

가 :

1

· · · · ·

: DeBakey 1 2
가

: DeBakey 1 13 2 6
, 5
19 11
, 3
40 (: 12.5). () 20 3-D FISP 3
12 (,),
가 (가 , 가),

: (9/11),
20 17
, DeBakey 1 14
8 가 가 가 가
6 (concave) 1
9 8
:
가

(acute aortic dissection) 가
가

(1,2).
, DeBakey 1 가 (false lumen) (4 - 8). DeBakey 1 2
, 가 (intimal flap) 가 MRI
(MRA)

1 3 , 6 CT
(3). CT

(transesophageal echocardiography)

1994 4 1997 5
53 MRI
19 20 가 11 , 가 8
27 66 44.2
DeBakey 1 13 , 2 6

MRI 3 40 ,
12.5 .
DeBakey 1 8 17
MRI
13 DeBakey 1 8
(graft inclusion technique) , 3
(ascending aorta replacement,) , 3
Bentall (Bentall's operation) .
2 (as-
cending aorta & total arch replacement) . 6
DeBakey 2 5 (n=3)
(n=2) , 3 Bentall
1 Bentall
(hemi-arch replacement)

woven dacron graft
(continuous suture)

가

(valve-conduit)

(reimplantation)

가

Bentall

가

(circulatory arrest)

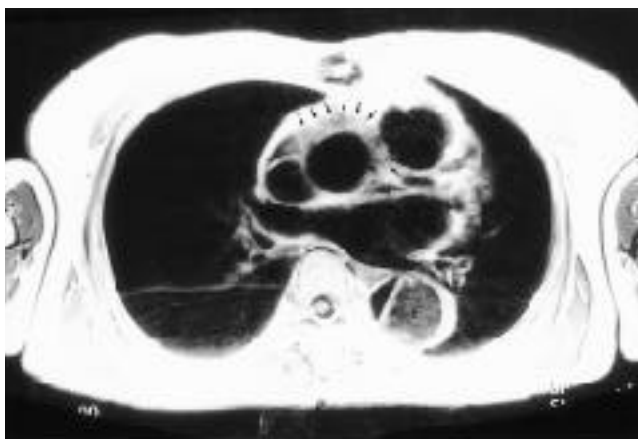


Fig. 1. Perigraft thrombosis. Axial spin-echo T1-weighted image shows an ill-defined area of intermediate signal intensity (arrows) surrounding the aortic prosthesis of the ascending aorta. Note descending aorta with remnant false lumen (F).

가

가

가

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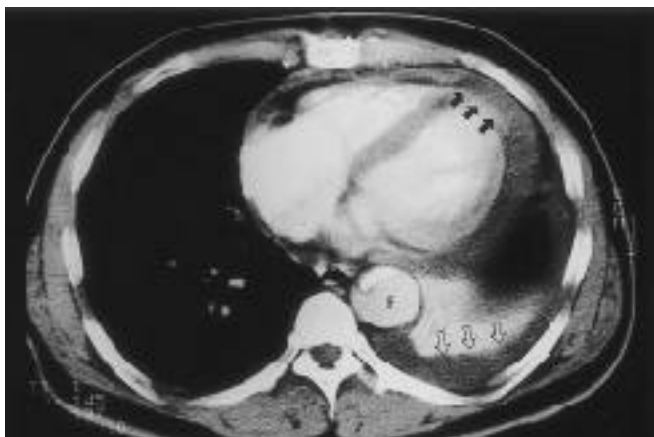
(obliteration)

1.5 Tesla

Siemens Magnetom

Vision VB 31B (Siemens, Erlangen, Germany) GE (General Electric Medical Systems : Milwaukee, WI, U.S.A.)

(ECG-gated spinecho sequence)



A



B

Fig. 2. A. Preoperative contrast-enhanced CT scan at the level of interventricular septum shows aortic dissection complicated with hemothorax (open arrows) and hemopericardium (solid arrows). False lumen (F) has a convex margin to true lumen.

B. Postoperative spin-echo T1-weighted image at the same level with A reveals false lumen (F) with a concave margin to the true lumen.

(axial view), (arch view), (oblique coronal view) T1 (TR/TE/Slice thickness/flip angle=600-1055.6/14/6-10mm/90°) T2 T1

(breath-hold turbo spin-echo sequence) (TR/TE/Slice thickness/flip angle=800/76/6-10mm/160°).

