

CT 혈관조영술로 평가한 대동맥박리 및 대동맥벽내 혈종 후 대동맥 내강 면적의 변화

최진오¹ · 김용석¹ · 황의석¹ · 오병희¹ · 정진욱² · 박재형² · 오세일¹
채인호¹ · 김철호¹ · 손대원¹ · 이명묵¹ · 박영배¹ · 최윤식¹

Changes of Aortic Morphology after Aortic Dissection Evaluated by CT Angiography

Jin-Oh Choi, MD,¹ Yong-Seok Kim, MD,¹ Eui-Seock Hwang, MD,¹ Byung-Hee Oh, MD,¹
Jin-Wook Chung, MD,² Jae-Hyung Park, MD,² Se Il Oh, MD,¹
In-Ho Chae, MD,¹ Cheol-Ho Kim, MD,¹ Dae-Won Sohn, MD,¹
Myoung-Mook Lee, MD,¹ Young-Bae Park, MD¹ and Yun-Shik Choi, MD¹

¹Department of Internal Medicine, ²Radiology, Seoul National University College of Medicine, Seoul, Korea

ABSTRACT

Background and Objectives : In aortic dissection (AD), CT angiography (CTA) is useful both in initial diagnosis and long term follow-up. In this study, we used CTA to evaluate the morphologic changes of aorta after AD. **Subjects and Methods :** We reviewed the initial and follow-up CTA images of 43 patients with AD. The diagnoses were double-lumen dissection (n = 13), intramural hematoma (n = 11), and residual dissection after surgery (n = 19). The duration of CTA follow-up was 3.3 ± 1.9 years (range 7 -89 months). After reviewing the CTA images of the thoracic aorta level, and of the upper and lower abdominal aorta levels, we compared the areas of total lumen, true lumen and false lumen and the area ratio of true/total lumen. **Results :** Changes in luminal areas were greatest in the thoracic aorta, where both the true lumen area and the ratio of true/total lumen area increased. Subgroup analysis revealed that although the total lumen area increased significantly in the classic AD group, no changes were noted in the ratio of true/total lumen area. Only the increase in false lumen area (from 5.8 cm^2 to 9.0 cm^2) was significant ($p = 0.036$). In patients with intramural hematoma, a decrease in total lumen area and an increase in the ratio of true/total lumen area were noted. **Conclusion :** In classic AD, false lumen dilatation occurs with false lumen enlargement, whereas in intramural hematoma total aorta size decreases with any increase in the ratio of true/total lumen area. (*Korean Circulation J* 2002;32(1):53-60)

KEY WORDS : Dissection ; Aorta ; Angiography ; Tomography, X-ray computed.

서 론

1%
가
1)

: 2001 10 8
: 2001 11 14
: , 110 - 744 28
: (02) 760 - 3345 · : (02) 762 - 9662 · E - mail : ohbhmed@snu.ac.kr

, CT , MR

대상 및 방법

1993 5 1999 5

4

2-6)

CT , 136

79

CT 6

A ,

, 가

가

1 CT 6

CT

4

가

2)5)

(aortic intramural hematoma)

CT

가

CT

24

19 43 (31.

3.3±1.9

CT

43

24 (55.8%),

19 (44.2%)

가 (false lumen)

13 (30.2%) 1

가

11 (25.6%) 2

가

CT

3

CT

CT

1 7

(

)

CT

CT

CT

(off line)

CT
가 CT 가 43
가 28 (65.1%), 15 (34.9%)
(Table 1).
29 , 12 ,
2 ,
가 24 ,
가
가 7
mm
CT
가
가 7)
A ,
B
7)
CT
(PACS :
picture archive and communication system)
DICOM Scion Im -
age for MacOS and Windows
1 2
CT Somatom Plus Scanner(Siem -
ens Medical System, Erlangen,)
100 150 mL iopromide(Ultravist 370,
Schering, Berlin,)
Mark V dedicated CT injector(Medrad, Pit -
tsburgh,) 3 mL/sec
, 3 mm (slice thickness), 1.3 1.
7 : 1 (pitch), 4 6 mm/sec
CT
SPSS 10.0
± ()
Wilcoxon signed ranks test

