Supplementary Doc 1

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Supplementary Table 1 Studies on EUS-LB in patients with NAFLD

Study	Design of the study	Patients	Technical success (%)	Diagnostic yield (%)	Specimen length (median, range) (mm)	CPT (median, range)	Needle used for EUS-LB	Needle passes (median)	Complications (n (%))
Saab et al (a)	Retrospective case series	47	100	100	65 (46-80)	18 (14-24)	19 G (SharkCore)	1	2(4.2)
Bazerbachi et al (b)	Prospective (RCT)	27	100	100	24 (20-27.5)	26 (7-62)	22 G (SharkCore)	2	6(7)
DeWitt et al (66)	Prospective case series	9	100	77.8	8 (1-13)	2 (0-9)	19 G (SharkCore)	3	0
Gleeson et al (65)	Retrospective case series	6	100	100	11.5 (8-27)	7 (5-8)	19 G (QuickCore)	2(1-3)	0
Gor et al (60)	Retrospective case series	4	100	100	11 (6-23)	6.5 (6-14)	19 G (FNA)	-	0
Stavropoulos et al (50)	Prospective case series	5	100	100	32.2 (12.5-58.7)	9 (4-13)	19 G (FNA)	1	0
Shah et al (61)	Retrospective study	11	100	100	71.1 (17.1-167.4)	33 (23-85)	19 G (SharkCore)	2 (1-3)	-

Abbreviations: NAFLD: nonalcoholic fatty liver disease; EUS-LB: endoscopic ultrasound guided liver biopsy; CPT: complete portal triads; RCT: randomized controlled trial; G: gauge; FNA: fine needle aspiration

a) Saab S, Phan J, Jimenez MA et al. Endoscopic Ultrasound Liver Biopsies Accurately Predict the Presence of Fibrosis in Patients with Fatty liver. Clin Gastroenterol Hepatol. 2017 Sep;15(9):1477-1478.

b) Bazerbachi, F.; Vargas, E.J.; Matar, R.; Storm, A.C.; Mounajjed, T.M.; Topazian, M.D.; Levy, M.J.; Chandrasekhara, V.; Abu Dayyeh, B.K. EUS-guided core liver biopsy sampling using a 22-gauge fork-tip needle: A prospective blinded trial for histologic and lipidomic evaluation in nonalcoholic fatty liver disease. Gastrointest. Endosc. 2019, 90, 926–932.

Supplementary Table 2 Studies on EUS guided treatement of hepatic cysts

Study	Design	Patients	EUS guided treatment	Size of cyst pre procedure (median)	Size of cyst post procedure (median)	Reduction of cyst on follow up	Complications	Comments
Lee et al (71)	Retrospective	8 (+1 combined with PCD)	Ethanol (pure alcohol)	368.9 (195.3-795.9) ml	0 ml (0-2.8)	100% at 15 months	2 cases (both mild abdominal pain)	100 ml (mean) ethanol injected
Shi et al (a)	Case report	1	1% lauromacrogol	75 x 45 mm	-	Significantly reduced on CT post 1 week	None	30 ml used
Lee et al (b)	Retrospective	14	Pure ethanol (99%)	-	-	Median time to clinical response 17 (10-36) months: no recurrence on follow up	-	Ethanol retention therapy done (mena 100 ml injected)
Taguchi et al (c)	Case report	1	Transmural pigtail stent (7F) with NBD (6F)	-	-	No cyst at 3 months post procedure	-	Infected hepatic cyst (*Edwardsiella tarda)*
Gupta et al (d)	Case series	1 (other case managed by PCD)	7 F pigtail stent with 7 F NBD	14.5x9.2x13 cm	-	6 weeks post procedure: complete resolution	none	Intrahepatic pancreatic pseudocyst

Abbreviations: EUS: endoscopic ultrasound; NBD: nasobiliary drain; CT: computed tomography; PCD: percutaneous catheter drain

a) Shi G, Sun S, Li H et al. A case of a giant cyst in the left lobe of the liver successfully treated with endoscopic ultrasound-guided fine needle aspiration (with video). Endosc Ultrasound. 2017 Jul 13;6(5):343–6.

b) Lee DS, Lee SK, Seo DW. Long-term safety and efficacy of ethanol retention therapy via percutaneous approach and/or EUS guidance for symptomatic large hepatic cysts (with video). Endosc Ultrasound. 2020 Jan-Feb;9(1):31-36.

c) Taguchi H, Tamai T, Numata M et al. Endoscopic ultrasonography-guided transmural drainage of an infected hepatic cyst due to Edwardsiella tarda: a case report. Clin J Gastroenterol. 2014 Oct;7(5):422-8.

d) Gupta D, Pipalia N, Pandav N et al. EUS guided drainage of intrahepatic pancreatic pseudocyst. Trop Gastroenterol. 2016 Apr-Jun;37(2):131-3.

