Comparison of 3D-TRICKS and 3D Bolus Chase MR Angiography for evaluation of infra-popliteal arteries

X. Zhang[1], H. Zhang[2], H. Wang[3], Y. Wang[2], and M. R. Prince[2]

[1]Radiology, Shandong University Qilu Hospital, Jinan, Shandong, China, People's Republic of, [2]Radiology, Weill Medical College of Cornell University, New York, NY, United States, [3]Radiology, Columbia College, New York, NY, United States

Purpose: To compare the utility of 3D time resolved MRA and 3D bolus chase MRA for evaluating infra-popliteal arteries and to determine in which patients 3D time resolved imaging of contrast kinetics (TRICK) adds additional information to the 3D bolus chase MRA and in which patients it is unnecessary.

Materials and Methods: Data from 113 patients (63 males, 50 females, mean age 71) undergoing peripheral MR angiographic examinations were reviewed retrospectively. All examinations were performed with a 1.5-T MR scanner (SIGNA EXCITE; GE Medical Systems) for 3D time resolved MRA(3D TRICKS , TR/TE/flip angle = 4.2-4.6/1.0-1.1/25° -35°, field of view = 44 x 44 cm, matrix = 512 x 224, slice thickness = 3.0-4.0 mm, overlap = 1.5-2.0 mm, 56-72 slices, acquisition time = 7-10 seconds/phase for 12-17 phases) and the 3rd station of the bolus chase MRA examination (coronal 3D FSPGR , TR/TE/flip angle = 8.8/3.3/30°, FOV = 46 x 32 cm, matrix = 512 x 384, slice thickness = 2.8-3.2 mm, overlap = 2.0-2.1 mm, 96-112 slices, acquisition time = 59 seconds). The image quality was determined as: 1) TRICKS is better than bolus chase MRA to show lesions and make diagnosis; 2) bolus chase MRA is better than TRICKS to show lesions and make diagnoses; 3) TRICKS and bolus chase MRA provide equivalent information; 4) these two techniques are complementary. The number of normal runoff arteries and branch order of the runoff arteries in the calf were counted. The duration of arterial phase of each calf was calculated. Stepwise Logistic regression applied to clinical features of the patients was used to predict the possible effect on choosing MRA methods.

Results: A total of 189 calves were analyzed. In 74 calves, TRICKS provided additional information, while in 115 calves the TRICKS were unnecessary and could have been skipped if that could have been predicted in advance. The contrast agent arrived earlier at the calf veins (59 ± 30 sec vs. 72 ± 28 sec, p = 0.003) and the arterial phase duration was shorter (35 ± 25 sec vs. 46 ± 28 sec, p = 0.004) for those 74 patients in whom TRICKS provided additional information (Table 1). Among all of the factors (age, gender, weight, ulcer/gangrene/cellulitis, diabetes, hypertension, CHF and arterial phase duration), only UGC and arterial phase duration had statistically significant partial effects. On bolus chase MRA, 73 (39%) calves had venous contamination, while only 5 (3%) calves had venous contamination on all arterial phase of TRICKS MRA. Visualized calf artery branch order was less on TRICKS than on bolus chase MRA (2.6 ± 0.7 vs. 2.8 ± 0.6, p = 0.003). In 15 calves, there was serious motion on 3D bolus chase MRA but not on 3D TRICKS. On the contrary, in only 2 calves, serious motion was found only on 3D TRICKS but not on the calf segment of 3D bolus chase MRA.

Discussion and Conclusions: TRICKS provides more information than bolus chase MRA in calves with fast flow due to ulceration, gangrene or cellulitis. In patients with slower flow and longer arterial phase with late venous enhancement, TRICKS is unnecessary and may be eliminated to reduce the total Gd dose.

Table 1. Effect of bolus timing on relative utility of 3D TRICKS vs 3D bolus chase.

	TRICKS is better	Bolus chase is better	Same	complementary	F	*P*
Number	58	75	40	16		
time to artery	25±12	27±15	24±9	23±8	0.926	0.429
time to vein	59±31	72±29	73±27	60±23	3.081	0.029
Arterial phase duration	34±25	44±28	49±27	37±22	3.139	0.027

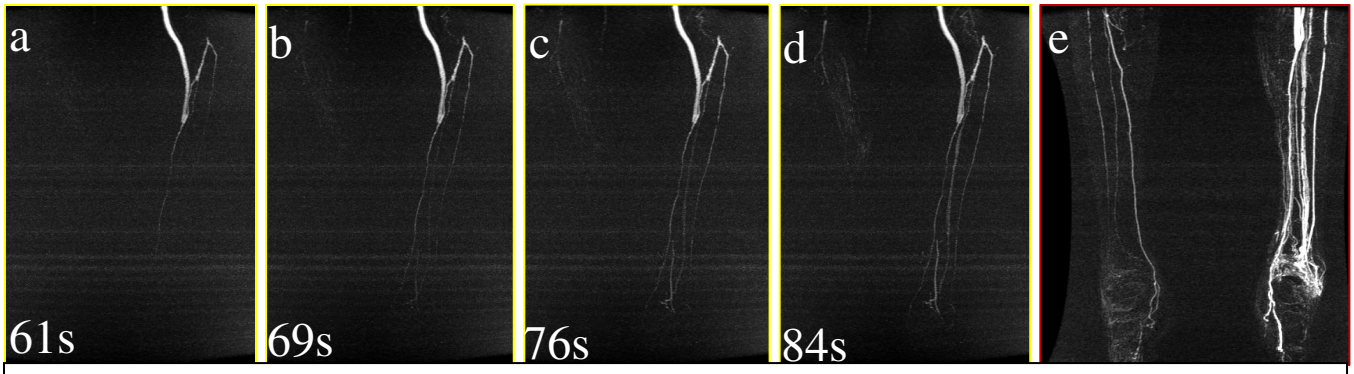

Figure 1. An example where 3D-TRICKS (a-d) is superior for the left calf arteries where there is a bypass graft and ankle inflammation but the 3rd station of the bolus chase exam (e) is superior for the right calf because of the slow flow.

References 1.Yi Wang, Invest Radiol. 2002,37:458-463. 2. J. C. STEFFENS, Acta Radiologica.2003,44:185-192. 3. HL Zhang, AJR. 2004,183:1041-1047. 4. Ranista Tongdee, AJR. 2006,186:1746-1753. 5. Christoph A. Binkert, Radiology. 2004,232:860-866. 6. Neil M. Khilnani, Radiology. 2002,224:63-74. 7. Gustav Andreisek, Radiology. 2007,242:610-620. 8. Dipan J. Shah, Cardiol Clin. 2007,25:185-212. 9. Hale Ersoy, Journal of Cardiovascular Magnetic Resonance. 2006,8:1-12. 10. MR. Prince, Radiology. 2002,224:55-61.