97 3 11 (1 9 , 2 3)

3-D FISP(Fast Imaging with

Steady-state Precession, TR/TE/flip angle, 4.2/1.7/25°)

MRA

Gd-DTPA

(Magnevist, Schering, Berlin, Germany) 0.2 mmol/kg 2cc/sec

20

(scan delay time)

(region of inter-

est) 1cc

(time-signal intensity curve)

, 0.1mmol/kg Gd-DTPA

(9) :

Am=Em

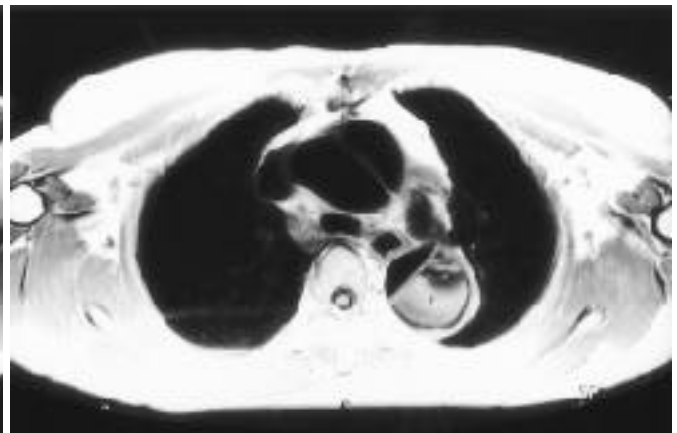
Table 1. MR Findings of Asymptomatic Patients who Underwent Repair of Aortic Dissections

Findings	n= 20*	%
Perigraft thickening or thrombosis	9	(45)
Buckling on anastomotic site	17	(85)
Deformity of graft	8	(40)
Residual intimal flap	14	(70)
Flow in false lumen	14	(70)
Concave shape of false lumen	10	(50)
Dissection extending to great vessels	8	(40)

Note.*means numbers of MRI.



A



B



C



D

Fig. 3. 46-year-old patient who underwent graft interposition for DeBakey type 1 aortic dissection.

A. Spin-echo T1-weighted image shows remnant false lumen in the brachiocephalic artery (arrow).

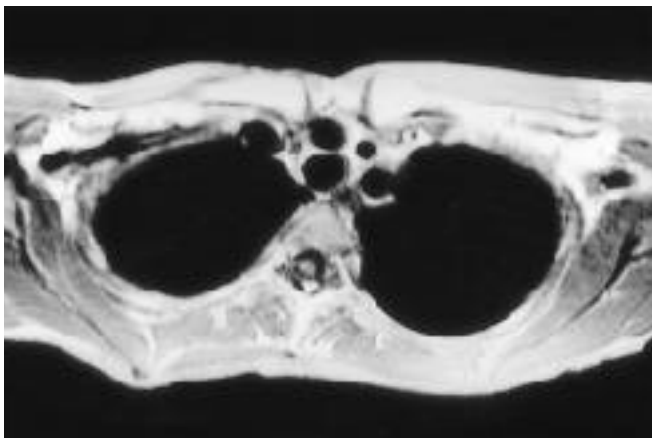
B. At the level of carina, false lumen(F) shows inhomogeneous signal intensity due to slow flow.

C. Early phase of 3-D FISP MR angiography with MIP shows highly enhancing grafted ascending aorta(G), true lumen(T) and false lumen(F) of the aortic arch and upper part of thoracic aorta. The innominate artery is faintly enhanced (arrow).

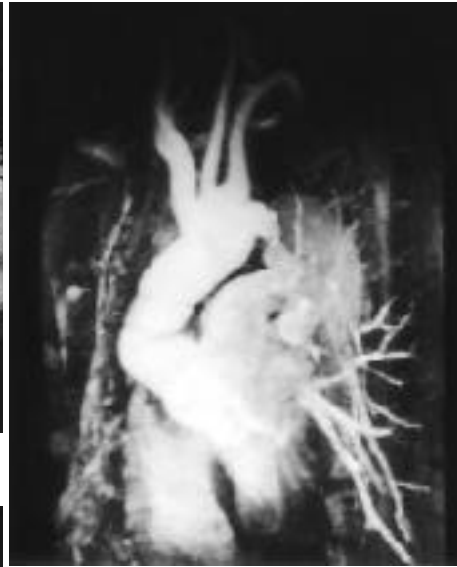
D. Delayed phase of 3-D MR angiography with MIP shows equilibrium of the contrast in the true and the false lumen. However, the false lumen in brachiocephalic artery and the remnant entry site to the false lumen in the aortic arch (arrows) show delayed enhancement.



