

Temperature safety profile of laparoscopic devices: Harmonic ACE (ACE), Ligasure V (LV), and plasma trisector (PT)

Kim FJ, Chammas MF Jr, Gewehr E, Morihisa M, Caldas F, Hayacibara E, Baptistussi M, Meyer F, Martins AC

Department of Surgery, Division of Urology, University of Colorado Health Sciences Center, Denver, Colorado, USA

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Background: Reports of iatrogenic thermal injuries during laparoscopic surgery using new generation vessel-sealing devices, as well as anecdotal reports of hand burn injuries during hand-assisted surgeries, have evoked questions about the temperature safety profile and the cooling properties of these instruments.

Methods: This study involved video recording of temperatures generated by different instruments (Harmonic ACE [ACE], Ligasure V [LV], and plasma trisector [PT]) applied according the manufacturers' pre-set settings (ACE setting 3; LV 3 bars, and the PT TR2 50W). The video camera used was the infrared Flex Cam Pro directed to three different types of swine tissue: (1) peritoneum (P), (2) mesenteric vessels (MV), and (3) liver (L). Activation and cooling temperature and time were measured for each instrument.

Results: The ACE device produced the highest temperatures (195.9 degrees +/- 14.5 degrees C) when applied against the peritoneum, and they were significantly higher than the other instruments (LV = 96.4 degrees +/- 4.1 degrees C, and PT = 87 degrees +/- 2.2 degrees C). The LV and PT consistently yielded temperatures that were < 100 degrees C independent of type of tissue or "on"/"off" mode. Conversely, the ACE reached temperatures higher than 200 degrees C, with a surprising surge after the instrument was deactivated. Moreover, temperatures were lower when the ACE was applied against thicker tissue (liver). The LV and PT cooling times were virtually equivalent, but the ACE required almost twice as long to cool.

Conclusions: The ACE increased the peak temperature after deactivation when applied against thick tissue (liver), and the other instruments inconsistently increased peak temperatures after they were turned off, requiring few seconds to cool down. Moreover, the ACE generated very high temperatures (234.5 degrees C) that could harm adjacent tissue or the surgeon's hand on contact immediately after deactivation. With judicious use, burn injury from these instruments can be prevented during laparoscopic procedures. Because of the high temperatures generated by the ACE device, particular care should be taken when it is used during laparoscopy.

Editorial Comment

The authors report the awareness of laparoscopic devices that although it may assist the surgeons the surgeon should be cognoscenti of the instruments that are in use during the surgery. The importance is to be familiar with the potential hazards and limitations that each laparoscopic instrument may cause during each surgical case.

Dr. Fernando J. Kim

Chief of Urology, Denver Health Med. Ctr.

Associate Professor, Univ. Colorado Health Sci. Ctr.

Denver, Colorado, USA

E-mail: fernando.kim@uchsc.edu