

# Pleuropulmonary blastoma: transition from type I (cystic) to type III (solid)

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## ABSTRACT

**Pleuropulmonary blastoma is a unique dysontogenetic neoplasm of childhood that appears as a pulmonary and/or pleural-based mass, and is characterised histologically by a primitive, variably mixed blastemata and sarcomatous appearance. We report a 12-month-old female child who was operated for a lung cyst at the age of six months and postoperative histopathology was suggestive of type I pleuropulmonary blastoma (PPB). She presented to us at the age of twelve months with a huge mass over the left chest wall and axilla, histopathological examination of which was type III PPB. Partial removal of the lung cyst led to transition from type I to type III PPB in a short span of a few months. Complete surgical removal followed by adjuvant chemotherapy is needed for a better outcome in type I PPB.**

**Keywords: dysembryogenic neoplasm, histopathological transition, pleuropulmonary blastoma**

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## INTRODUCTION

Pleuropulmonary blastoma (PPB) is a rare, aggressive intrathoracic neoplasm that typically occurs in young children. It has been classified as type I, II or III on the basis of a cystic versus solid nature of the lesion as well as histological appearance. Although it has been speculated that type I tumours may have a tendency to progress to type III, no such case has been reported in Asian literature. The clinical, radiological and histopathological features of one such case are discussed in this report.

## CASE REPORT

A 12-month-old female child presented to us with a huge mass over the left chest wall and axilla for four months. Her previous reports revealed that the child



**Fig. 1** Photograph shows huge pleuropulmonary blastoma, measuring 22 cm × 14 cm × 20 cm, over left chest wall and axilla.

developed a cough and fever at the age of four months. A diagnosis of pneumonia was made and the child was treated with intravenous antibiotics. However, the symptoms worsened and the patient was referred to a tertiary care centre. The child was operated at six months of age for a congenital lung cyst. The resected specimen was a broken cystic mass measuring 7 cm × 5 cm × 6 cm, with some portion of the wall missing. On the cut section, there was a cavity with a few smaller cystic spaces containing serous fluid. Major portions of the tumour had a hypocellular, myxoid appearance, with a cellular cambium layer separating the tumour from the cyst's epithelial lining. Occasionally, round-to spindle-shaped immature cells with ample eosinophils, aligned in parallel, were scattered haphazardly throughout the myxoid and cambium regions. Based on these features, a diagnosis of type I PPB was made.

At the age of eight months, the patient developed a small mass over the excision site on left upper chest wall and axilla. It rapidly increased in size, and hence the patient was referred to us. On examination, the child was malnourished and had a mild pallor without any lymph node enlargement. On local examination, there was a solid mass measuring 22 cm × 14 cm × 20 cm, over the left chest wall and axilla. Transillumination was negative

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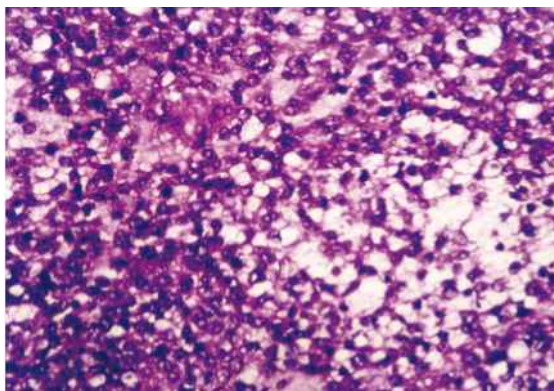
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**Fig. 2** Axial CT image of the chest shows a solid tumour filling almost the entire left hemithorax and extending to the mediastinum.



