

Endoscopic ultrasound-guided hepatic and perihepatic abscess drainage: an evolving technique

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Abstract

Interventional radiology-guided percutaneous drainage of liver abscesses with concomitant use of antibiotics has been the conventional approach for the treatment of liver abscesses. Hepatic abscesses refractory or not amenable to percutaneous drainage have been treated with surgical drainage, either via laparoscopic or open laparotomy techniques. The aim of this review was to evaluate the technical feasibility and efficacy of endoscopic ultrasound (EUS)-guided drainage of liver abscesses. A literature review was performed to identify the studies describing the technique. In this review article we have summarized case series or reports describing EUS-guided liver abscess drainage. The indications, techniques, endoprotheses, limitations and complications reported are discussed. A total of seven cases have been described so far in the literature which included patients with failed conventional treatment modalities. The EUS-guided drainage technique involves puncturing the abscess using endosonography to gain access, passing a guidewire followed by tract dilation and placement of an endoprosthesis for drainage. Studies have reported 100% technical and clinical success rates in selected cases. No complications were reported. EUS-guided drainage of liver abscesses can be a safe and effective alternative approach in the management of liver abscesses in selected patients.

Keywords: drainage, endoscopic ultrasound, liver abscess, management

Introduction

Liver abscesses are collections of infected or necrotic material in the liver parenchyma. The most common source of liver abscesses is ascending infection through the biliary tree and rarely extension of intra-abdominal processes and hematogenous spread during bacteremia. The etiology may be pyogenic, amebic, tubercular or rarely fungal [Bednarek *et al.* 2011; Slaughter, 2013]. Liver abscesses can be fatal if untreated. The traditional approach of management is antimicrobial therapy plus percutaneous or surgical drainage of abscesses. Surgical drainage is associated with a high mortality and morbidity rate of up to 25–30% [Zerem and Susic, 2012]. Surgery is usually indicated when there is evidence of multiple abscesses, failure of drainage by the percutaneous approach or perforated abscesses causing acute abdomen [Ferreira *et al.* 2011].

Currently, percutaneous drainage (PCD) is the first-line approach for the management of liver abscesses with success rates of 85–95% [Bertel *et al.* 1986; Gerzof *et al.* 1985; Onder *et al.* 2011; Rajak *et al.* 1998; Wuerz *et al.* 2012]. Advantages of this approach are minimal invasiveness, short hospital stays, low procedure-related morbidity and mortality, and low cost compared with surgery [Vogl and Estifan, 2001]. Limitations and complications include intraperitoneal bleeding, needle tract infection, hepatovenous fistula, sepsis, injury to surrounding vascular structures, and patient discomfort due to external drainage [Chung *et al.* 2003]. Dull and colleagues have reported endoscopic retrograde cholangiopancreatography-guided drainage of hepatic abscesses as an alternative [Dull *et al.* 2000]. The procedure is technically challenging and only suitable where there is a possibility of communication of the

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abscess with the biliary tree [Dull *et al.* 2000]. There is a need for alternative approaches of liver abscess drainage as all abscesses are not amenable to minimally invasive techniques, which lead to surgery in a significant proportion of patients. Ongoing advances in endoscopic ultrasound (EUS) techniques and accessories have led to the development of EUS-guided intraluminal drainage of collections at sites such as pancreas, gallbladder, and pelvis. Few authors have recently described successful transgastric or transduodenal drainage of liver abscesses. In the present review the indications, techniques, accessories, endoprotheses, limitations, and complications reported with EUS-guided liver abscess drainage are described.

Materials and methods

An extensive English language literature search was conducted using Pubmed, Medline, and Google to identify the peer-reviewed original and review articles using the keywords 'endoscopic ultrasound', 'liver abscess', and 'endoluminal drainage'. Only human articles were selected. The references of pertinent studies were manually searched to identify additional relevant studies. The indications, procedural details, technical and clinical success rates, complications, and limitations were considered as part of inclusion criteria. Search results yielded mostly small sample sized retrospective studies including case reports and case series. Search results yielding mostly retrospective studies with small numbers of patients and a variety of devices used for drainage limited statistical analysis in the form of meta-analysis.

Results

Four original articles published were considered appropriate to be included in the review article. Out of these, two were case reports from Germany [Seewald *et al.* 2005] and Singapore [Ang *et al.* 2009] and the other two were case series from Korea [Noh *et al.* 2010] and Japan [Itoi *et al.* 2011]. The total number of cases was seven. All cases have been summarized in Table 1.

Indications

Usual indications for EUS-guided liver abscess drainage were failure of antibiotic therapy or PCD approach [Ang *et al.* 2009; Itoi *et al.* 2011; Noh *et al.* 2010; Seewald *et al.* 2005]. Noh and

colleagues reported three cases where septic shock with failure of antibiotics and abscess inaccessible to PCD were indications in one case each [Noh *et al.* 2010]. Ang and colleagues reported successful EUS-guided drainage of a ruptured liver abscess after failed antibiotics and PCD [Ang *et al.* 2009].