Supplementary Table 3 Literature on EUS guided drainage of liver abscess

Study	Design	Patients	Location of abscess	Access	EUS needle used	Stent used	Reduction in collection size	Complications
Seewald et al (72)	Case report	1 (pyogenic)	Left lobe	TG	22 G	7 F DPT with 7 F nasocatheter Teflon drain	Complete resolution in 4 weeks	None
Noa et al (73)	prospective case series	3 (pyogenic)	2 caudate, 1 gastrohepatic extension	2 TG/ 1 TD	19 G FNA	7 F DPT (I case also has an NCD)	Complete resolution on follow up (2-12 weeks)	None
Itoi et al (74)	Case report	1 (tubercular abscess)	Caudate lobe	Both TG and TD	19 G	TD (7 F straight with 5 F NCD) and TG (7F DPT with 5F NCD)	Complete resolution in 2 weeks	None
Ang et al (a)	Case report	1 (pyogenic)	Left lobe	TG	19 G	8F and 10F DPT	Complete resolution in 11 days	None
Kumta et al (b)	Case report	1 (abscess post EUS-HGS)	Left lobe	TG	Electrocautery system	15 mm LAMS	Resolution in 1 month	None
Alcaide et al (76)	Case report	1 (pyogenic)	Left lobe	TG	19 G	10 mm (Hot AXIOS)	Resolution in 6 days	none
Koizumi et al (c)	Case report	1 (ALA)	Intrahepatic subcapsular	TG	19 G	7 F NCD	Resolution in 2 weeks	None
Carbajo et al (d)	Retrospective comparison study (EUS-AD vs PCD)	18 EUS vs 62 PCD (9 hepatic abscess drained by EUS)	Left lobe (3), right lobe (4) ?	-	19 G	LAMS (2), FCSEMS (5)	Clinical success (complete resolution of symptoms and disappearance of lesion) 77.5%	NA for liver abscess (overall 22.2%)
Yamamoto et al (e)	Case report	1 (patient had Chilaiditi	Right lobe	TD	19G	5 F NCD	Complete resolution in 6 days	None

		syndrome)						
Molinario et al (f)	Case report	1 (Fungal abscess)	Left lobe	-	19 G	LAMS (10 x 20 mm)	Resolution in 1 month	None
Ogura et al (77)	Retrospective study (EUS-AD vs PCD)	8 (EUS) vs 19 (PCD)	Left (6); right lobe (2)	TG (6), TD (2)	19 G	FCSEMS	Clinical success 100 % (EUS-AD) vs (PCD 89%)	None
Tonozuka et al (g)	Retrospective series	7	Left (6), right (1)	TG (6), TD (1)	19 G	FCSEMS with 5/6 F NCD (1 case needed DEN)	Clinical success 71.4%	None
Rana et al (h)	Retrsopective case series	14	Left (11), caudate (3)	TG (10), TE (4)	19 G	7 F DPT (2) in all cases	Mean 21.5 days (resolution of abscess)	None
Medrado et al (75)	Case report	1	Left lobe	TG	19 G	PCSEMS (60x10 mm)	Resolution in 8 weeks	Transgastric stent migration
Chnadra et al (i)	Case series	3	Caudate (1), left lobe (2)	TG	19 G	8 F DPT with 8F NCD/ 10 F NCD	Clinical resolution in both cases	None
Kawakami et al (j)	Case report	1	Left lobe	TG	19 G	NAGI stent	NA	None
Keohane et al (k)	Case series	2	Caudate lobe	TG	19 G	One case (7F and 10 F DPT); other case (1 7F DPT)	Complete resolution at 5 and 6 weeks	None
Ogura et al (l)	Case report	1	Right lobe (case of unresectable	TD	19 G	FCSEMS	Complete resolution (duration NA)	None

			CCA)					

Abbreviations: EUS: endoscopic ultrasound; TG: trnas-gastric; TD: trans-duodenal; G: gauge; DPT: double pigtail; NBD: nasobiliary drain; LAMS: lumen apposing metal stent; FCSEMS: fully covered self-expanding metal stent; NA: not available; PCD: percutaneous catheter drain; ALA: amebic liver abscess; HGS: hepatico-gastrostomy

a) Ang TL, Seewald S, Teo EK, Fock KM, Soehendra N. EUS-guided drainage of ruptured liver abscess. Endoscopy. 2009;41 Suppl 2:E21-2.

