

가: 3 Gadolinium

1

2 .

: 가

: 11 12 (DSA)

(CE - MR angiography) 1 . 11

4 , 3 , Buerger 1 ,

가 1 , calciphylactic 1 , 1 .

1.5T 3

(FISP) kg 0.2 mmol gadolinium

3 ml 10 ml ,

10 20 10 4 .

7 , 2 , 가 ,

: 84 16 39

26

3 .

5.42 , 3.50

(T - test, $p < 0.000$).

CE - MR angiography (T - test, $p <$

0.000)

: 가 3 .

, , Buerger

(1, 2) (FOV) , 가

가 가 , DSA

(3 - 6), plethysmography,

가 가 .

(Digital subtraction angiography, (Time of Flight,

DSA) TOF) (Phase Contrast, PC

. DSA)

1

2

2001 2001 8 13 2002 4 17 .

가 TOF (7 - 9).

2 TOF

(Contrast - enhanced MR angiography, CE - MR angiography) (10)
 CE - MR angiography DSA 100% 가
 (11 - 13).
 가 CE - MR angiography가
 DSA .

1999 11 2000 6
 가 11 12
 가 7 , 가 4 , 49.5
 (21 - 78) . 4 , 3 , Buerger
 1 ,
 가 1 , calciphylactic 1 , 1
 .
 DSA CE - MR angiography 1
 . CE - MR angiography 1.5T
 (Magnetom vision, Siemens, Erlangen,
 Germany) (extremity coil) (head
 coil)
 가 . 3 FISP(Fast Image in

: 가
 Steady State Precession, TR 7.8 msec, TE 2.0 msec, Flip
 angle 60 °, FOV 25 cm, Matrix 128 × 256, NEX 1 , Slice
 thickness 3 mm)
 kg 0.02 mmol gadolinium(Dotarem,
 Guerbet, Paris, France) 3 ml
 10 ml gadolinium 10
 20 10 4 .
 MIP(maximum
 intensity projection) . DSA
 5F Omni (Angioptic Omni

Table 1. Visualization of 84 Arterial Segments with CE-MR Angiography Versus DSA in 11 Patients

Artery	Both	Neither	CE-MRA only	DSA only	Total
Anterior tibial a.	8	1	3	0	12
Distal Peroneal a.	7	2	3	0	12
Posterior tibial a.	9	0	3	0	12
Medial plantar a.	5	2	4	1	12
Lateral plantar a.	4	3	4	1	12
Dorsalis pedis a.	3	3	6	0	12
Pedal arch	3	5	3	1	12
Total	39	16	26	3	84

a.: artery
 CE-MR Angiography: Contrast-Enhanced MR Angiography
 DSA: Digital Subtraction Angiography