결 과

환자의 특성

1993 5 1999 5

13 , 가 11 .
A 가 18 (41.9%) , B 가
25 (58.1%) . 43 ,
35
81.4% ,
157.0±4.4 mmHg ,
97.8±2.4 mmHg .
55.9±1.35
1 54.8±2.99
2 60.1±1.9
A
1 2 15.4%, 18.2%

Table 1. Baseline characteristics of study patients

	Group 1	Group 2	Group 3
Number	13	11	19
Male	11 (84.6%)	9 (81.8%)	8 (42.1%)
Age, years	54.8±3.0	60.1±2.0	54.4±1.9
Type* A	2 (15.4%)	2 (18.2%)	14 (73.7%)
B	11 (84.6%)	9 (81.8%)	5 (26.3%)
Aneurysm of aorta	6 (46.2%)	5 (45.5%)	11 (57.9%)
Pleural effusion	5 (38.5%)	2 (18.2%)	4 (21.1%)
Hypertension	11 (84.6%)	8 (72.7%)	16 (84.2%)
Stroke	2 (15.4%)	2 (18.2%)	0 (0.0%)
Renal failure	1 (7.7%)	1 (9.1%)	2 (10.5%)
Follow-up Interval, years	2.4±0.5	2.4±0.7	3.4±0.5

Number (%) or mean±SEM. * : stanford classification of aortic dissection. Group 1 : patients with typical aortic dissection with medical treatment, Group 2 : patients with intramural hematoma with medical treatment, Group 3 : patients with residual dissection after surgical treatment. Aneurysm of aorta : cases in which maximal aortic diameter was greater than 4.5cm in any segment of entire aorta

주요 관찰 데이터

		(3)			1
)	138.7 ± 15.8 mmHg		
		1			가
		129.5 ± 14.9 mmHg	(Table 2).	14.8	
		2	± 1.13 cm ²	21.0 ± 2.53 cm ²	
		3	(p=0.026)	가	/
		141.1 ± 15.4 mmHg			5.8 ± 1.09 cm ²
		가	2.23 cm ²	가	9.0 ±
		14.0 ± 0.78 cm ²	15.1 ± 1.26 cm ²	(p=0.036)(Fig. 1).	2
		7.15 ± 0.70 cm ²	8.56 ± 0.90 cm ²	가	가
		(p=0.016)	/	가	11.8 ± 1.21 cm ²
		0.639 ± 0.045	가	(p=0.001).	10.56 ± 1.41
				0.82 ± 0.02	0.61 ± 0.031
				9.26 ±	가
				(Fig. 2).	가
		0.45 cm ²	10.2 ± 0.68 cm ²	가	/
		가	4.70 ± 0.42 cm ²	0.56 ± 0.07	0.69 ± 0.06
		5.56 ± 0.55 cm ²	(p=0.025).	(Fig. 3).	가

