



The diagnostic value of time-resolved MR angiography with Gadobutrol at 3 T for preoperative evaluation of lower extremity tumors: Comparison with computed tomography angiography

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ABSTRACT

Purpose: To evaluate the diagnostic value of time resolved magnetic resonance angiography with interleaved stochastic trajectory (TWIST) using Gadobutrol for preoperative evaluation of lower extremity tumors.

Materials and methods: This prospective study was approved by the local Institutional Review Board. 50 consecutive patients (31 men, 19 women, age range 18–80 years, average age 42.7 years) with lower extremity tumors underwent TWIST and computed tomography angiography (CTA). Image quality of TWIST and CTA were evaluated by two radiologists according to a 4-point scale. The degree of arterial stenosis caused by tumor was assessed using TWIST and CTA separately, and the intra-modality agreement was determined using a kappa test. The number of feeding arteries identified by TWIST was compared with that by CTA using Wilcoxon signed rank test. The ability to identify arterio-venous fistulae (AVF) were compared using a chi-square test.

Results: Image quality of TWIST and CTA were rated as 3.88 ± 0.37 and 3.97 ± 0.16 , without statistically significant difference ($P=0.135$). Intra-modality agreement was excellent for the assessment of arterial stenosis (kappa = 0.806 ± 0.073 for Reader 1, kappa = 0.805 ± 0.073 for Reader 2). Readers identified AVF with TWIST in 27 of 50 cases, and identified AVF with CTA in 14 of 50 ($P<0.001$). Mean feeding arteries identified with TWIST was significantly more than that with CTA (2.08 ± 1.72 vs 1.62 ± 1.52 , $P=0.02$).

Conclusion: TWIST is a reliable imaging modality for the assessment of lower extremity tumors. TWIST is comparable to CTA for the identification of AVF and feeding arteries.

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1. Introduction

Needle biopsy prior to surgical resection is widely accepted for assessment of lower extremity tumors [1]. However, preoperative imaging tests remain indispensable, because imaging assists to design surgical planning [2]. Preoperative vascular evaluation of tumors can even alter the operative approach [3]. The degree of arterial invasion is important in deciding whether tumor could be surgically resected [4].

Catheter digital subtraction angiography (DSA) is the diagnostic gold standard due to its high temporal and spatial resolution.

Abbreviations: TWIST, time resolved magnetic resonance angiography with interleaved stochastic trajectory; CTA, computed tomography angiography; AVF, arterio-venous fistulae.

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Preoperative embolization can be performed concurrently in some cases to prevent hemorrhage during the definitive surgery. However, the performance of DSA is limited in practice as it is an invasive and expensive test relying upon the use of ionizing radiation [5–7]. Computed tomography angiography (CTA) and magnetic resonance angiography (MRA) are non-invasive alternatives to DSA for the depiction of tumors [8–11]. With respect to MRA, time resolved MRA has been reported as superior to conventional contrast enhanced MRA in several respects: lower contrast agent dose, decreased venous contamination, and added dynamic information [12–15]. TWIST (Time-resolved angiography With Interleaved Stochastic Trajectories, TWIST) imaging divided k-space into two regions – one central region responsible for overall image contrast and a peripheral, outer region responsible for image detail [16]. To accomplish greater temporal resolution, the central regions are sampled more frequently than the peripheral regions based on a technique called view sharing. While TWIST has been reported to yield excellent image quality and to be accurate in the diagnosis of peripheral arterial stenosis [11], its value in the assessment of lower

extremity tumors has not been studied to the authors' knowledge. The aim of the current study is to compare TWIST with CTA for the preoperative vascular evaluation of lower extremity tumors.

2. Material and methods

2.1. Patients

This prospective study was institutional review board approved. Inclusion criteria were: (1) a patient with a lower extremity mass;

(2) tumor protocol MRI confirming presence of a mass; (3) a surgical plan for open biopsy or definitive surgery; (4) patient agreement to both CTA and TWIST. Exclusion criteria were: (1) patient GFR < 30 ml/m²/1.73 m²; (2) patient on dialysis; (3) pregnancy; (4) standard contraindications for MR or CT (i.e. pacemaker, paramagnetic foreign bodies, claustrophobia, etc.). From January 2013 to March 2015, 57 consecutive patients met the inclusion criteria and were enrolled in this trial. Informed consent was obtained from every patient. All 57 patients underwent TWIST. However, 2 patients with positive results of iodine allergy test did not undergo