b) Kumta NA, Torres-Ruiz F, Reinoso PJ, Kahaleh M. Endoscopic management of hepatic abscess after EUS-guided hepaticogastrostomy. Gastrointest Endosc. 2016; 84:1054-1055.

c) Koizumi K, Masuda S, Uojima H, Ichita C, Tokoro S, Sasaki A, Egashira H, Kimbara T, Kako M. Endoscopic ultrasound-guided drainage of an amoebic liver abscess extending into the hepatic subcapsular space. Clin J Gastroenterol. 2015; 8:232-5.

d) Carbajo AY, Brunie Vegas FJ, Garc á-Alonso FJ et al. Retrospective cohort study comparing endoscopic ultrasound-guided and percutaneous drainage of upper abdominal abscesses. Dig Endosc. 2019; 31:431-438.

e) Yamamoto K, Itoi T, Tsuchiya T et al. EUS-guided drainage of hepatic abscess in the right side of the liver of a patient with Chilaiditi syndrome. VideoGIE. 2017; 2:299-300.

f) Molinario F, Rimbaş M, Pirozzi GA et al. Endoscopic ultrasound-guided drainage of a fungal liver abscess using a lumen-apposing metal stent: case report and literature review. Rom J Intern Med. 2020. In Press. [DOI: 10.2478/rjim-2020-0035]

g) Tonozuka R, Itoi T, Tsuchiya T et al. EUS-guided drainage of hepatic abscess and infected biloma using short and long metal stents (with videos). Gastrointest Endosc. 2015; 81:1463-9.

h) Rana SS, Ahmed S, Sharma R et al. Safety and efficacy of EUS-guided drainage of liver abscess: A single-center experience. Endosc Ultrasound. 2020; 9:350-351.

i) Chandra S, Chandra U. Endoscopic ultrasound-guided transgastric drainage of radiologically inaccessible left lobe liver abscess involving segment 4, caudate lobe, and left lateral segments using a modified technique. Endosc Int Open. 2021 Jan;9(1): E35-E40.

j) Kawakami H, Kawakubo K, Kuwatani M et al. Endoscopic ultrasonography-guided liver abscess drainage using a dedicated, wide, fully covered self-expandable metallic stent with flared-ends. Endoscopy. 2014;46:E982-3.

k) Keohane J, Dimaio CJ, Schattner MA et al. EUS-guided transgastric drainage of caudate lobe liver abscesses. J Interv Gastroenterol. 2011 Jul;1(3):139-141.

l) Ogura T, Takagi W, Onda S et al. Endoscopic ultrasound-guided drainage of a right liver abscess with a self-expandable metallic stent. Endoscopy. 2015;47:E397-8.

Supplementary Table 4 Studies on endoscopic transluminal drainage of bilomas

Study	Design	Patients	Access	Size of biloma	Stent used	Reduction in collection size	ERCP findings	Complications
Cury et al (a)	Case report	1	TG	NA	9Fx 3cm plastic	No collection at 2 months	No leak	None
Baron et al (b)	Case report	1	TG	4.5 x 6 cm	10Fx5cm DPT	Resolution in 1 month	No leak	None
Somani et al (c)	Case report	1	TG	NA	10Fx3 cm DPT	Resolution in 24 hours	No leak; CBD stone 7mm	None
Ulla Rocha et al (d)	Case report	1	TG	5.7x6.4x10 cm	8.5 F plastic	Resolution in 7 days	Not done	None
Prachayakul et al (e)	Case report	1	TG	4.5x 3.5 cm	7Fx7cm DPT	Resolution in 7 days	Not done	None
Shami et al (f)	Retrospective case series	5	TG (4), TD (1)	-	7F/10F single or double platic stents (DPT)	Resolution in 11 days -2 months	Not done	None
Nakamura et al (g)	Case report	1	TG	NA	7F plastic	Resolution occurred immediately	Not done	None
Cassis et al (h)	Case report	1	TD	19x15.6x20 cm	LAMS (15x10mm)	No collection at 3 weeks	Not done	None
Tonozuka et al (i)	Retrospective case series	6	TG (6)	68.5 (22.0-83.0) (median)	FCSEMS	Clinical success 83.3% (1 DEN); final 100% success	None	None
Ogura et al (j)	Case report	1	-	NA	7Fx12 cm DPT	Resolution in 1 week	Not done	None
Eso et al (k)	Case report	1	TG	NA	7F DPT	Complete resolution in 4 weeks	Not done	None

