Continuity between the bronchiole-like structures and the alveoli was easily demonstrated. Extensive foci of mature cartilage were found intermingled with the cystic structures. This was randomly distributed, showed no definite relationship with the epithelial cysts and consisted of non-bunching nests of mature cartilaginous tissue (Fig. 3). Strands of striated muscle fibres were present in the connective tissue surrounding the cysts, but elastic tissue was not prominent. Evidence of an inflammatory aetiology was absent. Subpleural emphysematous dilatations of alveoli were also noted.

The small intestine showed multiple areas of stenosis in a 6-cm-long segment of the ileum. The proximal bowel was dilated and the distally located tract was completely normal. Histologically, the atretic segment consisted of adipose tissue and congested vessels (type 3 of Louw's classification).

Gross and histological examinations of the remaining organs were unremarkable.

Discussion

Cases of sudden death due to rare diseases are a matter of forensic interest [8, 9, 10]. CCAM encompasses a spectrum of variable cystic developmental abnormalities of

the lung. A maturation arrest at some stage of bronchopulmonary development is accepted as the pathogenetic mechanism implied in its origin, but the aetiology remains unknown. The classification usually follows that proposed by Stocker et al. [7], who described three variants depending on the size of cysts, the extent of lung involvement and the histological features. Our lesion seems to fit in a type II CCAM, but shows some peculiarities. The distribution of the lesion in the lungs is extremely uncommon. Firstly, it is bilateral, affecting every lobe of both lungs. Bilateral CCAM is rare and we have been able to find only four additional cases [3, 7, 11, 12]. Secondly, cysts were predominately located in the subpleural area and followed the fibrous interlobular septa, which is a distribution only exceptionally found. Bale [4] reported a similar case, in which there were numerous small foci of cartilage extending down the airways to appear in respiratory bronchioles and subpleural alveoli. Nevertheless, it was restricted to the right upper lobe.

The presence of cartilage itself is also rare, with only isolated cases reported [3, 5, 7, 11, 13, 14] and when the type of CCAM is stated, it is always included under type I. According to Stocker's classification, cartilage is absent in type II, but overlap between subtypes has been recognised, and difficulty in subclassifying a lesion into one of the three types should not exclude the diagnosis of CCAM. On the other hand, except for the cartilage, the histopathology characteristics of this case are consistent with Stocker's type II CCAM: cysts are less than 1 cm in diameter, which occupy a considerable area of the lung tissue and fibres of striated muscle have been identified between cysts.

Mucous-producing cells are occasionally identified as a part of the malformation but he nature of these cells is still under discussion. Metaplastic change of the bronchiolar epithelium has been considered as an explanation, along with the possibility of considering them as a part of the hamartomatous proliferation. The identification of these cells in our case, with death occurring immediately after birth, seems to support this latter opinion.

Sudden death of a patient is uncommon, but it should be borne in mind that two-thirds of affected infants develop respiratory distress on the first day of life [14, 15]. The unusual extension of this lesion, with bilateral involvement affecting every single lobe of both lungs, could well explain the inability of the newborn to correctly expand the lungs and initiate spontaneous breathing. Bilateral pneumothorax could be an alternative explanation, but is difficult to demonstrate during autopsy on a newborn baby without reason to suspect its presence and it is unlikely, given the small size of the cysts.

The association of small bowel atresia has been previously reported [3, 7] and seems to be higher than expected, suggesting a common aetiopathogenic factor.

In summary, we report an unusual variation of CCAM with pathological peculiarities, which render its classification into one of the three recognised types difficult. Clinical presentation with sudden death is also exceptional and might be related to the wide extent of the disease. Forensic interest rests not only in the unusual presentation but also in excluding a medical malpractice during pregnancy and labour.

Acknowledgements Partially supported by Grants PGIDT99PXI-20808B and XUGA20807B98. We thank Susana Pérez Peña for excellent technical assistance.

References

1. Ch'In KY, Tang MY (1949) Congenital adenomatoid malformation of one lobe of a lung with general anasarca. Arch Pathol 48:221–229
2. Kwittken J, Reiner L (1962) Congenital adenomatoid malformation of the lung. Pediatrics 30:759–768
3. Wigglesworth JS (1987) Pathology of the lung in the fetus and neonate, with particular reference to problems of growth and maturation. Histopathology 11:671–689
4. Bale PM (1979) Congenital cystic malformation of the lung. A form of congenital bronchiolar ("adenomatoid") malformation. Am J Clin Pathol 71:411–420
5. Miller RK, Sieber WK, Yunis EJ (1980) Congenital adenomatoid malformation of the lung. A report of 117 cases and review of the literature. Pathol Annu 15:387–407
6. Roloff DW, Baillie EE, Weaver DK (1971) Macrobullous medullary polycystic kidney and kidney lung disease. Report of a rare association in a child. Am J Dis Child 121:318–324
7. Stocker JT, Madewell JE, Drake RM (1977) Congenital cystic adenomatoid malformation of the lung. Hum Pathol 8:155–171
8. Sperhake JP, Matschke J, Orth U, Gal A, Püschel K (2000) Sudden death due to cerebrotendinous xantomatosis confirmed by mutation analysis. Int J Legal Med 113:110–113
9. Priemer F, Keil W, Kandolf R (1999) Hydrocution in a case of Coxsackie virus infection. Int J Legal Med 112:368–371
10. Suárez-Peñaranda JM, Rico-Boquete R, Muñoz JI, Rodríguez-Núñez A, Martínez Soto MI, Rodríguez-Calvo M, Concheiro-Carro L (2000) Unexpected sudden death from coronary sinus thrombosis. An unusual complication of central venous catheterization. J Forensic Sci 45:920–922
11. Uroz Tristán J, García Urgellés A, Neumann AW, et al, (1995) Malformación adenomatoidea quística multilobular bilateral. Cir Pediatr 8:167–169
12. Cloutier MM, Shaeffer DA, Hight D (1993) Congenital cystic adenomatoid malformation. Chest 103:761–764
13. Benning TL, Godwin JD, Roggli VL, Askin FB (1987) Cartilaginous variant of congenital adenomatoid malformation of the lung. Chest 92:514–516
14. Madewell JE, Stocker JT, Korsower JM (1975) Cystic adenomatoid malformation of the lung. Morphologic analysis. AJR Am J Roentgenol 124:436–448
15. Cha I, Adzick NS, Harrison MR, Frinkbeiner WE (1997) Fetal congenital cystic adenomatoid malformations of the lung: a clinicopathologic study of eleven cases. Am J Surg Pathol 21: 537–544