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# Curvilinear Density in the Lower Lung of the Pediatric Age Group

—An Analysis of 73 Cases—

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## 小児の下肺野にみられる弧状一直線状陰影について

— 73 例 の 分 析 —

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いわゆる Vertical fissure line は 1960 年 Davis により記載されているが、以後散発的な報告があるのみである。われわれは小児領域で肺下野に斜走する線状陰影が病的か否か問題となる場合にしばしば遭遇するし、又その発生頻度の報告もみあたらないので 1971 年 1 月より 12 月まで九大病院中放で撮影された小児科患者 1000 例を無作為に選び出し、その胸部 X 線写真を再検討し、次のような結果を得た。

1000 例中 73 例 (7.3%) に線状陰影が陽性であった。陽性例中には両側性のもあり 73 例 83 本ということになる。このうち男児 42 例、女児 31 例であ

る。年齢別陽性率をみると生後 3 歳までの年齢域で 52 例 (73%) の好発をみた。部位的にみると右下肺野外側が多く (54 例) 左下肺に認めたものは 19 例である。このうち両側性に陽性であつたものは 10 例であつた。この線状陰影は毛髪線として認められ、その長さは 1.0 cm より 20 cm (平均 2.9 cm) の範囲に及んだ。走向は 4 型に大別出来たが直線的なものが最も多かつた。

この線状陰影の発現と心疾患の共存が報告されているので、陽性例につき 心横径・胸郭横径比 (CTR) をとつてみると外国の数値ではあるが Caffey の数値よりも上まわつていた。われわれの

73例のうち38%はX線学的に心大血管系の異常を認め、臨床的にも50%の症例で何らかの形の心疾患を指摘出来た。

われわれの分析からこの線状陰影の発現の機序を明らかにすることは出来なかつたがわれわれがみている線状陰影は葉間肋膜、特に major fissure

の一部であると考える。この陰影の発現を直ちに病的なものとは考えられないが隣接臓器ないし組織の異常が影響することが考えられる。すなわち、単一の因子ではなく心疾患も因子の一つであろう。臨床的には長さよりむしろ巾に注意すべきである。

### Introduction

Curvilinear density,—so-called vertical fissure lines—first described by Davis<sup>2</sup> in 1960, can be occasionally identified in the lower lung of the infants (Figure 1). In pediatric clinic, a question arises very often whether this is normal or abnormal. This is quite true with cases who have pulmonary symptoms of some sort. It is our primary interest to assess incidence of this curvilinear density and analyse positive cases.

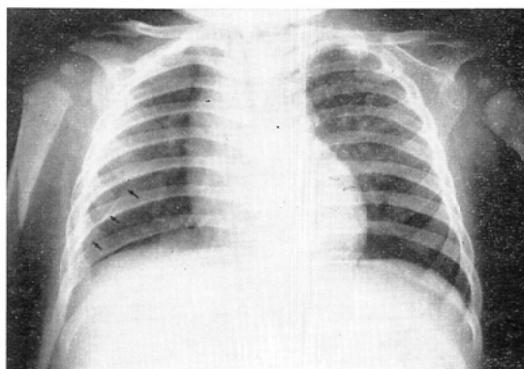


Figure 1. Frontal chest roentgenogram of 6 months old boy. Curvilinear density is seen in the right lower lung (arrow).

### Materials & Method

We reviewed randomly selected 1000 pediatric frontal chest roentgenograms taken at Kyushu University Hospital during 1971.

### Results

Seventy-three cases (7.3%) were found to have the curvilinear densities in the lower lung. Out of our 73 cases, 42 (58%) were in male and 31 (42%) in female. Figure 2 shows distribution of the positive cases by age and sex. 52 cases (73%) were found in the age from newborn to 3 years. Out of them, 28 were in male and 24 were in female. We found 83 curvilinear densities in our 73 cases. 64 curvilinear densities were seen on the right and 19 on the left. They were identified bilaterally in 10 cases (13.7% of all positive cases).

