

## Technical Editorial

### Hemostats, Adhesives, and Sealants in Endoscopic Surgery

**I**N THE LAST YEARS, the use of adhesives, hemostats, and sealants has become more popular in endoscopic surgery. Although these products have many features in common, they are intended for different indications:

1. Hemostats are used to halt bleeding. They can be applied directly to a bleeding site and work in the presence of actively flowing blood.
2. Glues/adhesives are used to attach organs, structures, or tissues. They can be applied to reduce or replace sutures.
3. Sealants are used to prevent the leakage of liquids, gases, or solids. They can be applied to dry or clamped tissue surfaces to create a barrier.

These products can be classified as fibrin-based, non-fibrin biologic, and synthetic products. The fibrin-based products are most commonly used. Most fibrin sealants contain fibrinogen, from human blood; bovine thrombin, obtained from commercially available products; and factor XIII, also obtained from pooled human blood. In the 1970s, fibrinogen products were found to transfer human hepatitis. Subsequently, the U.S. Food and Drug Administration canceled all licenses for human fibrinogen. In Europe, as in the rest of the world, manufacturers employed methods to reduce the risk for the transmission of hepatitis and other diseases. Since that time, manufacturers have been attempting to inactivate the virus while allowing the product to retain the fibrin in its original state. This is also the reason why attempts have been made to develop more sophisticated products in which an autologous fibrin sealant from the patient's own blood is used. Also used are nonfibrin products of biologic origin and synthetic products like the cyanoacrylate-based superglues.

The indications described in the literature are hemostasis in cases of parenchymal bleeding of liver, kidney, pancreas, and spleen,<sup>1–5</sup> intestinal anastomosis,<sup>6</sup> gastric and duodenal ulcers,<sup>7–11</sup> Nissen fundoplication,<sup>12</sup> and mesh fixation.<sup>13,14</sup>

Although only a few randomized studies of the laparoscopic indications for surgical glues have been performed,<sup>11</sup> a couple of experimental studies indicate that the use of these glues is safe and effective.<sup>15,16</sup> On the

other hand, the products have been extensively used in open surgery and are useful in the appropriate setting. The growing number of available products shows that, according to the medical devices industry, a huge market is available. The surgical community should carefully evaluate these products in endoscopic surgery before using them as a standard treatment.

### REFERENCES

1. Canby-Hagino ED, Morey AF, Jatoi I, Perahia B, Bishoff JT. Fibrin sealant treatment of splenic injury during open and laparoscopic left radical nephrectomy. *J Urol* 2000;164:2004–2005.
2. Chen RJ, Fang JF, Lin BC, et al. Selective application of laparoscopy and fibrin glue in the failure of nonoperative management of blunt hepatic trauma. *J Trauma* 1998;44:691–695.
3. Cuschieri SA, Jakimowicz JJ. Laparoscopic pancreatic resections. *Semin Laparosc Surg* 1998;5:168–179.
4. Kockerling F, Schneider C, Reymond MA, Hohenberger W. Controlling complications in laparoscopic cholecystectomy: Diffuse parenchyma hemorrhage in the liver parenchyma [in German]. *Zentralbl Chir* 1997;122:405–408.
5. Tricarico A, Tartaglia A, Taddeo F, Sessa R, Sessa E, Minelli S. Videolaparoscopic treatment of spleen injuries. Report of two cases. *Surg Endosc* 1994;8:910–912.
6. Faranda C, Barrat C, Catheline JM, Champault GG. Two-stage laparoscopic management of generalized peritonitis due to perforated sigmoid diverticula: Eighteen cases. *Surg Laparosc Endosc Percutan Tech* 2000;10:135–138; discussion 139–141.
7. Benoit J, Champault GG, Lebhar E, Sezeur A. Sutureless laparoscopic treatment of perforated duodenal ulcer. *Br J Surg* 1993;80:1212.
8. Khoursheed M, Fuad M, Safar H, Dashti H, Behbehani A. Laparoscopic closure of perforated duodenal ulcer. *Surg Endosc* 2000;14:56–58.
9. Lau WY, Leung KL, Zhu XL, Lam YH, Chung SC, Li AK. Laparoscopic repair of perforated peptic ulcer. *Br J Surg* 1995;82:814–816.
10. Lee FY, Leung KL, Lai BS, Ng SS, Dexter S, Lau WY. Predicting mortality and morbidity of patients operated on for perforated peptic ulcers. *Arch Surg* 2001;136:90–94.
11. Lee FY, Leung KL, Lai PB, Lau JW. Selection of patients

- for laparoscopic repair of perforated peptic ulcer. Br J Surg 2001;88:133–136.
12. Lima M, Domini M, Libri M, Garzi A. Laparoscopic Nissen fundoplication with fibrin glue: experimental study on pigs. Eur J Pediatr Surg 1997;7:4–7.
  13. Beattie GC, Kumar S, Nixon SJ. Laparoscopic total extraperitoneal hernia repair: Mesh fixation is unnecessary. J Laparoendosc Adv Surg Tech A 2000;10:71–73.
  14. Jourdan IC, Bailey ME. Initial experience with the use of *N*-butyl-2-cyanoacrylate glue for the fixation of polypropylene mesh in laparoscopic hernia repair. Surg Laparosc Endosc 1998;8:291–293.
  15. De Iaco P, Costa A, Mazzoleni G, Pasquinelli G, Bassein L, Marabini A. Fibrin sealant in laparoscopic adhesion prevention in the rabbit uterine horn model. Fertil Steril 1994;62:400–404.
  16. Salvino CK, Esposito TJ, Smith DK, et al. Laparoscopic injection of fibrin glue to arrest intraparenchymal abdominal hemorrhage: An experimental study. J Trauma 1993;35:762–766.

Address reprint requests to:

*Dirk W. Meijer, M.D., M.Sc., Ph.D.  
Editor, Technical Section  
Academic Medical Center  
Department of Experimental Surgery  
University of Amsterdam  
Amsterdam  
The Netherlands*

*E-mail:* d.meijer@factory-cro.com