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# Does metal matter?

What does it mean for esophageal temperature probes?

Is the RF Antennae effect real?

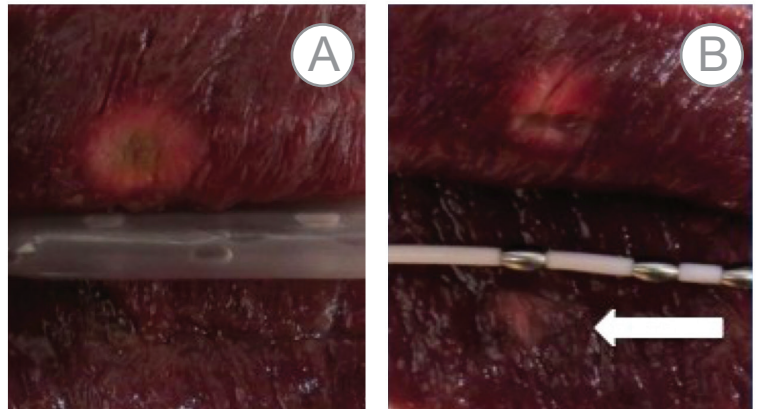
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To explore these questions, let's turn to the literature. Three key papers explore different aspects of these questions:

## RF Antennae Effect<sup>1</sup>

Work by Dr. William Sauer's group at the University of Colorado confirmed that the antennae effect is real. They discovered two conditions must be present for it to occur: The probe/catheter must have bare metal and the metal must be within 5mm of the RF Ablation catheter.

The paper summarized bench top studies done with fresh bovine tissue in which temperature probes were placed between two separate layers of tissue. After RF energy was applied to the top layer, the two layers were inspected for evidence of damage. In the "A" image, there was no evidence of heating of the tissue under an insulated temperature probe. Yet in the "B" image, you can clearly see evidence of tissue heating when a bare metal probe was used, highlighted by the white arrow. This tissue damage is directly under the non-insulated metal in the temperature probe.



**A:** Ablation of bovine tissue above an insulated esophageal probe did not lead to any injury to the bottom layer of tissue.

**B:** Ablation of bovine tissue above a non-insulated esophageal probe led to significant injury (white arrow) to the bottom layer of tissue.

## Insulated vs. Bare Thermocouples<sup>2</sup>

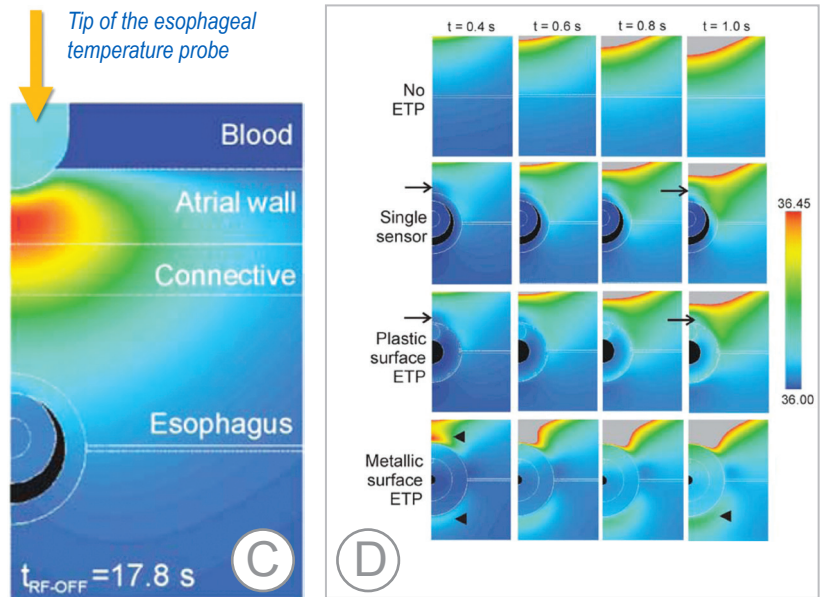
Is there an RF antennae effect with all temperature probes? The use of bare metal vs. insulated temperature probes was explored by Professor Enrique Berjano in Valencia, Spain. Professor Berjano, a recognized expert on theoretical modeling of RF energy in vivo, and his team, conducted independent research on several commercially available temperature probes.

They showed that it would be theoretically possible with commercially available probes to create an antennae effect. Once again, two conditions were required for it to occur: The probe had bare/exposed metal and needed to be in close proximity to the RF catheter.

The diagram “C” gives a perspective for the study results in image “D” that follows.

The image “D” shows the change in temperature within one second of RF power being initiated (right). The arrowheads on the Metallic Surface ETP\* indicate the location of hot points around the Esophageal Temperature Probe (ETP). The location of the two hot points is diametrically opposite, suggesting an alteration of the electric field provoked by the ETP itself.

Conversely, the so-called Plastic Surface ETP (CIRCA S-CATH™) shows no such hot point demonstrating the value of the CIRCA probe’s PEBAX® Coating in providing electrical isolation. In short, the research showed that there was no RF Antennae effect with the CIRCA S-CATH temperature probe.



## Endoscopically Detectable Esophageal Lesions (EDEL): Temperature probe type matters.<sup>3</sup>

Professor Thomas Deneke and a team of German researchers recently completed two studies in which the CIRCA S-CATH probe and a bare metal probe\* were evaluated under an identical protocol. Using a cutoff temperature of 39°C, the study showed a very low EDEL rate with the insulated metal CIRCA S-CATH, and a significantly higher rate of EDEL with the bare metal probe.

The authors:

“ In a recent study, it was hypothesized that ohmic heating of metallic objects in proximity to an RF ablation catheter might be responsible for an excess increase of EDEL if temperature probes were used. This would explain the finding of a significantly higher incidence of EDEL when using a temperature probe with non-insulated metallic thermocouples ... ”

The authors continued that the data suggest that

“ . . . probe used in previous studies is related to a higher incidence of EDEL during RF AF ablation procedures. In the present study using a luminal oesophageal temperature monitoring probe with small, insulated thermistors (CIRCA S-CATH), the incidence of EDEL was significantly lower (7.5%) when using the same ablation protocol as in previous studies. ”

This data, coupled with the research presented above, is further evidence that there is no RF antennae effect with the CIRCA S-CATH probe, and suggests that use of the CIRCA S-CATH probe to monitor temperature may lead to a lower incidence of esophageal injury.

### Sections summarized from the following papers:

<sup>1</sup> Duy T. Nguyen, MD, FHRS, Waseem Barham, MD, Lijun Zheng, MS, Sarah Dinegar, Wendy S. Tzou, MD, FHRS, William H. Sauer, MD, FHRS, Effect of radiofrequency energy delivery in proximity to metallic medical device components, Heart Rhythm Society, 2015.

<sup>2</sup> Juan J. Perez, MS, PhD, Andre D'Avila, MD, PhD, Arash Aryana, MS, MD, and Enrique Berjano, PhD, Electrical and thermal effects of esophageal temperature probes on radiofrequency catheter ablation of atrial fibrillation: Results from a computational modeling study, Journal of Cardiovascular Electrophysiology, April 2015.

<sup>3</sup> Philipp Halbfass, Patrick Muller, Karin Nentwich, Joachim Krug, Markus Roos, Karsten Hamm, Sebastian Barth, Attila Szollosi, Andreas Mugge, Bernhard Schieffer, and Thomas Deneke, Incidence of asymptomatic oesophageal lesions after atrial fibrillation ablation using an oesophageal temperature probe with insulated thermocouples: a comparative controlled study, Europace (2017) 19, 385–391.

\*FIAB/St. Jude

