

## 行政院國家科學委員會補助專題研究計畫成果報告

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| 計畫名稱：大動脈完全轉位左右肺動脈高度及血<br>流量對發生左右肺動脈形成不良之<br>影響 The influence of bilateral<br>pulmonary arterial level and blood<br>flow on first branch pulmonary arterial<br>hypoplasia in transposition of the great<br>arteries |
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執行期間：88年8月1日至89年12月31日

計畫主持人：邱英世

共同主持人：陳銘仁

吳芬芬

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# 行政院國家科學委員會專題研究計畫成果報告

計畫名稱：大動脈完全轉位左右肺動脈高度及血流量對發生左右肺動脈形成不良之影響

計畫編號：NSC 89-2314-B-002-193

執行期限：88 年 8 月 1 日至 89 年 12 月 31 日

主持人：邱英世 台大醫學院外科部

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## 中英文摘要

背景：左肺門通常比右肺門高，因為左肺動脈(LPA)走在較水平的左側支氣管之上。但是在完全大動脈轉位(TGA)，LPA 的最高點不一定是高於右肺動脈(RPA)。

方法：我們分析了 101 個患有 TGA 的病例(平均年齡  $4.1 \pm 1.2$  月)之心導管攝影。並測量 LPA 和 RPA 以及肺動脈幹(PT)在正面攝影上第一個分枝之前之寬度。將所有病人依照 RPA/PT 之比例分成 4 組，並分別比較其 LPA 和 RPA 最初之走向和正面之最高點，以及記錄有無流向 RPA 之傾向。

結果：48 個病例(47.5%)的 RPA/PT 小於 0.49 (RPA 與 LPA 同大)。LPA 在大部分之病例比 RPA 高(81 例，80.2%)，但是有 6 例(5.9%)同高，而有 14 例(13.9%) RPA 比 LPA 高。如果有 RPA 或 LPA 形成不良時有較多之病例會有 RPA 與 LPA 同高或 RPA 較高之情況，RPA 較高且形成不良解剖病例 RPA 內部後側在支氣管之位置有脊狀突出。

結論：在 TGA 血流傾向流至 RPA 並沒有造成 LPA 形成不良但卻造成更高之動量衝向後側之右支氣管導致 RPA 高於 LPA，而在 RPA 或 LPA 形成不良時這種情況比較多見。

關鍵詞：大動脈轉位，左右肺動脈高度，左右肺動脈形成不良。

## Abstract

**Background.** The left hilum of the lung

usually is higher than the right, because the left pulmonary artery (LPA) coursed above the left main bronchus (hypoarterial bronchus). In complete transposition of the great arteries (TGA), the zenith of LPA is not always higher than right pulmonary artery (RPA).

**Methods and Materials.** We reviewed 101 angiograms of patients suffering from TGA (mean age,  $4.1 \pm 1.2$  months). The width of RPA, LPA and pulmonary trunk (PT) were measured just before their first branch in frontal view. They were classified into four groups according to the ratio between RPA/PT. The initial course of LPA and RPA were compared and defined according to the height of their zenith in frontal view, and the preferential flow to RPA than LPA or not were recorded.

**Results.** Forty-eight cases (47.5%) have a RPA/PT diameter ratio below 0.49 (both PAs had same size). The LPA coursed higher than the RPA in the majority of cases (81 cases, 80.2%), but in the others, both were of the same level (6 cases, 5.9%), or the RPA coursed higher (14 cases, 13.9%). Patients with a high degree of PA hypoplasia tended to have a RPA and LPA of the same level, or a higher RPA.

**Conclusion.** Preferential flow to RPA in complete TGA did not result in LPA hypoplasia before its first branch. Yet preferential flow might cause higher RPA as a result of increased momentum against the posterior bronchus. This situation was more prevalent when more severe PA hypoplasia

was present.

**Keywords:** Transposition of the great arteries, Bilateral pulmonary arterial level, Pulmonary arterial hypoplasia.

## Introduction

The left hilum of the lung usually is higher than the right, because the left pulmonary artery (LPA) coursed above the left main bronchus (hypoarterial bronchus), which is more horizontal than the shorter right main bronchus, and the right pulmonary artery (RPA) usually is in front of the right main and intermediate bronchus [1]. In transposition of the great arteries (TGA), the zenith of LPA is not always higher than RPA (Fig. 1).

