Breaking the Circuit: Active Electrode Monitoring as a Shield Against Stray Energy Transfer

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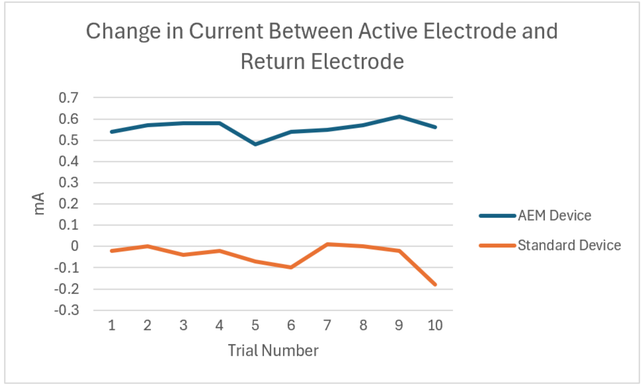
Background

- Laparoscopic surgery requires frequent radiofrequency energy. This energy can transfer to nearby instruments resulting in patient burns via capacitive coupling
- Nearly one-third of all laparoscopic instruments have a defect along the shaft, at the tip, or in the connection cabling which can lead to stray energy being delivered to patients during surgery
- Active electrode monitoring (AEM) is an emerging technology designed to reduce the risk of stray energy burns from laparoscopic devices

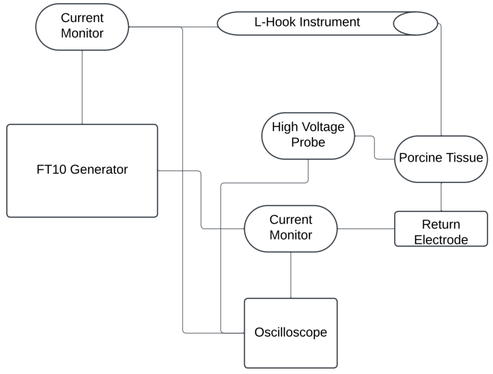
Methods

- A benchtop model was constructed utilizing porcine intestine, Maryland Grasper, and a standard laparoscopic L-hook vs. an AEM L-hook
- All energy devices were connected to an FT-10 Covidien generator at 30W coagulation mode
- Each L hook was held by a single operator approximately 4 cm apart from the Maryland Grasper to allow for capacitive coupling
- Current delivered and returned were measured with an oscilloscope with monitors placed on the active cable between the generator and the L-hook and the return cable between the generator and the return pad

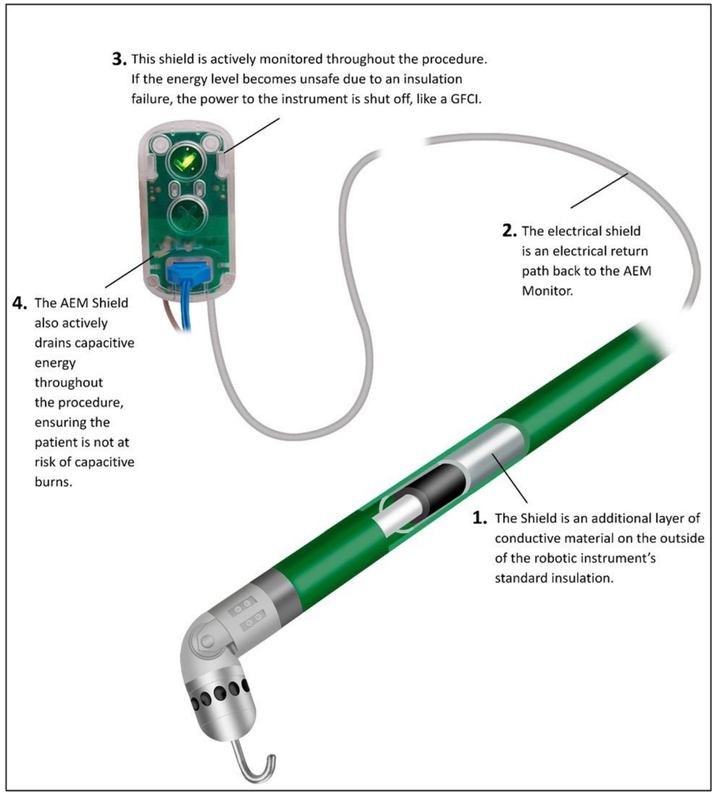
Results



A figure depicting the change in current between the active electrode and the return electrode for an AEM device compared to a standard laparoscopic device. There is significantly less current drop with the standard device.



The circuit diagram depicting the AEM L-hook instrument setup with current monitors.



This graphic illustrates the core components of an AEM device to provide an additional layer of safety to surgical instruments, leading to less tissue injury.

Conclusions

- This benchtop study revealed that the shielded AEM L-hook significantly reduced stray energy transfer by capacitive and antenna coupling
- Current drop-off was significantly greater in the AEM L-hook (0.56mA) vs. the standard device (-0.044) ($p < 0.001$)
- An average of 76% current drop-off was achieved with AEM technology while a standard laparoscopic instrument demonstrated a slight increase in current to the return electrode on average (18%)
- These findings suggest that incorporating shielded instruments such as AEM mitigates the risk of stray energy injuries and enhances patient safety

Implications

- Can reduce thermal spread and energy from laparoscopic devices, therefore, potentially limiting patient burns and complications
- Can limit the amount of capacitive coupling from one laparoscopic device to another, limiting patient injury

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