Abbreviations: ERCP: endoscopic retrograde cholangiopancreaticography; TG: trans-gastric; TD: trans-duodenal; NA: not available; DPT: double pigtail; LAMS: lumen apposing metal stent; FCSEMS: fully covered self-expanding metal stent; DEN: direct endoscopic necrosectomy

a) Cury MS, do Oliveira Conceição RD, Ferrari AP. Gastric drainage of postoperative biloma. Gastrointest Endosc. 2001 Sep;54(3):400-1.

b) Baron TH. Combined endoscopic transgastric and transpapillary drainage of an infected biloma. Endoscopy. 2006 Apr;38(4):436.

c) Somani SK, Somani A, Singh V. Endoscopic drainage of a post-cholecystectomy biloma with biloma-gastric stenting. Endoscopy. 2013;45:E173-4.

d) Ulla-Rocha JL, Lopez-Piñeiro S, Dominguez-Comesaña E. EUS-Guided Transgastric Drainage of Perihepatic Biloma After Laparoscopic Liver Metastasectomy from Colon Cancer. J Gastrointest Cancer. 2016 Dec;47(4):468-469.

e) Prachayakul V, Aswakul P. Successful endoscopic treatment of iatrogenic biloma as a complication of endosonography-guided hepaticogastrostomy: The first case report. J Interv Gastroenterol. 2012 Oct;2(4):202-204.

f) Shami VM, Talreja JP, Mahajan A, Phillips MS, Yeaton P, Kahaleh M. EUS-guided drainage of bilomas: a new alternative? Gastrointest Endosc. 2008 Jan;67(1):136-40.

g) Nakamura K, Kishikawa H, Ojiro K et al. Stent placement using dual-channel endoscope for biloma after EUS-guided hepaticogastrostomy. J Hepatobiliary Pancreat Sci. 2020 Dec 12.

h) Cassis P, Shah-Khan SM, Nasr J. EUS-guided drainage of a 20-cm biloma by use of a lumen-apposing metal stent. VideoGIE. 2019 Oct 31;5(1):20-21.

i) Tonozuka R, Itoi T, Tsuchiya T et al. EUS-guided drainage of hepatic abscess and infected biloma using short and long metal stents (with videos). Gastrointest Endosc. 2015;81(6):1463-9.

j) Ogura T, Okuda A, Miyano A, Nishioka N, Higuchi K. Successful treatment for infected biloma after endoscopic ultrasound-guided hepaticogastrostomy using double stent placement technique. Mini-invasive Surgery. 2018;2.

k) Eso Y, Marusawa H, Tsumura T et al. Endoscopic ultrasonography-guided transgastric drainage of infectious biloma following radiofrequency ablation for hepatocellular carcinoma. Dig Endosc. 2012; 24:390.

Supplementary Table 5 Technique of PPG measurement (124,126, a)

Technique of the procedure:

1. The measurement of PPG via EUS requires 4 components: 25 G FNA needle, non-compressible tubing, a compact digital manometer, and heparinized saline. The tubing is connected by a luer lock to the distal port and heparinized saline is connected the proximal port of the manometer.
2. With the patient supine, the manometer is placed at the patient's midaxillary line.
3. The HV measurement is conducted first, in which middle HV is targeted most often (larger caliber and better alignment with the needle trajectory). Then PV measurement is taken (umbilical portion of left PV is the target).
4. Doppler flow is used to confirm the typical multiphasic waveform of hepatic venous flow and typical venous hum of the portal venous flow.
5. Trans-gastric trans-hepatic route is taken for HV and PV puncture. Needle is flushed with heparinized saline (1 ml). The steadiest reading at equilibrium is recorded. Three measurements are taken and their mean is calculated (both HV and PV pressures)
6. The FNA needle is slowly withdrawn from the vein into the liver parenchyma and then back into the needle sheath with Doppler flow on to ensure there is no flow within the needle tract.
7. The PPG is calculated by subtracting the mean PVP from the mean HV pressure.
8. Post-procedural antibiotics are usually given for 3 to 5 days after the procedure.

