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Mechanical Dilation with a Nylon Monofilament for 0.1-mm Anastomoses

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Background: Despite advances in supermicrosurgical techniques, the ability to anastomose vessels with a diameter <0.2 mm remains limited. One of the reasons for this limitation is that the dilation methods currently available, such as inserting the tip of a microforceps into the lumen or topical application of a vasodilator such as papaverine hydrochloride or xylocaine spray, are not effective in very small vessels. To overcome this problem, we have developed a method whereby nylon monofilaments are placed inside the vessel lumen to act as a dilator.

Methods: We investigated the value of this technique in a rat model of intraperitoneal lymphaticovenular anastomosis (LVA). LVAs were established in ten rats. Using this method, a smaller nylon monofilament is inserted into the vessel as a guide before inserting a larger nylon monofilament as a dilator. After the smaller guide monofilament has been inserted, it is then much easier to insert another monofilament for dilation, even if it is a larger one. At this point, it is much easier to insert the guide monofilament through a hole made by making an incision into the vessel measuring half the diameter of the vessel than inserting it through the free distal end. The anastomotic procedure becomes easier to perform when more than two nylon monofilaments larger than 6-0 are successfully inserted. The nylon dilator monofilament that is already in position in the first vessel is then inserted into the second vessel. The nylon dilator is then used as an intravascular stent in the anastomosis. These vessels were stained with hematoxylin and eosin and evaluated histologically to determine if there was any damage to the intimal layer.

Results: the minimum vessel diameter was <0.1 mm. In the group that underwent mechanical dilation using the nylon monofilament technique for vessel anastomosis, the vessels were well dilated and their diameter was increased to approximately larger than 0.2 mm using two 6-0 nylon monofilaments. All the anastomosis procedures were straightforward to perform. The immediate patency rate was 100%. One week later, the patency rate was 70%. We did not observe any amage to the intimal layer in vessels. Conclusion For now, we cannot anastomose 0.1-mm vessels without changing the vessel diameter. However, vessels are composed of elastic tissue, and can be mechanically dilated to a diameter of larger than 0.2-mm. Anastomosis of larger than 0.2-mm vessels using conventional supermicrosurgery techniques is straightforward and does not require special equipment.