A



B



C

Fig. 4. 28-year-old patient who underwent the replacement of the ascending aorta and the total aortic arch for DeBakey type 1 aortic dissection with involvement of arch vessels.

A. Preoperative contrast enhanced CT scan shows intimal flaps (arrows) in the brachiocephalic, the left common carotid, and the left subclavian arteries.

B. Postoperative spin-echo T1-weighted image shows no definite remnant intimal flap in arch vessels.

C. MR angiography reveals patent luminal enhancement in the arch vessels without evidence of remnant intimal flap.

$$Ts + Ta/2 = Td + Tg/2$$

$$Ts = Td + Tg/2 - Ta/2,$$

(Am; mid point of data acquisition, Em; mid point of optimal arterial enhancement, Ts; scan delay time, Ta; acquisition time, Td; contrast peak time estimated by time-signal intensity curve, Tg; infusion time).

(early phase) 2 10 (delay phase)

11
(perigraft)

(3).

(end-to-end anastomosis)

가

가

14

DeBakey 1

가

가

가

가

(signal void)

(10)

MRA

가

가

가

CT

MRI

CT

MRI

11

9

(n=5)

(n=4)

(Fig.1).

3.5 mm)

4-6 mm(

가 2-5 mm(

5.3 mm)

(85%)
가
(buckling)
8 (40%), (redundancy), 가, CT, MRI가 MRA
(3 - 7, 11).
가 MRA
DeBakey 2 6 가 , DeBakey
1 14 가 1 14
가 12
, 2
가 가 . MRA
9 7 가 가 ,
2 가 11 82% Rofsky (3)
MRI . 10 CT , 3
가 . 13 14 가
가 6 가
. 가 ,
가 7 , 가 6 ,
가 4 , 가 10 (Fig. 2).
가 가 1
가 9 ,
가 7 . 1
가 , 1
. MRA 12
6 가 가
4 가 (Fig. 3). 1
가 , 1 가 가 (entry) (re-entry) 가
(Fig. 4). 가 Moore 79% 가 DeBakey 1 가
(4). 가 가
가 . 가
가 (12,13) T2 MR (8)
(10). DeBakey cine MR MR soft ware
short TE가가

가 3-D FISP
MRA 9 가
MRA 20
2 ,
7 가
가
가 2
가
MRA
, 10 MRA 가
가 (7/13)
(chamber) MRI
(10/14)
가 6 가
가 ,
가 , 가
가
9 8
, 1
, MRA
가 (4/6).
MRI
가 , MRA 가

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Postoperative Assessment of Aortic Dissection : The Usefulness of MR Imaging and MR Angiography¹

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Purpose : To demonstrate the usefulness of MR imaging and MR angiography in the evaluation of patients who have undergone surgery for DeBakey type 1 or 2 aortic dissection.

Materials and Methods : Nineteen patients who had undergone surgery for DeBakey type I (n=13) or type II (n=6) aortic dissection were included in our study. Graft interposition had been performed in 11 patients, ascending aorta replacement in five, and hemi-arch or total arch replacement in three. MRI was performed 3-40 months (mean:12.5) months after surgery. Twenty (turbo) spin-echo MR images and 12 contrast-enhanced MR angiographs (3-D FISP) of 19 patients were retrospectively analyzed with regard to perigraft site (perigraft thickness or thrombus), graft site (anastomotic site, deformity of graft), status of remnant false lumen (remnant intimal flap, flow in false lumen, size, and shape), and involvement of arch vessels.

Results : Perigraft sites were demonstrated on spin-echo axial images (9/11), and in no case was there demonstrable hematoma or perigraft flow. Distal anastomotic sites were identifiable in 17 of 20 cases, and graft redundancy was noted in eight. Remnant false lumen distal to the graft vessel was present in all patients who had undergone DeBakey type 1 aortic dissection (n=14). Flow in the false lumen was also demonstrated in all DeBakey type 1 cases on spin-echo images and MR angiography. Remnant false lumen increased in size in six of 14 cases, and tended to show a concave margin to true lumen compared with preoperative imaging. In 8 of 9 patients whose arch vessels had been preoperatively involved, intimal flaps in arch vessels remained.

Conclusion : MR imaging is a useful tool for the postoperative assessment of patients who have undergone aortic dissection. In addition, remnant intimal flap, flow dynamics in false lumen, and involvement of arch vessels can be easily identified by MR angiography.

Index words : Aorta, dissection
Aorta, MR

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