**Fig. 3** Photomicrograph of the tumour shows a highly pleomorphic tumour with bizarre, multinucleated giant cells. The tumour is composed mostly of sheets of undifferentiated blastemal cells with focal myxoid changes (Haematoxylin & eosin,  $\times 400$ ).

and there were dilated veins on the overlying skin (Fig. 1). On systemic examination, the trachea was shifted towards the right side, and percussion was dull on the left side of chest. The rest of the examination was normal. On investigation, haemoglobin level was 8.4 gm/dL, and total leukocyte count was 17,000/mm<sup>3</sup> with 70% neutrophils. Chest radiograph revealed complete opacification of left hemithorax. CT of the chest revealed a huge, solid tumour filling almost the entire left hemithorax and extending to the mediastinum (Fig 2). Histopathology of the core biopsy taken showed a highly pleomorphic tumour composed of blastoma and rhabdomyoblasts. The former predominated in some fields and the latter in others. Bizarre, multinucleated cells were also numerous. Macrophages were frequently found in areas of necrosis. Type III PPB with severe anaplasia was diagnosed (Fig 3). CT of the brain and bone marrow examination,

were done to rule out metastasis, were normal. As the tumour was non-operable, after appropriate antibiotic treatment, the patient was put on combination chemotherapy. After the first cycle of chemotherapy (SIOP Study, MMT 84 protocol), the patient was discharged. She died after a few days at home.

## DISCUSSION

Manivel et al first described the term, PPB, which includes tumours that has previously been described as pulmonary blastoma, pulmonary sarcoma, embryonal sarcoma, pulmonary rhabdomyosarcoma, embryonal rhabdomyosarcoma, and malignant mesenchymoma.<sup>(1)</sup> In paediatric patients, the lesion is a true dysembryogenic neoplasm of the thoracopulmonary mesenchyma, without malignant epithelial cells. This tumour is characterised histologically by primitive blastema and a malignant mesenchymal stroma that often shows multidirectional differentiation (rhabdomyosarcomatous, chondrosarcomatous or liposarcomatous pattern). In 25% of cases, PPB patients or their siblings have either dysplastic or neoplastic condition.<sup>(2)</sup>

Clinical presentation of our patient was misinterpreted as respiratory tract infection initially, and this is not unusual. In a review of 11 patients with PPB, it is reported that diagnosis was delayed for up to 45 days, due to similar reasons.<sup>(3)</sup> At the time of diagnosis, mediastinal or pleural involvement was found to correlate significantly with a poorer survival; our case had similar findings and outcome. Interestingly, in a recent report, two cases of multicystic foetal lung masses seen on prenatal ultrasonography, which were thought most consistent with type II congenital cystic adenomatoid malformation, were found to be PPB on postnatal histopathology.<sup>(4)</sup>

Based on the gross and microscopic features, PPB can be divided into three types. The exclusively cystic or type I PPB is the least complex and presents at an earlier age. Type II PPB has both cystic and solid lesions, while type III PPB is a purely solid tumour consisting of friable, gelatinous to mucoid, lobulated tissue often accompanied by haemorrhage and necrosis.<sup>(5)</sup> In the case of type I PPB, the diagnostic pitfall is failure to sample or recognise the immature mesenchymal cells, often with a rhabdomyoblastic immunophenotype, beneath the epithelial surface of the cysts. The cambium layer of primitive cells beneath the surface epithelial layer is not a continuous band of tumour cells in all cases. For this reason, extensive tissue sampling from any cystic or multicystic structure submitted as an intrathoracic or pulmonary cyst from a child is necessary in the course of the pathological examination.

It has been speculated that the natural history of PPB is that there is a natural progression from type I to type III over time. In our case, the patient had a type I lesion that was excised partially. In subsequent recurrences, the tumour became solid, anaplastic, multiphasic with mesenchymal pattern. The patient did not receive chemotherapy or radiotherapy after the excision, and hence the transition from type I to type III cannot be secondary to the effect of therapy.

