Initial, multi-site clinical experience using an integrated interventional needle guidance workflow

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Purpose: Present first clinical results using an integrated and efficient interventional needle guidance workflow.

Methods and Materials: The workflow and system described in [1] was used for this study and consisted of optimized methods for pre-procedure planning of multiple trajectories, entry point localization and target visualization during intervention. Highlight features included rapid, double oblique trajectory planning; automatic calculation of table movement and lateral offset for entry point localization; and automatic slice alignment for continuous visualization of needle, target and surrounding structures. Clinical feasibility was evaluated at three sites for abdominal biopsies, sclerotherapies, spinal infiltrations, and RF applicator placement.

Results: Needle placement was successful in all 18 cases. Examples of procedures performed using the described interventional needle guidance workflow are shown in Figure 1 and procedure details are described in Table 1.
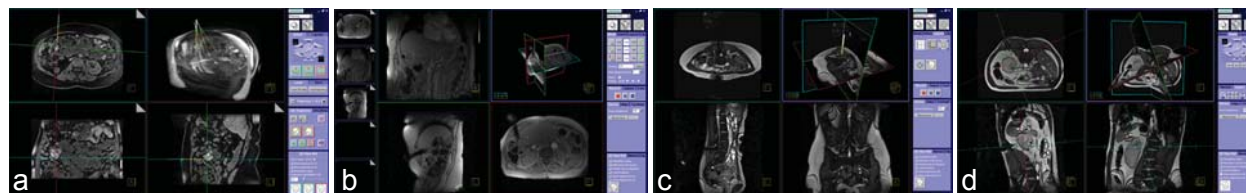

Figure 1. (a) Sclerotherapy to treat a large abdominal venous malformation. (b) Placement of multiple RF applicators to ablate a liver lesion. (c) Needle placement in the spine for pain treatment injection. (d) Biopsy of a kidney lesion.

Table 1. Overview of procedures performed. Targeting refers to the time needed for real-time MRI guided needle placement.

Procedure (# of patients)	# of needles	Average path length	Average time			Average procedure time
			targeting	MR imaging	non-imaging	
Ablation (1)	2	78 mm/ 85 mm	4.5 min	41 min	187 min	228 min
Abdominal biopsy (3)	3	76 mm (range,47-100)	6 min (range, 5 - 7)	12 min (range, 9 - 15)	44 min (range, 38 - 54)	56 min (range, 49 - 69)
Spinal infiltration (10)	10	61 mm (range, 45-98)	3 min (range, 1 - 6)	6 min (range, 2 - 12)	22 min (range, 12 - 34)	28 min (range,16 - 44)
Sclerotherapy (4)	13	95 mm (range, 38-122)	3 min (range, 0.5 - 10)	34 min (range, 20-60)	107 min (range, 74 -146)	141 min (range, 100-177)

Conclusions: Our initial experience at multiple clinical sites suggests that the proposed methods simplify MR-guided percutaneous interventions and have the potential to increase adoption of MRI for image-guided minimally-invasive procedures.

[1] Rothgang et al. ISMRM 2012, 1561.