

“Tissue Welding” by Ultrasound: Is Torsional Mode Superior to Longitudinal Mode for Sealing Blood Vessels?

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Background & Aims

Ultrasonic coagulating shears are popular alternatives to electro-surgical instruments during laparoscopic surgery.

One of the abilities of ultrasonic shears is “tissue welding”, a process of sealing blood vessels that involves the simultaneous application of energy to denature tissue proteins and pressure to facilitate bonding of these proteins.

Recently a torsional mode ultrasonic coagulating shears has been developed for endoscopic surgery.

This study compared the effectiveness of this torsional mode device with a longitudinal mode device for the haemostasis of medium- and large-sized arteries.

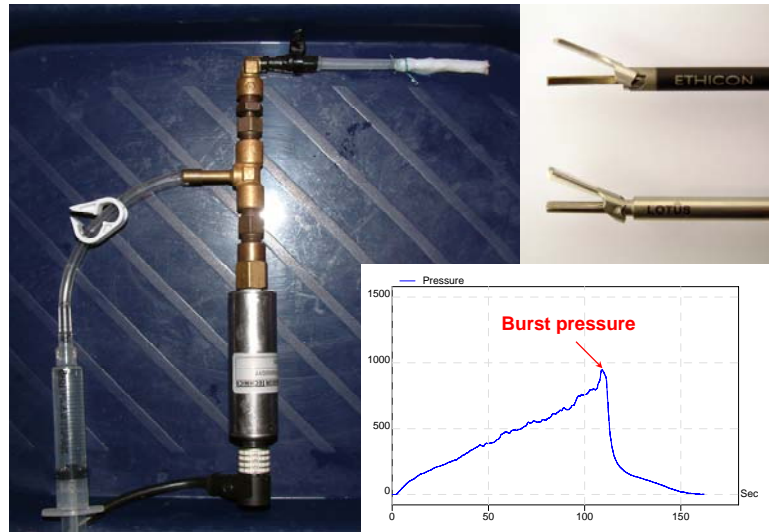


Methods

Porcine carotid arteries were prepared by removing the surrounding connective tissues in vitro. Each vessel was coagulated and cut at different sites by both longitudinal mode (Harmonic Scalpel®, Ethicon Endo-Surgery) and torsional mode (LOTUS™, SRA Developments Ltd.) devices using the lower power settings. Each seal was then tested for the acute burst pressure.

A catheter was placed into the open end of the vessel and secured with a ligature. The catheter was connected to a pressure monitor and saline was gradually infused to increase the artery's intraluminal pressure until there was leakage from the sealed end. The acute burst pressure was defined as the peak pressure recorded.

Statistical differences were evaluated by Mann-Whitney U Test and linear regression analysis.



Results

A total of 104 seals were made. There was no overall difference in acute burst pressures.

Torsional mode:

n=52, median 353, range 56-1247 mmHg.

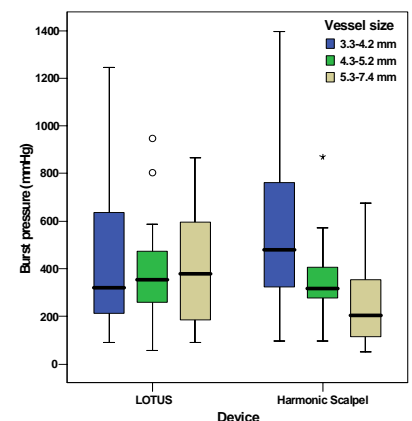
Longitudinal mode:

n=52, median 324, range 52-1395 mmHg.

Burst pressures in the 3.3-4.2 mm and 4.3-5.2 mm groups were not statistically different between the two devices ($p = 0.193$ and 0.579 respectively).

Burst pressure for torsional mode was significantly higher than longitudinal mode in the 5.3-7.4 mm group ($p = 0.027$).

There was a significant correlation between burst pressure and diameter of vessels for longitudinal mode device ($r = -0.552$, $p = 0.000$).



Conclusions

Both torsional and longitudinal mode ultrasonic coagulating shears can achieve secure haemostasis on vessels up to 5 mm in diameter.

The torsional mode device has the extended ability to coagulate larger-sized vessels up to 7 mm in diameter with the same degree of confidence.

Increasing vessel size is correlated with lower burst pressures for the longitudinal mode device.