In a report of 50 cases of PPB registered at PPB Reference Centre based at St. Paul Children's Hospital, 38% of the children had radiologically-identified pulmonary cysts prior to surgery. In more than one-third of these instances, the cysts were presumed to be developmental or infectious, and the children were just monitored for several months, often until a suspicious, solid component had developed. At the time of surgical intervention, two-third of these children had either type II or type III lesions. The increasing median age at presentation and the large number of cases presenting as innocuous pulmonary cysts, suggested to the authors that there was a tendency for progression from type I to type III.<sup>(6)</sup> Our case and few other cases clearly document a transition from type I to type III tumour. The transition in our case was extremely fast and took only a few months in contrast to that reported by Wright.<sup>(7)</sup>

Complete surgical resection remains the primary goal of treatment of children with PPB. Tagge et al convincingly admonished against the indiscriminate non-surgical management of thin-walled cystic structures that are found radiologically in the lungs of neonates and children.<sup>(8)</sup> The PPB Reference Centre suggests that postoperative chemotherapy should be considered strongly for children with type I PPB to minimise the possibility of recurrence, as seen with the more aggressive type II or type III lesions.<sup>(6)</sup> Recent data from the registry suggest that adjuvant chemotherapy may decrease the risk of recurrence and improve the outcome for these children.<sup>(9)</sup> Of the 20 registry patients who had surgery alone for type I lesions, eight developed recurrent disease, and five died despite all efforts at salvage. In contrast, among

17 children who underwent surgery and received adjuvant chemotherapy as well, only one died, and the rest are disease-free at an average follow-up of 4.9 years. A combination of vincristine, actinomycin-D and cyclophosphamide has been advocated as adjuvant chemotherapy by the registry. Adjuvant therapy has also been used consistently for patients with type II and type III tumours, while radiotherapy is recommended for patients with type II or type III tumours with known areas of residual disease.<sup>(10)</sup>

We emphasise that complete excision of cystic lesions in infancy with meticulous sampling and histopathological examination are important, to exclude any solid component or malignant mesenchymal immature cells. These measures will ensure better outcome for the cystic form of PPB. In cases of incomplete excision of the cystic form, close surveillance with imaging is necessary for the early detection of recurrence, as it has been shown that there is a tendency for type I PPB to progress towards type III tumours.

## REFERENCES

1. Manivel JC, Priest JR, Watterson J, et al. Pleuropulmonary blastoma: the so-called pulmonary blastoma of childhood. *Cancer* 1988; 62:1516-26.
2. Priest JR, Watterson J, Strong L, et al. Pleuropulmonary blastoma: a marker for familial disease. *J Pediatr* 1996; 128:220-4.
3. Indolfi P, Casale F, Carli M, et al. Pleuropulmonary blastoma: management and prognosis of 11 cases. *Cancer* 2000; 89:1396-401.
4. Miniati DN, Chintagumpala M, Langston C, et al. Prenatal presentation and outcome of children pleuropulmonary blastoma. *J Pediatr Surg* 2006; 41:66-71.
5. Dehner LP, Watterson J, Priest J. Pleuropulmonary blastoma: a unique intrathoracic pulmonary neoplasm of childhood. *Perspect Pediatr Pathol* 1995; 18:214-26.
6. Priest JR, McDermott MB, Bhatia S, et al. Pleuropulmonary blastoma: a clinicopathologic study of 50 cases. *Cancer* 1997; 80:147-61.
7. Wright JR. Pleuropulmonary blastoma: a case report documenting transition from type I (cystic) to type III (solid). *Cancer* 2000; 88:2853-8.
8. Tagge EP, Mulvihill D, Chandler JC, et al. Childhood pleuropulmonary blastoma: caution against nonoperative management of congenital lung cysts. *J Pediatr Surg* 1996; 31:187-90.
9. The International Pleuropulmonary Blastoma Registry. Type I PPB Treatment Recommendations. Available at: [www.ppbregistry.org/doctors/treatment\\_1.asp](http://www.ppbregistry.org/doctors/treatment_1.asp). Accessed October 8, 2006.
10. Parsons SK, Fishman SJ, Hoorntje LE, et al. Aggressive multimodal treatment of pleuropulmonary blastoma. *Ann Thorac Surg* 2001; 72:939-42.