Site of liver abscess

The left lobe of liver (segments two and three) and the caudate lobe usually lie in close proximity to the stomach or duodenum. These segments are likely to be accessible transluminally using EUS. Seewald and colleagues described drainage of liver abscesses located in the lateral segment of the left lobe of liver [Seewald *et al.* 2005]. Ang and colleagues reported drainage of collection in the subhepatic space after ruptured liver abscess [Ang *et al.* 2009]. Noh and colleagues reported three cases with two abscesses located in the caudate lobe of the liver, one with extension into the portal and inferior vena cava, and a third abscess located in the gastrohepatic space [Noh *et al.* 2010]. Itoi and colleagues described drainage of two different tuberculous abscesses in the same patient at different locations, one in the caudate lobe of liver and the other between the caudate lobe and the pancreas [Itoi *et al.* 2011].

Size of liver abscess

The size of abscesses ranged from 5 cm × 4 cm to 11 cm × 7 cm [Ang *et al.* 2009; Itoi *et al.* 2011; Noh *et al.* 2010; Seewald *et al.* 2005] (see Table 1).

Etiology

Of seven patients, five had a pyogenic abscess and two had a tubercular abscess [Ang *et al.* 2009; Itoi *et al.* 2011; Noh *et al.* 2010; Seewald *et al.* 2005].

Technique

Echoendoscope

Therapeutic linear array echoendoscopes with 2.8 mm diameter accessory channels that allow the passage of an endoprosthesis have been used by most endoscopists. Carbon dioxide (CO₂) insufflation during endoscopy can potentially limit post-procedure abdominal discomfort and bowel remnant gas volume and is widely used at most centers performing EUS-guided drainage procedures.

Table 1. Summary of reports describing endoscopic ultrasound-guided liver abscess drainage.

Study, location	Indications	Location of Abscess	Size (cm)	Approach	Puncture needle	Tract dilator	Endoprosthesis for drainage	Follow up
Seewald <i>et al.</i> [2005], Germany	Failed ABX therapy (1 week)	Lateral segment of left lobe	7 × 11	Proximal TG	22 G	6F Teflon outer sheath	7F Nasoabscess catheter with two side holes at distal end	4 weeks, 3 months and 6 months
Ang <i>et al.</i> [2009], Singapore	Failed ABX and PCD (ruptured)	Left subhepatic space collection	10.7 × 5.7	TG	19 G	10F Soehendra biliary dilator and balloon dilation	8F and 10F × 7cm double pigtail stents	11 days
Noh <i>et al.</i> [2010], Korea	Failed ABX and PCD	Gastrohepatic space	5.1 × 4	TG	19 G	6F and 7F biliary dilator catheter	7F double pigtail stent	Repeat CT on 10 days and 11 months, stent removal in 2 weeks
Noh <i>et al.</i> [2010], Korea	Failed ABX and PCD	Caudate lobe of liver	4.5 × 6	TG	19 G	6F and 7F biliary dilator catheter	7F double pigtail stent	Repeat CT in 2 weeks and 9 months, stent removal in 3 months
Noh <i>et al.</i> [2010], Korea	Failed ABX and inaccessible to PCD	Caudate lobe of liver with portacaval extension	5.5 × 4	TD	19 G	6F and 7F biliary dilator catheter	Two 7F double pigtail stents with nasocystic tube	Repeat CT in 4 weeks and 3 months, nasocystic tube and stent removal in 5 days
Itoi <i>et al.</i> [2011], Japan	Failed ABX and PCD (TB)	Between pancreas and caudate lobe of liver	7 (multiloculated)	TD	19 G	6 mm balloon dilatation	7F straight stent and 5F nasocystic catheter	Repeat CT in 5 days and 6 months, nasocystic tube removal in 2 weeks.
Itoi <i>et al.</i> [2011], Japan	Failed ABX and PCD (TB)	Caudate lobe	NA	TG	19 G	6 mm balloon dilatation	7F double pigtail stent and 5F nasocystic catheter	Repeat CT in 5 days and 6 months, nasocystic tube removal in 2 weeks.

ABX, antibiotic; PCD, percutaneous drainage; TB, tubercular; NA, not available; TG, transgastric; TD, transduodenal; G, gauge.

Endoluminal puncture site

CT scan or alternative high-quality imaging prior to procedure is helpful in determining a guide map. A transgastric approach via the antral wall has been the preferred site reported for puncture because of proximity to the liver [Ang *et al.* 2009; Itoi *et al.* 2011; Noh *et al.* 2010; Seewald *et al.* 2005]. A transduodenal approach was successful for two cases with the abscess located in the caudate lobe of the liver [Itoi *et al.* 2011; Noh *et al.* 2010]. The decision regarding the puncture site should be individualized depending on the

location of the abscess; where the abscess lies closest to the luminal wall with no intervening vascular structures assessed by color Doppler ultrasonography.

