Introduction: Though primarily recognized by disorder, atrial fibrillation (AF) clinically displays varying levels of organization by surface electrocardiography and intracardiac electrograms. Organization has previously been defined globally by regularity indices or spectral analysis but has not yet been described in terms of the atrial mass that is organized or disorganized. We hypothesized that AF comprises patches of organized activity separated by disorganization, and that when patches exceed a critical size their elimination will terminate persistent AF.

Methods: In a multicenter registry of persistent AF patients, we included patients who did (n=20) and did not (n=20) experience acute AF termination with ablation. Unipolar AF electrograms were recorded globally from each atrium via a 64-pole basket catheter prior to ablation. AF organized areas were analyzed using a novel propagation vector approach (wavefront field mapping) developed in our laboratory.

Result: Patients (61.1±13.2Y, 100% persistent, LA 47.1±6.9 mm) exhibited fluctuating organized patches by wavefront field mapping (Figure). Panel A shows AF termination in a 79 Y man, at a site (Panel B) from which vectors emanate focally (centrifugally) to cover 40% of mapped atrium. Panel C shows cardioversion in a 59 Y man in whom ablation did not terminate AF, and (panel D) ablation site surrounded by small organized patch (<10% of atrium). Overall, organized areas were larger surrounding sites of AF termination than non-termination (44.1±11.1% vs 15.2±5.6%, p<0.01), and more temporally stable (p<0.0001). In panel E, ablation of sites controlling >30% of mapped atrial area terminated all cases of AF.

Conclusion: Global mapping of propagation vectors in AF shows organized patches interspersed with disorder. Ablation within patches controlling critical atrial areas terminated persistent AF. Studies should quantify organized areas controlled by various ablation targets in varying locations, and whether ablation of targets controlling larger atrial areas may improve success.