Partially patent false lumen does not exhibit the highest growth rate ☆

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Previous studies have suggested that patients in the chronic phase of type B aortic dissections or following repaired acute type A aortic dissections with complete thrombosis of the false lumen have improved outcomes, whereas those with a patent false lumen have an increased risk of aortic expansion and death [1,2]. However, whether a partially patent false lumen is an independent risk factor to a faster and higher yearly growth rate and worst outcome compared with a completely patent false lumen has been divergent [3–7]. We therefore investigated to clarify the natural history of the affected aorta in cases of residual patent false lumen and to determine whether a residual patent false lumen affects distal aorta enlargement in patients with repaired acute type A aortic dissection.

Between March 1997 to October 2010, 61 patients were enrolled who had enough computed tomography (CT) scans available for the aortic year growth rate review. Patients were sub-classified into 3 groups according to the preoperative status of the false lumen [4]: patients assigned to the completely thrombosed false lumen (CTFL) group had an absence of contrast in the entire false lumen. Patients assigned to the completely patent false lumen (CPFL) group had an absence of thrombus in their false lumens. Patients assigned to the partially patent false lumen (PPFL) group had both thrombus and contrast in false lumens. Aortic growth rate was calculated in the following manner [8]: the difference in the diameter between initial (D1) and final (D2) measurements was divided by the time interval (T) between the 2 measurements, i.e., growth rate = (D2 − D1) / T.

The long-term mortality was 6.6% (4/61) among these 61 patients; 3 patients belonged to CPFL group and 1 patient belonged to CTFL group. The Kaplan–Meier curves revealed an overall 5-year survival of 85.6% (95% CI; 74.9% to 96.3%). The status of preoperative false lumen thrombosis did not affect the 5-year survival rates ($p = 0.304$; Fig. 1). Among the 3 groups, the CPFL group had the greatest year growth rates (Table 1). The means of the proximal descending aorta were statistically significant different ($p = 0.0479$), and post-hoc comparison further indicated that CPFL group (1.9 ± 4.1 mm) was significantly greater than
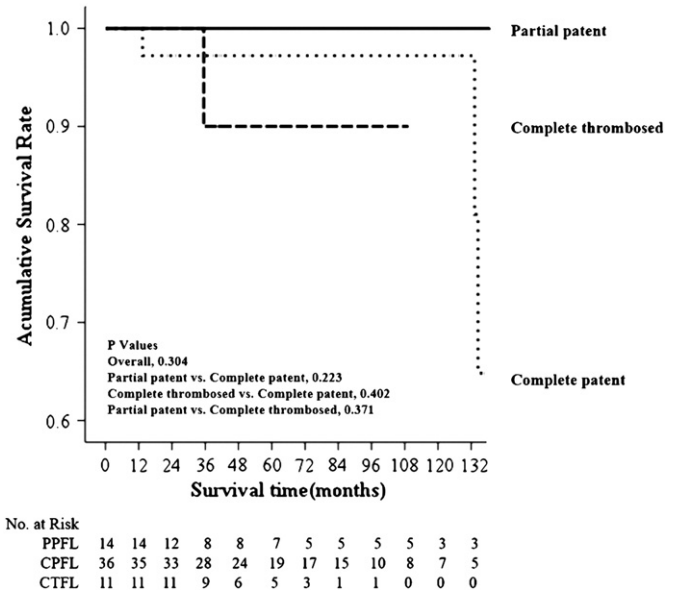
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Fig. 1. Actuarial Kaplan-Meier survival curves from hospital discharge data.

CTFL group (-0.9 ± 2.9 mm). At the level of the middle descending aorta ($p = 0.0300$), CPFL group (1.6 ± 2.5 mm) was significantly greater than PPFL group (-0.2 ± 2.2 mm). The CTFL and PPFL groups had an aortic year growth regression at the aortic arch and descending aorta. The segment analysis of maximum year growth rate found no significant different ($p = 0.4458$) among groups although the CPFL group had the highest maximum year growth: CPFL = 3.2 ± 4.5 mm, PPFL = 1.7 ± 1.4 mm, and CTFL = 2.1 ± 4.0 mm.

When evaluating the segments with the highest growth rate to demonstrate the association of the status of the aortic false lumen with the year growth rate, the CPFL group was found to have significant greater aortic growth rate than the PPFL group at the level of the aortic arch (2.41, 95% CI = 0.03–4.79, $p = 0.0473$), but became not significant (2.14, 95% CI = -0.20–4.48, $p = 0.0717$) after being adjusted for sex, age ≥ 60 years, smoking and asthma–chronic obstructive pulmonary disease. The CPFL group had a significant greater proximal descending aorta growth rate than the CTFL group, and it remained statistically significant after being adjusted for covariates (3.36, 95% CI = 0.39–6.33, $p = 0.0271$). At the level of the middle descending aorta, the CPFL group had a significant greater growth rate than the PPFL group, and it remained statistically significant after being adjusted for covariates (1.56, 95% CI = 0.13–2.99, $p = 0.0336$). The CPFL group had a significant greater terminal aorta growth rate than the CTFL group (0.90, 95% CI = 0.05–1.75, $p = 0.0384$), but became not significant after being adjusted for covariates (Table 2).

In the all-segment analysis for aortic growth rate of ≥ 1 mm/year (Table 3), a CPFL resulted to be a risk factor for a faster year growth

Table 1
Aorta segment-based analysis according to patient group assignment (mm).

