Impact Of Blade Orientation And Cautery Mode When Delivering Electrocautery To Transvenous Leads Using An Insulated Blade Jeremiah Wasserlauf¹, MD, MS, Taiki Esheim², MBA, Natasha M. Jarett², BS, Eric K.Y. Chan², PhD, FHRS and Bradley P. Knight¹, MD, FHRS

Background

- Electrocautery can cause thermal injury to insulated transvenous cardiac device leads.
- > Newer cautery blades have been developed to minimize collateral thermal damage by using an insulated coating that surrounds the blades except for an exposed edge.
- > The optimal blade orientation and generator settings to minimize lead damage using insulated blades are not well established.

Research Objectives

> To determine whether coagulation (COAG) or cutting (CUT) mode, and active-edge (active) versus flat blade (flat) orientation result in less thermal damage when using an insulated cautery blade on transvenous leads.

Methods

- > 3 transvenous leads with silicone, polyurethane, and copolymer insulation types were placed in grooves prepared in chicken breast tissue.
- Energy was delivered using the PhotonBlade insulated electrocautery blade (Invuity, San Francisco, CA) and a ValleyLab Force FX-C electrosurgical generator (Covidien/Medtronic, Minneapolis, MN) using all combinations of:
 - 1. Output modes: COAG at 20 W Pure and CUT at 20 W Fulgurate
 - 2. Blade orientations: active and flat
 - 3. Lead insulation materials: polyurethane, silicone, and copolymer
- Each combination was replicated with 3 separate blades, 3 times each, for a total of 108 lesions. Applied force was monitored for treatment consistency.
- > Damage was assessed by an independent microscopist who was blinded to treatment variables.
- > Damage to each lead was classified after visual and microscopic analysis on a scale from 0 to 4: 0 = no visual damage, 1 = minimal damage, 2 = significant damage, 3 = minor insulation breach, and 4 = major insulation breach.
- Cochran-Mantel-Haenszel statistics were used to test hypotheses of no partial association.

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Table 1: Distribution of Damage by Cautery Mode

Result

	Damage Rating; n (%)			
Output	No Damage 0	Minimal Damage 1	Significant Damage 2	Total
CUT 20W Pure	53 (98.1%)	1 (1.9%)	0 (0.0%)	54
COAG 20W Fulgurate	28 (51.9%)	16 (29.6%)	10 (18.5%)	54

Figure 1: Mean Damage Ratings





- More lead samples were damaged using COAG vs. CUT (48% vs 2%, p<0.0001). The mean damage rating was 0.67 for COAG and 0.02 for the CUT setting.
- > When stratified by orientation, 74% of lesions using COAG and active orientation had damage, compared with 22% of lesions with COAG and flat orientation (p=0.0002).
- > When COAG lesions were stratified by lead insulation material, both the copolymer (61%) and polyurethane (68%) lead insulations had significantly greater damage than the silicone (17%) lead insulation (p=0.006 and p=0.003, respectively).
- > Using CUT, no significant difference was seen by insulation type or orientation since only a single CUT lesion was associated with
- damage.
- \blacktriangleright Mean applied force was 0.14 ± 0.11 N.

Limitations

- Electrical conductor integrity of leads was not assessed.
- Some leads were surrounded by more than 1 layer of insulation which may have reduced the appearance of damage.
- > Lesions were delivered to sequential segments along each lead body to reduce the total number of leads required – resulting in arcing in some cases.

Conclusions

- tissue surrounding transvenous leads.

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- > In this study using an insulated cautery blade, greater damage occurred to transvenous leads when:
 - > Polyurethane or copolymer insulations were tested
 - Using the COAG output mode
 - Using an active-edge orientation
- > These techniques should be considered when applying electrocautery to scar