Experimental Model to Assess the and Safety of Energy Sealing Devices in Saphenous Vein Graft in Bypass Surgery

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Objectives: Energy sealing devices achieve hemostasis of the blood vessels through sequential coagulation and transection. Although its use has been widely spread in multiple surgical fields, its safety for sealing collaterals of autologous grafts during bypass surgery is unknown. We compare the efficacy of the main sealing devices used (Electrothermal Bipolar Tissue Sealing System [EB] and harmonic scalpel [HS]) versus conventional vessel ligation of saphenous vein (SV) collaterals for revascularization surgery.

Methods: Experimental in vitro study of 25 fragments of SV extracted from cadaveric donor or from residual fragments obtained during amputation or lower limb revascularization procedures. Two venous collateral seals were made on each fragment, one by conventional ligation with 3/0 silk (control) and the other one by EB (N= 13) or HS (N= 12). Each venous fragment was then incorporated into a pulsatile flow circuit, and the pressure was progressively increased until 300 mmHg was reached (supraphysiological pressure), and until sealing breakage occurred (Fig). Collateral vein diameter, burst pressure, and leakage points were recorded. A histological study with hematoxylin-eosin and Masson's trichrome stain was also performed for each energy sealing device.

Results: The mean burst pressure was slightly higher for EB (788,9 ± 455 mmHg) than for HS (602,5 ± 363,1 mmHg), but without significant differences (p = 0,268). Only in one case (HS) the outbreak occurred in the sealing zone at pressures below 300 mmHg. The leakage point for HS occurred in the sealing zone in all cases (12/12). The leakage point for EB occurred in the sealing zone in 8 of 13 fragments and in the conventional ligation (control) in 5 fragments (p=0,039, Table). The histological study showed no differences.

Conclusions: Vessel sealing devices are as effective for the sealing of saphenous vein collaterals as conventional ligation. These devices may be useful due to their fast sealing time and easy handling during surgical venous graft preparation for lower limb revascularization. Although the EB showed greater strength, the outbreak occurred at supraphysiological pressure, so this fact may not have clinical relevance.

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**Fig.** Sealing of saphenous vein collaterals with energy haemostatic devices. A: Electrothermal Bipolar Tissue Sealing System (EB). B: Leakage point at EB sealing zone (black arrow) and conventional ligation (white arrow). C: Harmonic Scalpel (HS). D: Leakage point at HS sealing zone.

**Table. Comparison of energy sealing devices in saphenous vein collaterals**

<table>
<thead>
<tr>
<th></th>
<th>EB (n=13)</th>
<th>BA (n=12)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Collateral vein mean diameter (mm)</strong></td>
<td>2,4±0,7</td>
<td>2,4±0,6</td>
<td>0,852</td>
</tr>
<tr>
<td><strong>Mean burst pressure (mmHg)</strong></td>
<td>788,9±455</td>
<td>602,5±363,1</td>
<td>0,268</td>
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<tr>
<td><strong>Leakage point in the sealing zone</strong></td>
<td>8/13 (61,5%)</td>
<td>12/12 (100%)</td>
<td>0,039</td>
</tr>
</tbody>
</table>

EB: Electrothermal Bipolar Tissue Sealing System.  
HS: Harmonic Scalpel.

FALCÓN ESPÍNOLA M, REQUEJO GARCÍA L, PLANÀ ANDANI E, SÁNCHEZ NEVÁREZ MI, ROJAS FERRER N, MIRALLES HERNÁNDEZ M. Evaluación in vitro de los dispositivos de energía para el sellado de colaterales de vena safena en cirugía de revascularización. Angiología 2019;71(1): 2-10 DOI: 10.20960/angiologia.00016