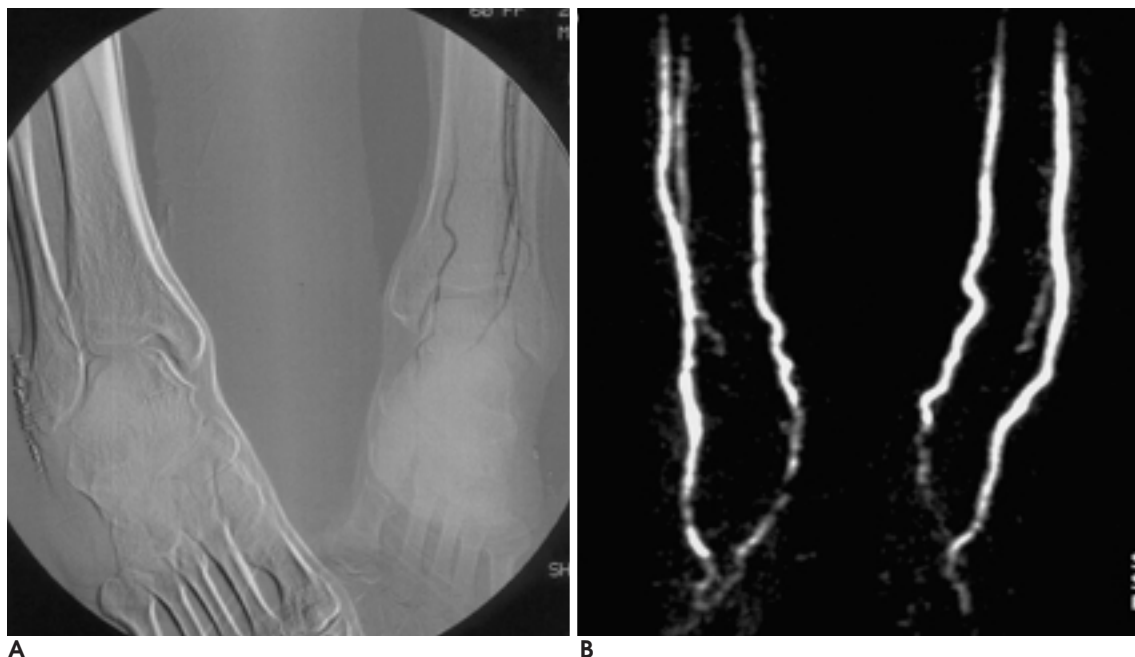


Fig. 1. 64 - year - old man with atherosclerotic stenoses in both common iliac arteries.
A. DSA of left ankle shows anterior tibial, posterior tibial, and peroneal artery but in DSA of right ankle, these arteries are not displayed.
B. CE-MR angiography of both ankle shows patent anterior tibial, posterior tibial, and peroneal arteries. Also dorsalis pedis and lateral plantar arteries of both feet are seen.

Flush, Angiodynamic, New York, U.S.A.) 5

, 6

DSA (SX - VA30, Hitachi, Tokyo, Japan)
35 70 cc 3 15 cc

MR angiography

. PC

가

가

TOF가

3D

TOF

2D TOF가

2D TOF가

(14).

TOF

T - test

, in - plane flow

, MIP

(stepladder artifact)

(15).

2D TOF

presaturation pulse FOV

FOV CE - MR angiography

11 angiography
16

12 DSA

84

CE - MR

가

84

68

(Table 1).

CE - MR angiography

3

DSA

48

CE - MR angiography

가 17 (Fig.1), DSA

3

CE - MR angiogra -

phy

5.41 , DSA 3.50

가 (T - test, $p=0.000$).

CE - MR angiography

(T - test, $p=0.000$)

가

CE - MR angiography

gadolinium T1

가

,

가

가

,

가

TOF

가

,

TOF

가

(17)

phy

가

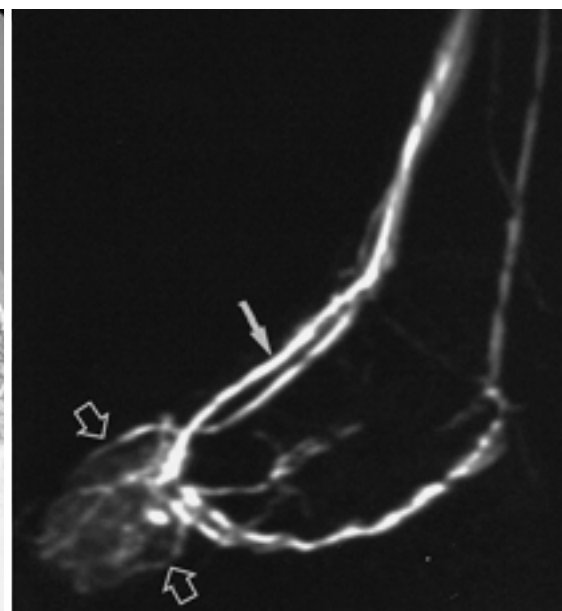
(16) Rofsky

MR angiogra -

CE - MR angiography가



A



B

Fig. 2. 19-year-old woman with arteriovenous malformation.

Both DSA (A) and CE-MR angiography (B) show nidus (open arrows) with early draining vein (closed arrow).

