Damage To Transvenous Leads During Electrocautery - A Comparison Of Two Insulated Electrocautery Blades

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Background

- Electrocautery can cause thermal injury to the insulation of transvenous cardiac device leads.
- Newer electrocautery blades have been developed to minimize collateral damage by using an insulated coating that surrounds the blades except for an exposed edge.
- PhotonBlade (Invuity, San Francisco, CA) has emerged as an alternative insulated blade to Plasmablade (Medtronic, Minneapolis, MN). There are no studies to date comparing these two systems.

Research Objectives

- To compare thermal damage occurring due to electrocautery using PhotonBlade and PlasmaBlade on transvenous cardiac device leads.

Methods

- 8 transvenous leads with silicone, polyurethane, and copolymer insulation types were placed in grooves prepared in chicken breast tissue.
- Leads were chosen from all three major US manufacturers (Table 1).
- Energy was delivered using PhotonBlade with a ValleyLab Force FX-C electrosurgical generator (Covidien/Medtronic, Minneapolis, MN) and PlasmaBlade with a PULSAR II electrosurgical generator (Medtronic).
- For each electrocautery blade system, lesions were created using all combinations of:
  - 8 lead models
  - 4 power levels (Table 2)
  - 3 separate electrocautery blades from each model, repeated 3 times each
- 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.

Table 1. Lead Descriptions

Manufacturer	Model Number	Insulation Material
Medtronic	6947 DF4 / DF1	Silicone
Medtronic	5086	Silicone
Boston Scientific	4593	Polyurethane
Medtronic	4196	Polyurethane
Medtronic	3830	Polyurethane
St. Jude Medical	1056K	Polyurethane
St. Jude Medical	1258T	Copolymer
St. Jude Medical	2088TC	Copolymer

Table 2. Incidence of Damage by Device

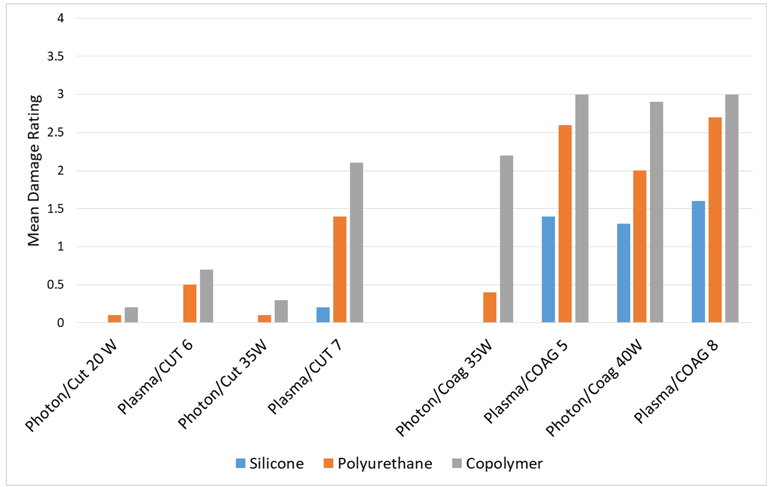
PhotonBlade	PlasmaBlade	Treatments Resulting in Damage; n (%)		Risk Ratio	p-value
		PhotonBlade	PlasmaBlade		
CUT 20W	CUT 6	8 (12.7%)*	28 (38.9%)	3.1	0.0006
CUT 35W	CUT 7	7 (9.7%)	50 (69.4%)	7.1	<.0001
COAG 35W	COAG 5	33 (45.8%)	68 (94.4%)	2.1	<.0001
COAG 40W	COAG 8	64 (88.8%)	71 (98.6%)	1.1	0.016

* There were 63 observations for this treatment condition. All others had 72 observations.

Results

- 567 treatments were delivered.
- 40% of treatments using PhotonBlade and 75% of treatments using PlasmaBlade resulted in lead damage ($p<0.0001$).
- The mean damage score was 0.78 for PhotonBlade and 1.64 for PlasmaBlade.
- Regardless of device, 74% of treatments to copolymer leads resulted in damage vs. 61% for polyurethane and 35% for silicone ($p<0.0001$).
- Higher power resulted in more damage (Figure 1).
- At the commonly used setting of CUT 20W, damage occurred with 12.7% of treatments using PhotonBlade vs. 38.9% with PlasmaBlade ($p=0.0006$).
- Mean applied force was 0.32 N ± 0.17 N.

Figure 1. Mean Visual Damage Ratings



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 – in some cases resulting in electrical arcing.

Conclusions

- The use of PhotonBlade was associated with less damage to transvenous leads than PlasmaBlade.
- Aggressive electrocautery with output up to 40W using both insulated cautery blades resulted in a high rate of damage to transvenous leads.
- At the commonly used setting of CUT 20W, damage occurred with 12.7% of treatments using PhotonBlade versus 38.9% with PlasmaBlade.
- The CUT function of both devices resulted in less lead damage than COAG.
- Greater damage compared to prior research may reflect higher power output used in this study to simulate "real-world" applications.
- PhotonBlade should be considered when using electrocautery on chronically implanted transvenous leads.

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Disclosures: ***J. Wasserlauf***: *Invuity Inc.*, ***T. Esheim***: *Invuity Inc.*, ***N.M. Jarett***: *Invuity Inc.*, ***E.K.Y. Chan***: *Invuity Inc.*, ***R.D. Schaller***: *Invuity Inc.*, ***F.C. Garcia***: *Invuity Inc.* ***B.P. Knight***: *Medtronic, Inc.*