An analysis of localization of the lines showed 44 lines far laterally in mid and lower zones of the right lung. The lines in the left lung showed same distribution inspite of smaller number of the cases. Length of the lines was extending from 1.0 to 20 cm with mean value of 2.9 cm. Width of the lines was within 1.0 mm in 93% of positive lines. Shape of the lines was divided into four types. We saw

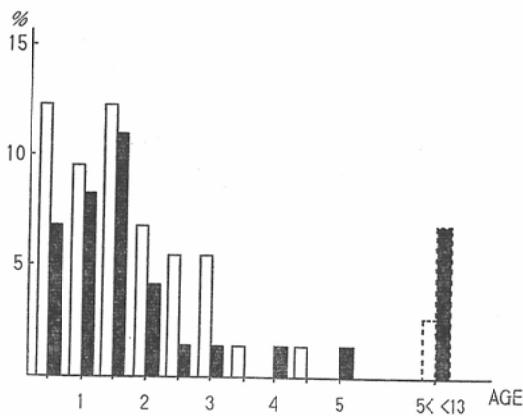


Figure 2. Distribution of 73 positive curvilinear cases by age and sex. Shaded column represents female and the other represents male.

32 lateral convexity, 12 lateral concavity, 37 straight and 2 others. Relation to lateral chest wall and diaphragm is variable. 38 lines were extending from lateral chest wall, 11 from costophrenic angle, and 6 from lateral half of the diaphragmatic dome. 26 lines had no direct visible connection to lateral chest wall and diaphragm. Two lines were commencing from outermost diaphragmatic dome, running superiorly with lateral concavity, and terminating to the lateral chest wall. Concomitant hair lines of minor fissure were identified in 34 cases, of which 31 lines did not cross so-called vertical fissure lines.

Cardiothoracic ratio (CTR) was measured in positive cases under 5 years of age and results were shown in Figure 3. Positive cases show slightly larger CTR. in all age groups.

AGE	CTR		Our Positive Cases	
	Range	Mean	Range	Mean
0—1	0.39—0.65	0.49	0.43—0.65	0.57
1—2	0.39—0.60	0.49	0.39—0.69	0.51
2—3	0.39—0.50	0.45	0.47—0.62	0.61
3—4	0.40—0.52	0.45	0.62—0.83	0.74
4—5	0.40—0.52	0.45	0.53—0.59	0.66

\* by Caffey

Figure 3. Cardiosthacic ratio (CTR) in our positive curvilinear cases comparing with CTR described by Caffey<sup>1)</sup>.

Attention was paid to the radiolucency of the lung fields in the vicinity of the vertical fissure lines. There is no difference in radiolucency in the outside and inside of 70 vertical fissure lines. Less radiolucency in the outside of 11 lines and less radiolucency in the inside of 2 lines were noted. We could follow up 13 positive cases from 1 to 10 months and we found 2 cases which showed disap-

pearance of the vertical fissure lines in 8 months and 10 months respectively. We studied relationship between incidence of vertical lines and underlying diseases. Analyses were performed by roentgenological and clinical diagnoses separately. Figure 4a showed 28 cases (38%) of 73 positives had cardiomegaly with or without increased vascularities of the lung, whereas 22% had cardiomegaly in 927 negatives in radiological analysis. However, analysis by clinical diagnosis did not show such a distinct difference as far as cardiomegaly was concerned (Figure 4b). Cases which were diagnosed as "Negative" either roentgenologically or clinically had tendency of low incidence of positive vertical lines.

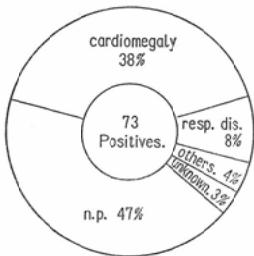


Figure 4a. Analysis of underlying diseases of 73 positives and 927 negatives by roentgenological diagnosis.

