

## Correlation of Real-Time Measurement of Ablation Catheter Tip Force with Subjective Tissue Contact Assessment in the Beating Heart

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**Introduction:** Objective quantification of tissue contact may allow precise control of radiofrequency lesion size and improve safety of catheter manipulation and ablation.

**Methods:** An open tip irrigated steerable ablation catheter with an optical fiber sensor allowing tip force measurement (sensitivity < 1 g) at 100ms intervals (TactiCath™, Endosense SA, Switzerland) was introduced via femoral venous access into the heart of anaesthetized and ventilated 50-60 kg pigs. An experienced operator blinded to force readings positioned the catheter at the lateral right atrial (RA) wall, the high RA and against the interatrial septum with poor (PC), good (GC) and excessive (EC) contact based on subjective contact assessment using fluoroscopy, electrograms and tactile feedback. The protocol was repeated with the catheter introduced through a long sheath.

**Results:** A total of 165 catheter placements were evaluated. Mean tip force was significantly greater for poor vs. excessive ( $7.3 \pm 3.6g$  vs  $44.8 \pm 24.4g$ ,  $p < 0.05$ ) and good vs. excessive contact ( $22.7 \pm 12.5g$  vs  $44.8 \pm 24.4g$ ,  $p < 0.05$ ) at all three RA sites. For the same subjective contact, the actual force applied varied, being significantly higher against the interatrial septum ( $p < 0.05$ ). Positioning through a long sheath resulted in increased delivered tip force despite similar subjective contact ( $p < 0.0004$  for all contact levels). The contractile dynamic response (CDR: systolic - diastolic force) correlated with mean force and with different levels of contact ( $p < 0.05$ ) while showing a lower variability at all contact levels ( $p < 0.05$ ) compared to mean force.

**Conclusions:** Real-time catheter tip electrode-tissue contact force measurement in the beating animal heart allows objective distinction of subjectively assessed poor, good and excessive wall contact. In order to achieve similar subjective contact, different tip forces will be delivered at different sites in the RA. Moreover higher forces are delivered with a long sheath. The contractile dynamic response may be a more robust parameter of tissue contact than peak/mean force.