Abbreviations: PPG: portal pressure gradient; EUS: endoscopic ultrasound; FNA: fine needle aspiration; HV: hepatic vein; PV: portal vein

a) Huang JY, Samarasena JB, Tsujino T, et al. EUS-guided portal pressure gradient measurement with a simple novel device: a human pilot study. Gastrointest Endosc 2017; 85:996–1001.

Supplementary Table 6 Studies on EUS-PPG measurement in animal models and humans.

Study	Year	Animal models	Approach	EUS FNA needle	Technical success	Complications	Correlation between EUS and trans-hepatic PVP measurement
ANIMAL MODELS							
Lai et al (124)	2004	21 pigs (14 PH model with PVA; 7 coagulopathy with heparin)	Transduodenal	22 G	18/21 cases	Small subserosal hematomas in all 21 cases	r=0.91
Giday et al (123)	2007	5 pigs	Trans-gastric	19 G (with a modified ERCP catheter)	5/5 cases	None	NA
Buscaglia et al (a)	2008	5 pigs	Trans-gastric	19 G	5/5 cases	None	NA
Schulman et al (b)	2016	5 pigs	NA	22 G	5/5 cases	None	HVPG within $\pm$ 1 mmHg of PVP
Schulman et al (c)	2017	5 pigs	NA	22 G	5/5 cases	None	NA
Huang et al (d)	2016	3 pigs	Trans-gastric	25 G	3/3 cases	None	R=0.985-0.99
HUMAN STUDIES							
Fujii-Lau et al (e)	2014	1	Trans-gastric	22 G	1	None	PPG 1 mmHg (excellent correlation with HVPG)
Huang et al (f)	2017	28	-	25 G	25/25 cases	None	Excellent correlation with varices (P = .0002), PH gastropathy (P = .007), and thrombocytopenia (P = .036); few of them also underwent liver biopsy in same setting
Samarasena et al (g)	2018	51	-	-	51/51 cases	3 cases had mild abdominal discomfort	Correlated with varices, PHG, low platelets, cirrhosis
Zhang et al (h)	2020	12	-	22 G	11/12 cases	None	R=0.923

					(91.7%)		
Shah et al (i)	2021	1	Trans-gastric	25 G	1	None	NA (same session EUS-liver biopsy was done)

Abbreviations: EUS: endoscopic ultrasound; FNA: fine needle aspiration; PVP: portal vein pressure; PVA: polyvinyl alcohol; HVPG: hepatic vein pressure gradient; G: gauge; ERCP: endoscopic retrograde cholangio-pancreaticography; PHG: portal hypertensive gastropathy

a) Buscaglia JM, Shin EJ, Clarke JO, et al. Endoscopic retrograde cholangiopancreatography, but not esophagogastroduodenoscopy or colonoscopy, significantly increases portal venous pressure: direct portal pressure measurements through endoscopic ultrasound-guided cannulation. Endoscopy 2008;40: 670–4.

b) Schulman AR, Thompson CC, Ryou M. EUS-guided portal pressure measurement using a digital pressure wire with real-time remote display: a novel, minimally invasive technique for direct measurement in an animal model. Gastrointest Endosc 2016; 83:817–20.

c) Schulman AR, Thompson CC, Ryou M. endoscopic ultrasound-guided direct portal pressure measurement using a digital pressure wire with real-time remote display: a survival study. J Laparoendosc Adv Surg Tech A 2017; 27:1051–4.

d) Huang JY, Samarasena JB, Tsujino T, Chang KJ. EUS-guided portal pressure gradient measurement with a novel 25-gauge needle device versus standard transjugular approach: a comparison animal study. Gastrointest Endosc. 2016; 84:358-62.

e) Fujii-Lau LL, Leise MD, Kamath PS, et al. Endoscopic ultrasound-guided portalsystemic pressure gradient measurement. Endoscopy 2014;46: E654–6.

f) Huang JY, Samarasena JB, Tsujino T, et al. EUS-guided portal pressure gradient measurement with a simple novel device: a human pilot study. Gastrointest Endosc 2017; 85:996–1001.

g) Samarasena JB, Han J, Patel A, et al. EUS-guided portal pressure gradient measurement: a single center experience. Gastrointest Endosc 2018;87: AB107.

h) Zhang W, Peng C, Zhang S et al. EUS-guided portal pressure gradient measurement in patients with acute or subacute portal hypertension. Gastrointest Endosc. 2020; S0016-5107:34531-4.

i) Shah SL, Dawod Q, Kumar S et al. "One stop" liver-focused endoscopy: EUS-guided portal pressure gradient measurement technique. VideoGIE. 2020; 5:658-659.