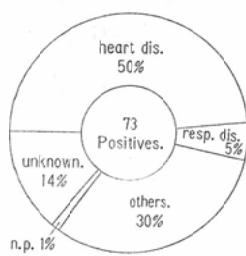
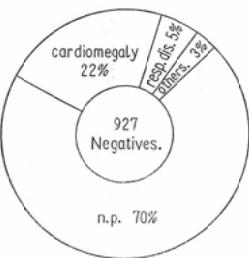


Figure 4b. Analysis of underlying diseases of 73 positives and 927 negatives by clinical diagnosis.

### Discussion

Davis<sup>2)</sup> pointed out, the vertical fissure lines are paralleling the right thoracic wall. On the other hand, Webber<sup>4)</sup> described positive lines in the left in some of his cases. In 1966, Friedman<sup>3)</sup> reported 26 cases of positive line on the right, 7 cases on the left and 4 cases on both sides. In our study, we see 83 positive lines in 73 cases. Out of 83 lines, there are 19 on the left, including bilateral positive cases. However, it is general agreement that the vertical fissure line can be identified much more frequently on the right. Incidence of vertical fissure line has never been reported and we have obtained 7.3% positive incidence in our 1000 cases. In Friedman's cases<sup>3)</sup>, 33 out of 37 positive cases were seen under 1 year of age. In Japan, Yamasaki<sup>5)</sup> reported 6 positive cases of which 4 cases were seen under 1 year of age. In our 73 positive cases, 39 cases (37%) were seen under 1 year of age with subsequens rapid reduction of the incidence.

Friedman<sup>3)</sup> described that the laterally situated lines were straight and those beginning more medially were slightly curved with lateral convexity. We have not observed such a characteristic. Davis<sup>2)</sup> first described that vertical fissure lines were more frequently observed in cases with enlarged heart. Our positive cases also showed larger cardiothoracic ratio. An entity of the vertical fissure lines has not fully understood so far. According to Davis<sup>2)</sup> the vertical fissure line is the lateral portion of the major fissure which has been directed in the anterior position so that this portion of the fissure is in a sagittal plane and thus is visualized on the frontal roentgenogram. He proved this in one case by postmortem examination. Webber and O'Loughlin<sup>4)</sup> considered it to be the fissure line, simply as a result of variation in its position. In Friedman's<sup>3)</sup> opinion, the vertical line represents the lateral border of a partially collapsed lower lobe, as it is projected by the tangential beam. Yamasaki<sup>5)</sup> considered the line was due to underdevelopment of the lower lobe. He also mentioned that the under-

development of the lower lobe was normally seen in the infants, so the fissure itself had no clinical significance. In our study, it was very hard to conclude a mechanism of the vertical fissure line because of lack of case proved either surgically or by autopsy. We made 7.3% observation and considered it to be rather high incidence for ectopic fissure. We considered that this line corresponded to the lateral inferior major fissure, and fissure was rotated so as to cast the curvilinear density on the frontal roentgenogram. Rotation of the fissure could be induced by more than one factor, such as rotation by enlarged heart, pulmonary abnormalities, and developmental abnormalities of the lower lung. The most of the vertical fissure lines have no clinical significance as Yamasaki<sup>5)</sup> pointed out, but we consider that sharpness and width of the lines are worthy to be checked. Unsharp and wider vertical fissure lines may be caused by inflammatory processes of the pleura and pulmonary parenchyma, and congestive heart diseases.

Differential diagnosis includes pleural effusion, pneumothorax, skin fold, skeletal density and artefacts.

### Summary

We reviewed frontal chest roentgenograms of 1000 cases examined at Pediatric Department of Kyushu University Hospital during 1971 and observed 73 positive cases (7.3%) of so-called vertical fissure lines. We reviewed the previous literatures and discussed. Mechanism of the vertical fissure lines was not conclusive but we considered that rotation of the major fissure could be one of causative factors.

(本論文の内容は第1回臨床小児放射線研究会(47. 10. 前橋)で発表した)

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