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 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.

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 PlasmaBlade vs. 38.9% with PlasmaBlade.

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.