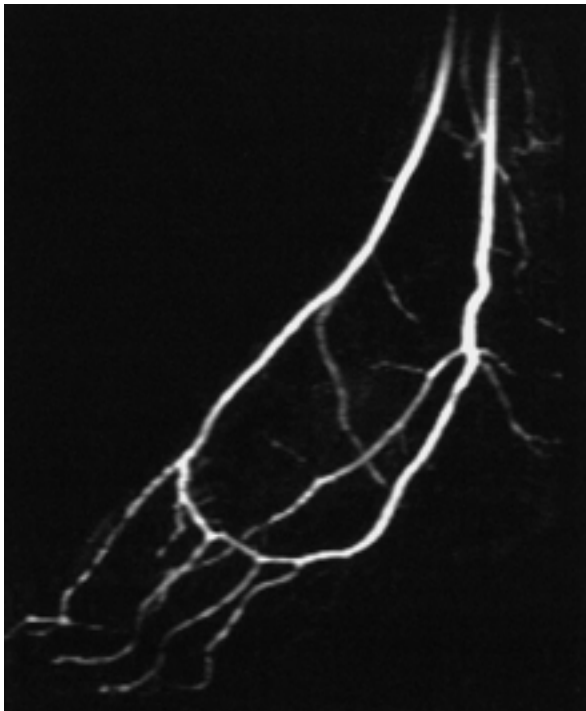


Fig. 3. 26-year-old man normal volunteer
CE-MR angiography acquired with the scan time of 20 seconds shows all seven arterial segments in ankle and foot.

Unger (18) CE - MR angiography
2D TOF
DSA
가
가 CE - MR angiography
가
가 CE - MR angiography
(T - test, $p=0.014$).
Kreitner (19) 24 DSA
CE - MR angiography 가 9
(38%) CE - MR angiography가 DSA
3 2 DSA CE - MR angiography
raphy
Calciphylaxis
(20, 21),

: 가
(22). 64
7 가 2
가 calciphylaxis
. DSA CE - MR angiography
,
CE - MR angiography 가
가
가 10
4 . CE - MR angiography
,
가
(23).
(Fig. 2).
Matrix
5 20
(Fig. 3), 30 , 40 , 50 , 60
가 . , 11 20
4
가 가
가 가
가
3D CE - MR angiography 가
DSA 가
DSA
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Evaluation of the Pedal Artery: Comparison of Three-dimensional Gadolinium-Enhanced MR Angiography with Digital Subtraction Angiography¹

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Purpose: To compare the three-dimensional gadolinium-enhanced MR angiography with digital subtraction angiography (DSA) for evaluation of the pedal artery.

Materials and Methods: In 12 extremities of 11 patients, both digital subtraction angiography (DSA) and contrast-enhanced MR angiography (CE-MR angiography) were performed during the same week. Among ten of the 11 patients, the following conditions were present: atherosclerosis ($n=4$), diabetic foot ($n=3$), Buerger's disease ($n=1$), calciphylactic arteriopathy ($n=1$) and arteriovenous malformation of the foot ($n=1$). The remaining patient underwent angiography prior to flap surgery. For MR angiography, a 1.5T system using an extremity or head coil was used. A three-dimensional FISP (fast imaging with steady state precession) sequence was obtained before enhancement, followed by four sequential acquisitions (scan time, 20 secs; scan interval time, 10 secs) 10 seconds after intravenous bolus injection of normal saline (total 10 cc), following intravenous administration of gadolinium (0.02 mmol/kg, 3 ml/sec). Arterial segments of the ankle and foot were classified as the anterior or posterior tibial artery, the distal peroneal artery, the medial or lateral plantar artery, the pedal arch, and the dorsalis pedis artery. Two radiologists independently analysed visualization of each arterial segment and the mean of visible arterial segments in one extremity using CE-MR angiography and DSA.

Results: Among 84 arterial segments, 16 were invisible at both CE-MR angiography and DSA, while 39 were demonstrated by both modalities. Twenty-six segments were visible only at CE-MR angiography and three only at DSA. CE-MR angiography displayed a higher number of arterial segments than DSA (mean, 5.42 vs. mean 3.50, respectively), a difference which was statistically significant ($p<0.000$). The difference between each arterial segment was not statistically significant, except for the dorsalis pedis artery (t test, $p<0.000$).

Conclusion: In that it provides additional information for the planning of treatment of lower-extremity arterial disease, three-dimensional CE-MR angiography is superior to DSA for evaluation of the pedal artery.

Index words : Magnetic resonance (MR), vascular studies
Magnetic resonance (MR), contrast enhancement
Extremities, MR
Angiography

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