Puncture needle

Seewald and colleagues was the first reported case of using a 22-gauge needle with 6F Teflon outer sheath [Seewald *et al.* 2005] for initial puncture. In all other cases 19-gauge EUS fine-needle aspiration (FNA) needle was used [Ang *et al.*



Figure 1. Endoscopic ultrasound image of a liver abscess with a puncture needle in the abscess cavity.



Figure 2. Fluoroscopic image showing 0.035-inch guidewire looped inside the abscess cavity with 8 mm biliary balloon dilators.

2009; Itoi *et al.* 2011; Noh *et al.* 2010]. No preference in the puncture location on the abscess was reported by any author (Figure 1A).

Tract dilator

After gaining access to the abscess cavity with a needle and confirming the position of the needle by fluoroscopy, a 0.035-inch guidewire is advanced to coil into the abscess cavity under EUS and fluoroscopy guidance (Figure 2). It is generally recommended to make at least two loops in the abscess cavity to make easy and safe passage of the catheter and to ensure stability of the guidewire. If initial puncture is made by a



Figure 3. Fluoroscopic image showing double pigtail stents and nasocystic catheter in place.

needle with outer Teflon sheath then no further tract dilation is needed [Seewald *et al.* 2005]. The endoscopist's preference of either 6F or 10F biliary dilators or 6 mm biliary balloons either alone or sequentially has been used to achieve effective dilation with no difference in technical success rates (Figure 2).

Endoprosthesis

After tract dilation, an endoprosthesis is placed into the abscess cavity for drainage. Most endoscopists have used 7F double pigtail plastic stents for drainage [Ang *et al.* 2009; Itoi *et al.* 2011; Noh *et al.* 2010; Seewald *et al.* 2005] (Figure 3). In most of the cases a single stent was used, while Ang and colleagues and Noh and coworkers used two pigtail stents possibly because of the larger abscesses involved [Ang *et al.* 2009; Noh *et al.* 2010]. Double pigtail stents are less likely to migrate and seem to be the preferred stents in most reports, while only one report (by Ito and colleagues) described the use of straight stents for drainage of multilocular tubercular abscess where the placement of pigtail stents might be challenging [Itoi *et al.* 2011]. Nasocystic catheters can provide a means for lavage and confirm continued drainage from abscesses by monitoring output (Figure 4). Clinical significance of using nasocystic drains is uncertain. Success rates have been similar in case reports with or without nasocystic drain [Ang *et al.* 2009; Noh *et al.* 2010; Seewald *et al.* 2005].

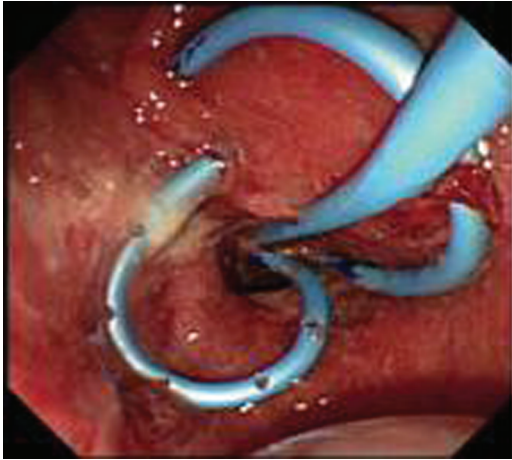


Figure 4. Endoscopic view of two double pigtail stents and nasocystic tube.
(Reproduced from Noh *et al.* [2010] with permission from Elsevier.)

Technical and clinical success rate

The combined technical and clinical success rate was 100% with improvement in the patient's clinical condition and laboratory parameters. The success rates are unlikely to represent true clinical success rates in practice as unsuccessful cases are unlikely to be reported.

Complications

There were no procedural-related complications or failure reported.

Follow up

Most authors reported the use of CT scan with contrast for a follow up of 5 days to 4 weeks after EUS-guided drainage. Monitoring clinical signs and symptoms such as fever, abdominal pain, or high white blood cell count (WBC) should increase suspicions for failed drainage or re-accumulation of abscess. Repeat CT scans might be useful to guide timing of endoprosthesis removal. A delayed CT scan at 6 months might be helpful to document resolution of abscess.

Summary and future directions

EUS-guided transluminal liver abscess drainage can be a safe and minimally invasive alternative approach to surgery in selected patients who fail PCD. With present techniques and accessories, drainage of abscesses in the left and caudate lobes of the liver has been shown to be successful.

Preliminary reports appear promising and large multicentric prospective studies are needed in the future to adopt it as a standard primary or alternative therapy. Inevitably, when a new procedure is attempted, there is a publication bias; only cases that are technically and clinically successful are published. With further experience and the development of more sophisticated accessories, the arena of EUS-guided drainage is likely to expand to other areas of the liver and other abdominopelvic organs. The technique has a potential in assisting in diagnosis by aspiration or biopsy of hepatic lesions as well as directed injection or placement of endoprosthesis for delivery of therapeutic agents into hepatic lesions.

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Conflict of interest statement

None of the authors have any conflicts of interest or financial relationships with the company that produces or distributes the device described in the review article.

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