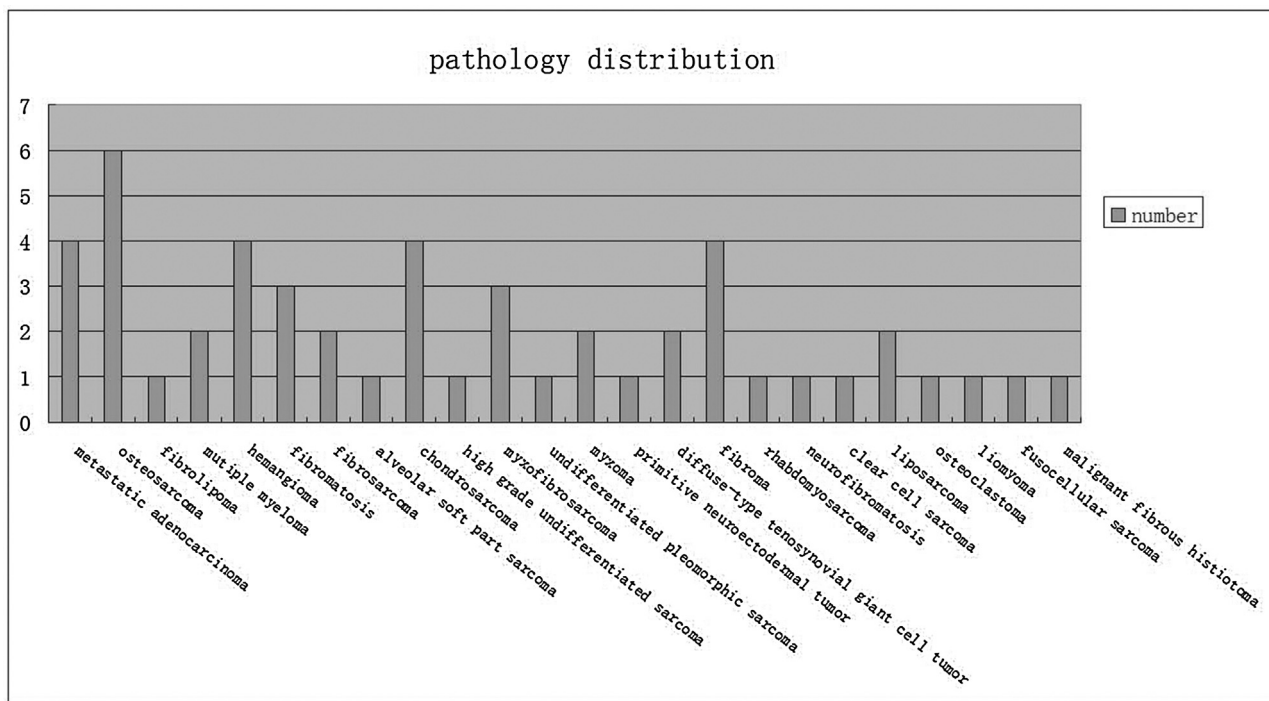


Fig. 1. Pathology results.

Distribution of histopathology for the lower extremity tumors of the 50 evaluated patients.

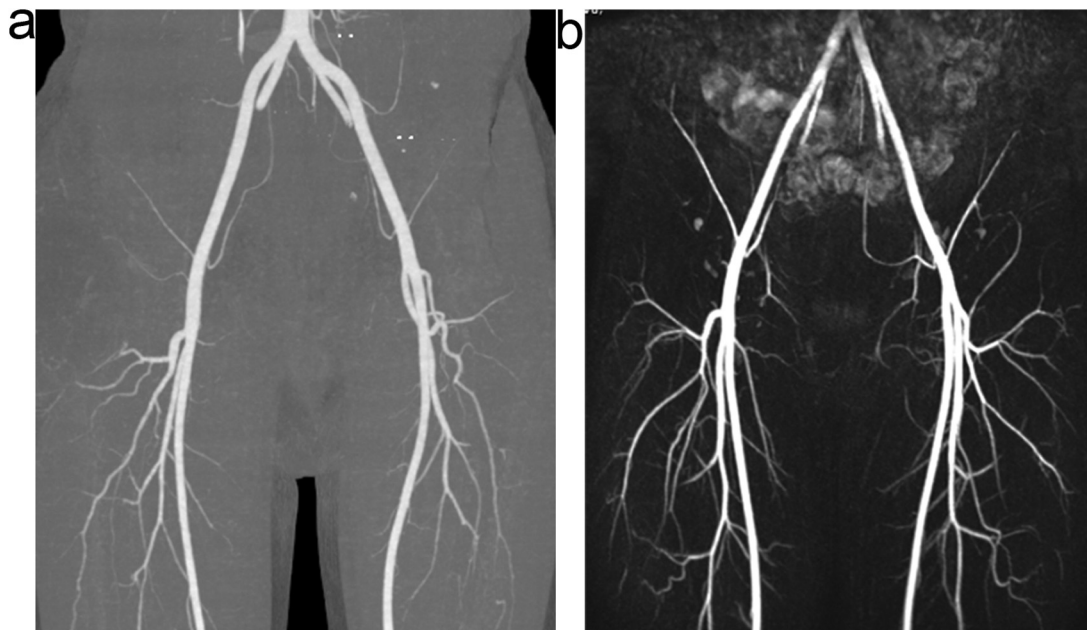


Fig. 2. Image quality of TWIST.

(a) CTA image rated as excellent image quality. b: arterial phase TWIST image rated as excellent image quality. The arterial SNR is high with small branches clearly depicted.

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