

# Unintended Damage From Powered Surgical Instruments

Michael R. Treat\* MD, Associate Professor of Clinical Surgery; Department of Surgery, Columbia University, New York, NY

## OBJECTIVE

When using a powered laparoscopic instrument, surgeons obviously understand that tissue in the jaws of the instrument will be affected by the energy. Surgeons also understand that there will be some collateral damage a certain distance beyond the tissue enclosed in the jaws. However, sometimes an instrument is capable of injuring tissue in ways which are not anticipated by the surgeon. We consider three such effects. The first effect is tissue injury from a part of the instrument that does not appear to be designed to treat the tissue. For example, the bottom surface of the jaws of an instrument may be capable of injuring tissue. The next effect is tissue injury which occurs after the instrument has been deactivated. The third is tissue injury at a site which is not in physical contact with any part of the instrument.

## METHODS

In a porcine model, we evaluated monopolar, ultrasonic and direct-thermal laparoscopic instruments.

**Test A:** Activate the instrument for ten seconds while bottom surface of instrument jaws is in contact with tissue.

**Test B:** Activate instrument for ten seconds, then turn it off and immediately touch test tissue with side of jaws.

**Test C:** Activate instrument for five seconds while 1 mm away from tissue.

## RESULTS

Using an injury severity score (least damage = 0, most damage =5), we observed the following results for Tests A,B, and C:

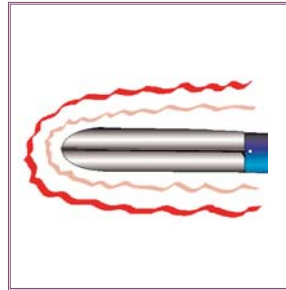
	Monopolar	Ultrasonic	Direct-Thermal
TEST A	5	4 - 5	1 - 2
TEST B	0 - 1	2 - 3	1
TEST C	3	0	0



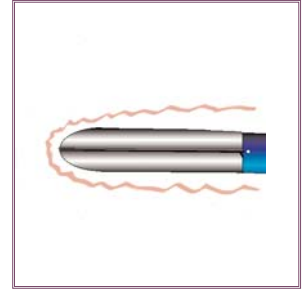
*Burn produced serosal surface of small intestine from side application of ultrasonic device.*

## CONCLUSIONS

All powered instruments have the capability to produce unanticipated damage to tissue. An awareness of these capabilities should be beneficial in avoiding complications.



*Example of an instrument with a large thermal damage profile.*



*Example of an instrument with a small thermal damage profile.*

## FURTHER DISCUSSION

Surgical instruments using various forms of energy to coagulate tissue can be characterized by how much collateral or extra tissue effect they produce in addition to the amount of tissue effect that is actually needed to obtain hemostasis or seal blood vessels. In fact, the minimum amount of tissue coagulation that is needed for hemostasis or sealing of blood vessels is not precisely known and but probably varies with the clinical situation. Another consideration is how much collateral tissue damage is clinically acceptable. Over the years, the amount of collateral tissue damage that is acceptable to surgeons has decreased, partly owing to the rise of laparoscopic surgery that has given surgeons a greatly magnified view of the tissues they are working on.

There has been a tendency over the past few years for laparoscopic surgeons to use energy sources that are alternatives to traditional monopolar electrosurgery. These alternative energy sources include bipolar, ultrasonic and direct thermal devices. All of these devices offer lesser degrees of collateral damage compared to monopolar devices. In certain clinical situations, the lesser degree of collateral damage makes a difference but in many others it does not. While the difference in collateral damage between these various energy sources has been well described, there is another way of characterizing these instruments that has not received so much attention in the literature. This way is to describe the ability of the instrument to enable the operator to produce unintended tissue damage. This point of view for considering the different instrument technologies may prove useful in further refining our surgical tools.

\* The views expressed in this paper are solely those of Michael R. Treat, MD and do not necessarily reflect those of Starion Instruments Corporation or Columbia University. Michael R. Treat and Columbia University have a financial interest in Starion Instruments Corporation.