Table 2. Measured aortic luminal areas by CT angiography at basal and follow-up

	Group 1		Group 2		Group 3	
	Basal	Follow-up	Basal	Follow-up	Basal	Follow-up
Total luminal area (cm ²)						
Thoracic Aorta	14.80 ± 1.13	21.03 ± 2.53*	11.83 ± 1.21	10.56 ± 1.41*	14.69 ± 1.42	13.58 ± 1.43
Upper Abd Aorta	9.85 ± 0.72	12.04 ± 1.17*	8.06 ± 0.96	8.35 ± 1.53	9.54 ± 0.69	9.95 ± 0.86
Lower Abd Aorta	5.47 ± 0.75	6.53 ± 1.02*	5.41 ± 1.52	5.55 ± 1.98	6.46 ± 0.99	6.32 ± 0.73
Maximal diameter(cm)						
Thoracic Aorta	4.69 ± 0.19	5.41 ± 0.39*	4.03 ± 0.19	3.84 ± 0.23	4.36 ± 0.25	4.31 ± 0.29
Upper Abd Aorta	3.60 ± 0.12	4.08 ± 0.16*	3.22 ± 0.17	3.73 ± 0.24	3.65 ± 0.14	3.61 ± 0.20
Lower Abd Aorta	2.61 ± 0.98	2.99 ± 0.24*	2.59 ± 0.35	2.57 ± 0.39	2.88 ± 0.23	2.92 ± 0.19
True lumen area (cm ²)						
Thoracic Aorta	5.68 ± 1.09	8.17 ± 2.41	7.33 ± 1.05	8.52 ± 0.93*	8.13 ± 1.27	8.87 ± 1.14
Upper Abd Aorta	3.53 ± 0.56	4.21 ± 0.93	5.38 ± 0.76	6.47 ± 1.19	5.15 ± 0.72	5.99 ± 0.81
Lower Abd Aorta	2.56 ± 0.57	2.70 ± 0.82	4.04 ± 1.00	4.08 ± 1.32	4.02 ± 0.72	3.73 ± 0.56
False lumen area (cm ²)						
Thoracic Aorta	5.84 ± 1.44	9.01 ± 2.29*			2.96 ± 1.01	1.56 ± 0.87
Upper Abd Aorta	3.94 ± 0.74	4.53 ± 0.93			2.50 ± 0.70	1.79 ± 0.72
Lower Abd Aorta	1.95 ± 0.51	2.22 ± 0.69			1.27 ± 0.28	1.27 ± 0.37
Ratio of true lumen/total luminal area						
Thoracic Aorta	0.38 ± 0.06	0.42 ± 0.09	0.61 ± 0.03	0.82 ± 0.02*	0.56 ± 0.07	0.69 ± 0.06*
Upper Abd Aorta	0.36 ± 0.05	0.37 ± 0.07	0.67 ± 0.04	0.79 ± 0.03*	0.54 ± 0.06	0.63 ± 0.0
Lower Abd Aorta	0.48 ± 0.08	0.45 ± 0.10	0.79 ± 0.04	0.77 ± 0.04	0.62 ± 0.06	0.61 ± 0.06

Expressed as Mean ± SEM. * : statistically significant interval change between basal and follow-up study. P value less than 0.05 by Wilcoxon signed ranks test. Group 1 : patients with double-lumen dissection with medical treatment, Group 2 : patients with intramural hematoma with medical treatment, Group 3 : patients with residual dissection after surgical treatment

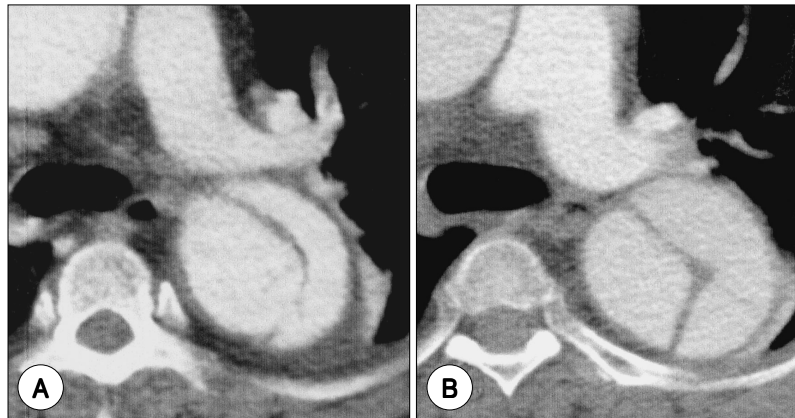


Fig. 1. Morphologic change of aorta in classic aortic dissection after long term follow-up. A : CT angiography of a 61-year-old male at the time of diagnosis of acute aortic dissection. Aortic dissection in descending thoracic aorta at carina level are seen, B : at 21 months follow-up, false lumen increased from 6.6 cm² to 11.6 cm², and total outer aorta area increased from 21.7 cm² to 24.7 cm².

