Limitations
The high-density epicardial mapping plaque used in this study provides coverage of ~10% of the atria and hence has a narrow field of view relative to the global bi-atrial surface area. Thus from a segment of atria mapped, we could only determine whether a rotational circuits or a focal source is present and not whether it was critical in driving wavefronts elsewhere in the atria. It is possible that more rotational circuits could have been present if we had been able to map more widely. In addition, we cannot exclude the possibility that rotational circuits were quiescent during the recording period. It is possible that drivers would be more frequently observed in patients with PerAF of <1 year in duration. There was heterogeneity in the types of structural heart disease present in the study population. As such we were unable to determine the relative impact of structural remodelling and differences in atrial fibrosis patterns on the types of wavefront propagation patterns observed in this study.

The clustered samples used in this study are not as statistically efficient as simple random samples and similarities among subject clusters may reduce the variability of responses from a cluster compared with those expected from a simple random sample. As a result, multiple measurements from the same patients tend to be positively correlated and hence are more alike than observations between individuals.

Conclusion
Human long-lasting PerAF is characterized by heterogeneous and unstable patterns of activation including wavefronts, transient rotational circuits, and disorganized activity.

Supplementary material
Supplementary material is available at European Heart Journal online.

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References
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CARDIOVASCULAR FLASHLIGHT

Belts, braces, and pacemaker erosion
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An 85-year-old man had a left-sided dual chamber pacemaker inserted for intermittent complete heart block 2 years previously. At a routine pacing clinic check, postero-lateral skin erosion was noted which appeared infected (Panels A and B), and the patient was scheduled for device extraction. As the patient re-dressed himself, it became apparent that the erosion was in close proximity to the patient’s braces (Panels C and D). Further questioning revealed that the patient was a life-long brace wearer. The pacemaker and leads were explanted and a right-sided system placed subsequently without further complications. He was advised to use belts instead of braces.

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