## Materials and Methods

We reviewed 101 angiograms of patients suffering from complete TGA (mean age,  $4.1 \pm 1.2$  months). The width of RPA, LPA and pulmonary trunk (PT) were measured just before their first branch in frontal view. They were classified into four groups according to the ratio between RPA/PT as in Table 1. The initial course of LPA and RPA were compared and defined according to the height of their zenith in frontal view, and the preferential flow to RPA than LPA or not were recorded [2].

## Results

Forty-eight cases (47.5%) has a PA/PT diameter ratio (both PAs had same size) below 0.49 (Table 1). The LPA coursed higher than the RPA in the majority of cases (81 cases, 80.2%) (Table 2), but in the others, both were of the same level (6 cases, 5.9%), or the RPA coursed higher (14 cases, 13.9%), either the initial or the whole proximal RPA (Fig. 1A, B). Patients with a high degree of PA hypoplasia tended to have a RPA and LPA of the same level, or a higher RPA

(Table 2).

## Comments

Preferential flow to the RPA has been well recognized in complete TGA, especially when there was a wide angle between the right border of PT and RPA [2,3]. This situation occurred in one quarter of our cases ( $27/101 = 26.7\%$ ), but the difference in flow probably was not significant enough to limit the LPA growth, as both RPA and LPA had the same size before their first branch in this study. The pathogenesis of PA hypoplasia were reported [4].

From this study, the initial segment of RPA or the whole proximal RPA coursed higher that was present more in the severe group (Table 2) than in the other groups suggests the presence of an obstruction contributed by the posterior ridge, which might be a result of increased momentum [2] against the posterior bronchus, as demonstrated in the autopsy specimen (Fig. 2) and in the case of Aziz et al [5].

**In Conclusion,** preferential flow to RPA in complete TGA did not result in LPA hypoplasia before its first branch. Yet preferential flow might cause higher RPA as a result of increased momentum against the posterior bronchus. This situation was more prevalent when more severe PA hypoplasia was present.

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## Legend

Fig. 1 The right pulmonary artery (star) courses higher than the left (dot) in both frontal (A) and lateral (B) angiograms. More blood flow is distributed to the right lung. A typical “arms from the shoulder” appearance with shrugged right shoulder is evident.



Fig. 2 The posterior ridge (arrowhead) at the junction between the right pulmonary artery (star) and pulmonary trunk (PT) is caused by increased momentum against the bronchus (arrow) in a case with complete transposition. The whole proximal right pulmonary artery courses higher than the left (dot). (Ao=aorta, H=hump of the arterial duct).



Table 1. Number of cases, age, and assumed flow ratio in each group

| Group    | Diameter ratio | Flow ratio     | No. of cases |
|----------|----------------|----------------|--------------|
| normal   | $\geq 0.71$    | $> 1/2$        | 14           |
| mild     | $0.70 - 0.50$  | $1/2 \sim 1/4$ | 39           |
| moderate | $0.49 - 0.41$  | $1/4 \sim 1/6$ | 25           |
| severe   | $\leq 0.40$    | $< 1/6$        | 23           |

Table 2. Comparison of the level of the first-branch pulmonary arteries and distribution of their blood flow

| Level    | Higher lpa |     | Same height |     | Higher rpa |     | Total |     |
|----------|------------|-----|-------------|-----|------------|-----|-------|-----|
|          | r=l        | r>l | r=l         | r>l | r=l        | r>l | r=l   | r>l |
| normal   | 8          | 6   | 0           | 0   | 0          | 0   | 8     | 6   |
| mild     | 32         | 6   | 1           | 0   | 0          | 0   | 33    | 6   |
| moderate | 17         | 6   | 0           | 0   | 1          | 1   | 18    | 7   |
| severe   | 3          | 3   | 3           | 2   | 10         | 2   | 15    | 8   |
| Total    | 60         | 21  | 4           | 2   | 11         | 3   | 74    | 27  |

lpa: left pulmonary artery, rpa: right pulmonary artery, r=l: equal distribution of blood flow to both lungs, r>l: preferential flow to rpa.