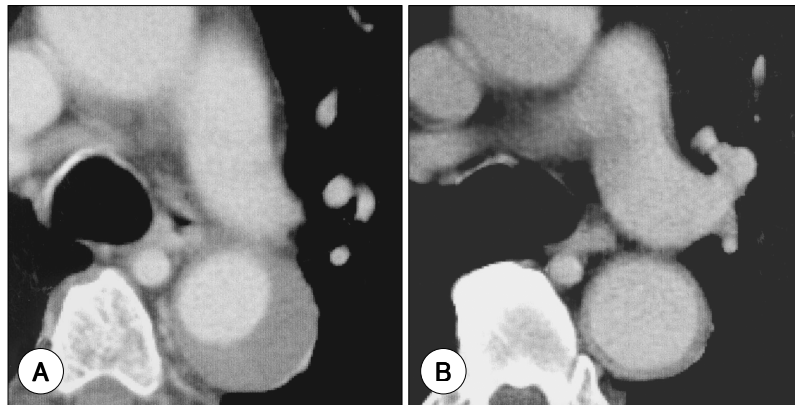


Fig. 2. Morphologic change of aorta in intramural hematoma patients at long term follow-up. A : CT angiography in a 65-year-old male shows crescent-shaped wall thickening with no enhancement after contrast injection, B : follow-up CT angiography after 17 months shows increase in true lumen area and decrease in total outer diameter of aorta.

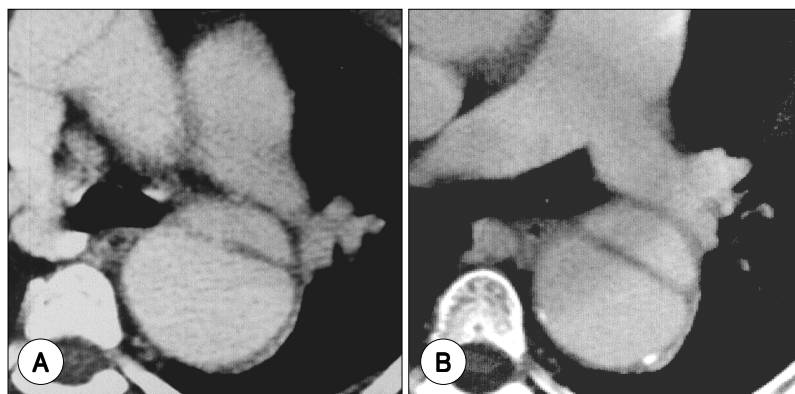


Fig. 3. Morphologic change of aorta in patients with residual dissection after surgical correction of intimal tear at long term follow-up. A : CT angiography of 52 year-old-female, one month after aorta surgery for type A aortic dissection, B : not significant interval changes were noted at 35 months later.

고 찰

CT 가 가 가

가 . CT (CT, computed Geroni ¹⁴⁾ B 가

tomography) 가 가 가

가 가 가

3 가 3 가

(multiplanar and 3 dimensional image)

⁸⁾ Mo -

Kozai ⁹⁾ 1973 1998 hr - Kahaly ¹⁵⁾ 114

15 가 70

가 가 가 33%

27%

40 mm , B

가 Gysi ¹⁰⁾ ¹⁵⁻¹⁷⁾

B 30 , Shimizu ⁶⁾ 1991 1997 51

96 45

Be -

rnard ¹¹⁾ 10% 40% (p=0.0005), 5% 26%

70 B 가 73

Marui ¹²⁾ 40

mm 가 가

¹²⁾¹³⁾ ber ⁷⁾ 12 7 2

가 가 가 가 (28%) 5 4

가가 3 가 19

11 가 ¹⁸⁾

요약

59

결 과 :

43 CTA
13 , 11
19
3.3 ± 1.9
가 7.15 cm²
8.57 cm² 가 (p=0.016), /
가가
가 /
가 5.8 cm² 9.0 cm²
가가 (p=0.036).
가가
가가

결 론 :

가 가
가
가
가
가

중심 단어 : ; ; ;