Level	Status of the false lumen						*p*-Value	Post hoc comparison
	CPFL (n = 36)[a]		PPFL (n = 14)		CTFL (n = 11)			
	Mean ± SD		Mean ± SD		Mean ± SD			
Aorta mean initial diameter								
1. Aortic arch	41.9	8.0	41.0	7.3	41.7	6.9	0.9316	
2. Proximal descending aorta	39.6	7.8	39.4	7.8	37.0	7.7	0.5764	
3. Middle descending aorta	37.2	7.5	37.2	9.9	32.3	4.2	0.1473	
4. Distal descending aorta	34.0	6.7	33.3	5.0	29.5	3.5	0.0808	
5. Proximal abdominal aorta (suprarenal)	31.3	5.7	29.4	2.9	26.1	5.0	0.0124	CPFL > CTFL[b]
6. Middle abdominal aorta (infrarenal)	24.0	3.9	25.1	3.8	20.6	3.3	0.0095	CPFL and PPFL > CTFL[b]
7. Terminal aorta	22.9	4.6	22.6	3.5	19.5	2.7	0.0820	
Aorta mean yearly growth rate								
1. Aortic arch	1.7	4.3	−0.7	3.2	−0.3	2.0	0.0797	
2. Proximal descending aorta	1.9	4.1	−0.1	1.9	−0.9	2.9	0.0479	CPFL > CTFL[c]
3. Middle descending aorta	1.6	2.5	−0.2	2.2	0.2	1.2	0.0300	CPFL > PPFL[c]
4. Distal descending aorta	0.4	2.8	0.3	1.6	−0.4	0.8	0.6316	
5. Proximal abdominal aorta (suprarenal)	1.1	2.4	0.9	1.1	1.4	4.1	0.8706	
6. Middle abdominal aorta (infrarenal)	0.4	1.0	0.4	1.6	0.1	1.1	0.8212	
7. Terminal aorta	0.6	1.3	0.0	0.8	−0.3	0.7	0.0678	
Maximum aorta growth rate[d]	3.2	4.5	1.7	1.4	2.1	4.0	0.4458	

SD = standard deviation; CPFL = completely patent false lumen; PPFL = partially patent false lumen; CTFL = completely thrombosed false lumen.
[a] Total number of computed tomography scans per segment.
[b] Tukey–Kramer test.
[c] Hsu's MCB test.
[d] All segment analysis.

Table 2
Simple and multiple linear regression analysis of aortic growth rate.

Variable	β	Simple linear regressions			β	Multiple linear regressions[a]		
		p-Value	95% confidence interval			*p*-Value	95% confidence interval	
			Lower limit	Upper limit			Lower limit	Upper limit
1. Aortic arch								
CPFL vs. PPFL	2.41	0.0473	0.03	4.79	2.14	0.0717	−0.20	4.48
CTFL vs. PPFL	0.37	0.8091	−2.68	3.41	−0.76	0.6440	−4.07	2.54
CPFL vs. CTFL	2.04	0.1221	−0.56	4.64	2.91	0.0538	−0.05	5.86
2. Proximal descending aorta								
CPFL vs. PPFL	1.94	0.0890	−0.30	4.18	1.64	0.1672	−0.71	3.99
CTFL vs. PPFL	−0.79	0.5818	−3.67	2.08	−1.72	0.3012	−5.04	1.59
CPFL vs. CTFL	2.73	0.0297	0.28	5.19	3.36	0.0271	0.39	6.33
3. Middle descending aorta								
CPFL vs. PPFL	1.77	0.0167	0.33	3.21	1.56	0.0336	0.13	2.99
CTFL vs. PPFL	0.38	0.6782	−1.46	2.23	−0.48	0.6341	−2.50	1.54
CPFL vs. CTFL	1.39	0.0826	−0.19	2.96	2.04	0.0280	0.23	3.85
4. Distal descending aorta								
CPFL vs. PPFL	0.07	0.9227	−1.41	1.55	0.00	0.9969	−1.40	1.41
CTFL vs. PPFL	−0.70	0.4643	−2.58	1.19	−1.68	0.0954	−3.67	0.30
CPFL vs. CTFL	0.77	0.3458	−0.85	2.38	1.68	0.0632	−0.10	3.46
5. Proximal abdominal aorta (suprarenal)								
CPFL vs. PPFL	0.18	0.8252	−1.45	1.82	0.36	0.6813	−1.38	2.10
CTFL vs. PPFL	0.54	0.6050	−1.55	2.64	0.46	0.7064	−1.99	2.92
CPFL vs. CTFL	−0.36	0.6867	−2.15	1.43	−0.11	0.9237	−2.31	2.10
6. Middle abdominal aorta (infrarenal)								
CPFL vs. PPFL	−0.06	0.8838	−0.81	0.70	−0.15	0.7096	−0.94	0.64
CTFL vs. PPFL	−0.28	0.5584	−1.24	0.68	0.11	0.8482	−1.01	1.22
CPFL vs. CTFL	0.23	0.5833	−0.60	1.05	−0.25	0.6111	−1.25	0.74
7. Terminal aorta								
CPFL vs. PPFL	0.57	0.1207	−0.15	1.29	0.45	0.2447	−0.32	1.23
CTFL vs. PPFL	−0.33	0.4924	−1.30	0.63	−0.42	0.4677	−1.56	0.73
CPFL vs. CTFL	0.90	0.0384	0.05	1.75	0.87	0.0984	−0.17	1.91
8. Maximum aortic growth rate								
CPFL vs. PPFL	1.46	0.2437	−1.02	3.93	1.37	0.2851	−1.18	3.92
CTFL vs. PPFL	0.39	0.8046	−2.77	3.56	−0.82	0.6492	−4.42	2.78
CPFL vs. CTFL	1.06	0.4350	−1.64	3.77	2.19	0.1782	−1.03	5.41

CPFL = completely patent false lumen; PPFL = partially patent false lumen; CTFL = completely thrombosed false lumen.
[a] Analysis variables also include sex, age ≥ 60 years, smoking and asthma–chronic obstructive pulmonary disease.