Interventional Endosonography

Kenneth F. Binmoeller
Director, Interventional Endoscopy Services, California Pacific Medical Center, San Francisco, USA

EUS differs from all noninvasive imaging modalities in that it acquires images from within the intestinal tract. High frequency ultrasound transducers are used to render images of the target area with unsurpassed detail and resolution. Furthermore, EUS couples high-resolution imaging with real-time image-directed intervention using an FNA needle. This powerful combination has made EUS a pivotal imaging tool for gastrointestinal and bilio-pancreatic disease. EUS-guided fine needle injection (FNI) uses the same needle as FNA, but for injection rather than aspiration. Three targets for injection have been described in the literature: celiac plexus ganglia, tumors, and varices. Celiac plexus neurolysis (CPN) under EUS-guidance has gained widespread preference to external image-guided approaches. Three techniques of EUS-guided neurolysis have been described: 1. Single (central) injections; 2. Bilateral injection (L+R of Aorta); 3. Selective gangliolysis. A recent randomized trial comparing central and bilateral injection from LeBlanc et al (GIE 2011) showed no differences in onset or duration of pain relief, and no difference in safety or survival. A nonrandomized study by Ascunce et al (GIE 2011) showed visualization and injection of the ganglia to be the best predictor of response (>15 times more likely to respond (odds ratio 15.7; p<0.001). Tumors have been treated by various agents, including sclerosants (Ethanol), Chemotherapeutic agents (Paclitaxel), activated lymphocytes , and gene therapy. Vessels have been treated with sclerosants and cyanoacrylate glue. Advantages of EUS-guided hemostasis include the ability to image the bleeding vessel with Doppler, targeted intravessel injection, elimination of the need for endoscopic visualization of the bleeding site, and confirmation of vessel obliteration after treatment.

It is also possible to implant a device rather than inject a solution (the term 'FNI' still applies: the 'I' stands for 'implant'). Although not directly therapeutic, fiducials have been shown to be very useful for pre radiation therapy marking. Clinical studies have reported implant of radiation seeds for brachytherapy, and the use of radiofrequency ablation, PDT, and Nd: YAG laser have been reported in animal studies. Locally delivered immunotherapy and gene therapy have been used in clinical studies. A recent case report of Nd: YAG laser therapy for a caudate lobe hepatocellular carcinoma (DiMatteo, GIE 2010) illustrates the promise of these modalities.

For hemostasis, a device may be a coil. There have been several reports of coils have used for embolization for ectopic variceal bleeding (Levy et al, GIE 2008) and gastric varices (Romero-Castro et al, GIE 2010). The synthetic strands attached to the coil body may provide a scaffold to retain glue at site of intravariceal injection to prevent embolization. We recently reported on EUS-guided tranesophageal treatment of gastric fundal varices using coiling and cyanoacrylate glue injection in 30 patients (GIE 2011).

Another implant one can pass through the needle is a wire. The wire, in turn, can serve as a scaffold to deliver a catheter, stent, or other coaxial tool using the Seldinger technique. One application of the Seldinger technique that is now widely disseminated is EUS-guided pseudocyst drainage. The cyst is accessed with a 19 G needle, a wire is advanced into the cyst, the needle removed leaving the wire in place and a dilating tool (bougie or balloon) inserted to create a tract for stent placement. A further application is anterograde access to the bile and pancreatic ducts. Endoscopic ultrasonography (EUS) offers an alternative route of access to the bile and pancreatic ducts when ERCP fails or is not technically feasible (eg, due to prior surgery). The route of access is ‘anterograde’, in contrast to the ‘retrograde’ approach of ERCP. The literature has validated the feasibility of EACP, but complication rates have been high. The safety profile of EACP needs to be improve and this will require efforts in device development and training.

EUS-guided therapy makes it possible to extend endoscopic therapeutic procedures beyond the gastro-intestinal lumen. We can inject and implant different solutions and devices very accurately into organs and lesions. In the next era of development we will see the emergence of new tools and devices to make EUS-guided therapy more successful and safer.