REFERENCES

- 1) Cigarroa JE, Isselbacher EM, DeSanctis RW, Eagle KA. Diagnostic imaging in the evaluation of suspected aortic dissection: old standards and new directions. *N Engl J Med* 1993;328:35-43.
- 2) Sebastia C, Pallisa E, Quiroga S, Alvarez-Castells A, Dominguez R, Evangelista A. Aortic dissection: diagnosis and follow-up with helical CT. *Radiographics* 1999;19:45-60.
- 3) Erbel R. Diseases of the thoracic aorta. *Heart* 2001;86:227-34.
- 4) Novelline RA, Rhea JT, Rao PM, Stuk JL. Helical CT in emergency radiology. *Radiology* 1999;213:321-39.
- 5) Hartnell GG. Imaging of aortic aneurysms and dissection: CT and MRI. *J Thorac Imaging* 2001;16:35-46.
- 6) Shimizu H, Yoshino H, Udagawa H, Watanuki A, Yano K, Ide H, Sudo K, Ishikawa K. Prognosis of aortic intramural hemorrhage compared with classic aortic dissection. *Am J Cardiol* 2000;85:792-5.
- 7) Nienaber CA, von Kodolitsch Y, Petersen B, Loose R, Helmchen U, Haverich A, Spielmann RP. Intramural hemorrhage of the thoracic aorta: diagnostic and therapeutic implications. *Circulation* 1995;92:1465-72.
- 8) Chung JW, Park JH, Im JG, Chung MJ, Han MC, Ahn H. Spiral CT angiography of the thoracic aorta. *Radiographics* 1996;16:811-24.
- 9) Kozai Y, Watanabe S, Yonezawa M, Itani Y, Inoue T, Takasu J, Masuda Y. Long-term prognosis of acute aortic dissection with medical treatment: a survey of 263 unoperated patients. *Jpn Circ J* 2001;65:359-63.
- 10) Gysi J, Schaffner T, Mohacsi P, Aeschbacher B, Althaus U, Carrel T. Early and late outcome of operated and non-operated acute dissection of the descending aorta. *Eur J Cardiothorac Surg* 1997;11:1163-70.
- 11) Bernard Y, Zimmermann H, Chocron S, Litzler JF, Kastler B, Etievent JP, Meneveau N, Schiele F, Bassand JP. False lumen patency as a predictor of late outcome in aortic dissection. *Am J Cardiol* 2001;87:1378-82.
- 12) Marui A, Mochizuki T, Mitsui N, Koyama T, Kimura F, Horibe M. Toward the best treatment for uncomplicated patients with type B acute aortic dissection: a consideration for sound surgical indication. *Circulation* 1999;100:II275-80.
- 13) Kato M, Bai H, Sato K, Kawamoto S, Kaneko M, Ueda T, Kishi D, Ohnishi K. Determining surgical indications for acute type B dissection based on enlargement of aortic diameter during the chronic phase. *Circulation* 1995;92:II107-12.
- 14) Genoni M, Paul M, Jenni R, Graves K, Seifert B, Turina M. Chronic-blocker therapy improves outcome and reduces treatment costs in chronic type B aortic dissection. *Eur J Cardiothorac Surg* 2001;19:606-10.
- 15) Mohr-Kahaly S, Erbel R, Kearney P, Puth M, Meyer J. Aortic intramural hemorrhage visualized by transesophageal echocardiography: findings and prognostic implications. *J Am Coll Cardiol* 1994;23:658-64.
- 16) Murray JG, Manisali M, Flamm SD, VanDyke CW, Lieber ML, Lytle BW, White RD. Intramural hematoma of the thoracic aorta: MR image findings and their prognostic implications. *Radiology* 1997;204:349-55.
- 17) Robbins RC, McManus RP, Mitchell RS, Latter DR, Monon MR, Olinger GN, Miller DC. Management of patients with intramural hematoma of the thoracic aorta. *Circulation* 1993;88:III-10.
- 18) Kang DH, Song JK, Song MG, Lee IS, Song H, Lee JW, Park SW, Kim YH, Lim TH, Park SJ. Clinical and echocardiographic outcomes of aortic intramural hemorrhage compared with acute aortic dissection. *Am J Cardiol* 1998;81:202-6.
- 19) Sohn DW, Jung JW, Oh BH, Lee MM, Park YB, Choi YS, Lee YW. Should ascending aortic intramural hematoma be treated surgically? *Am J Cardiol* 2001;87:1024-6.
- 20) Song JK, Kim HS, Kang DH, Lim TH, Song MG, Park SW, Park SJ. Different clinical feature of aortic intramural hematoma versus dissection involving the ascending aorta. *J Am Coll Cardiol* 2001;37:1604-10.
- 21) Nishigami K, Tsuchiya T, Shono H, Horibata Y, Honda T. Disappearance of aortic intramural hematoma and its significance to prognosis. *Circulation* 2000;102:III243-7.