

[Clinical and Technical Guideline for Endoscopic Ultrasound-guided Tissue Acquisition of Pancreatic Solid Tumor: Korean Society of Gastrointestinal Endoscopy].

Title: [Clinical and Technical Guideline for Endoscopic Ultrasound-guided Tissue Acquisition of Pancreatic Solid Tumor: Korean Society of Gastrointestinal Endoscopy].

Publication year: 2021

Journal: The Korean journal of gastroenterology = Taehan Sohwagi Hakhoe chi

Authors: Department of Internal Medicine, Severance Hospital, Yonsei University College of Medicine, Seoul, Korea.

Society: European Respiratory Society

Origin country: International (Europe)

Target countries: Europe

DOI: 10.4166/kjg.2021.057

PMID: 34446631

Source: <https://pubmed.ncbi.nlm.nih.gov/34446631/>

pmc Korean J Gastroenterol Korean J Gastroenterol 4730 kjgastro 101189416 Korean J
Gastroenterol The Korean Journal of Gastroenterology 1598-9992 2233-6869 Korean Society of
Gastroenterology PMC12286448 PMC12286448.1 12286448 12286448 34446631
10.4166/kjg.2021.057 kjg-78-2-73 1 Review Article ■■■■■■■■ ■■■ ■■■ ■■■ ■■ ■■ ■■
■■■■■: ■■■■■■■■■■ Clinical and Technical Guideline for Endoscopic Ultrasound-guided
Tissue Acquisition of Pancreatic Solid Tumor: Korean Society of Gastrointestinal Endoscopy ■ ■■
Chung Moon Jae <https://orcid.org/0000-0003-1603-7468> ■ ■■ Park Se Woo 1 ■ ■■ Kim
Seong-Hun 2 ■ ■■ Cho Chang Min 3 ■ ■■ Choi Jun-Ho 4 ■ ■■ Choi Eun Kwang 5 ■ ■■ Lee
Tae Hoon 6 ■ ■■ Cho Eunae 7 ■ ■■ Lee Jun Kyu 8 ■ ■■ Song Tae Jun 9 ■ ■■ Lee Jae Min 10
■ ■■ Son Jun Hyuk 11 ■ ■■ Park Jin Suk 12 ■ ■■ Oh Chi Hyuk 13 ■ ■■ Park Dong-Ah 14 ■
■■■ Byeon Jeong-Sik 9 ■ ■■ Lee Soo Teik 2 ■ ■■ Kim Ho Gak 15 ■ ■■ Chun Hoon Jai 10 ■ ■■
Choi Ho Soon 16 ■ ■■ Park Chan Guk 17 ■ ■■ Cho Joo Young 18 ■■■■■■ ■■■ ■■■■■■ ■■
Department of Internal Medicine, Severance Hospital, Yonsei University College of Medicine,
Seoul, Korea 1 ■■■■■■ ■■■■ ■■■■■■ ■■ 1 Department of Internal Medicine, Hallym
University Dongtan Sacred Heart Hospital, Hallym University College of Medicine, Hwasung, Korea
2 ■■■■■■ ■■■■ ■■■■■■ ■■ 2 Department of Internal Medicine, Research Institute of Clinical
Medicine of Jeonbuk National University-Biomedical Research Institute of Jeonbuk National
University Hospital, Jeonbuk National University Medical School, Jeonju, Korea 3 ■■■■■■ ■■■■
■■■■■■■ ■■ 3 Department of Internal Medicine, Kyungpook National University Hospital,
School of Medicine, Kyungpook National University, Daegu, Korea 4 ■■■■■■ ■■■■ ■■■■■■
■■■ 4 Department of Internal Medicine, Dankook University Hospital, Dankook University College of
Medicine, Cheonan, Korea 5 ■■■■■■ ■■■■ ■■■■■■ ■■ 5 Department of Internal Medicine,
Jeju National University Hospital, Jeju National University College of Medicine, Jeju, Korea 6
■■■■■■■ ■■■■ ■■■■■■■■■■ ■■ 6 Department of Internal Medicine, Soonchunhyang
University Hospital, Soonchunhyang University College of Medicine, Cheonan, Korea 7 ■■■■■■
■■■■■ ■■■■■■■■ ■■ 7 Department of Internal Medicine, Chonnam National University Hospital,
Chonnam National University Medical School, Gwangju, Korea 8 ■■■■■■ ■■■■ ■■■■■■■■
■■■ 8 Department of Internal Medicine, Dongguk University Medical Center, Dongguk University
College of Medicine, Goyang, Korea 9 ■■■■■ ■■■■■ ■■■■■■ ■■ 9 Department of Internal
Medicine, Asan Medical Center, Ulsan University College of Medicine, Seoul, Korea 10 ■■■■■■
■■■■■ ■■■■■■■■■■ ■■ 10 Department of Internal Medicine, Korea University Anam Hospital,
Korea University College of Medicine, Seoul, Korea 11 ■■■■■■ ■■■■ ■■■■■■■■■■ ■■ 11
Department of Internal Medicine, Inje University Ilsan Paik Hospital, Inje University College of
Medicine, Goyang, Korea 12 ■■■■■■ ■■■■ ■■■■■■■■ ■■ 12 Department of Internal Medicine,

[illegible]

fanning 扇風機 fānfēngjī fan-feng-gee, electric
fan 電風扇 diànfēngshàn -to-and-fro movement)

② **液体细胞学 (liquid-based cytology, LBC)** 与传统的巴氏涂片相比，LBC 具有更高的细胞学诊断准确性。LBC 的细胞学诊断准确性为 53% [1]。Siddiqui 等 [54] 的研究显示，LBC 的细胞学诊断准确性为 54% [54]。Qin 等 [55] 的研究显示，LBC 的细胞学诊断准确性为 73.3% [55]。

By the Korean Society of Gastrointestinal Endoscopy (KSGE) Task Force for Clinical Guideline. Any costs for literature searching, conferences, and other statistical activities were covered by a research fund provided by the KSGE.

By the Korean Society of Gastrointestinal Endoscopy (KSGE) Task Force for Clinical Guideline. Any costs for literature searching, conferences, and other statistical activities were covered by a research fund provided by the KSGE.

Vilman P Jacobsen GK Henriksen FW Hancke S 1992 Endoscopic ultrasonography with guided fine needle aspiration biopsy in pancreatic disease *Gastrointest Endosc* 38 172 173 10.1016/S0016-5107(92)70385-X 1568614 2 Eisen GM Chutkan R Goldstein JL 2000 Role of endoscopic ultrasonography *Gastrointest Endosc* 52 852 859 10.1016/S0016-5107(00)70223-9 11182690 3 Maluf-Filho F Dotti CM Halwan B 2009 An evidence-based consensus statement on the role and application of endosonography in clinical practice *Endoscopy* 41 979 987 10.1055/s-0029-1215192 19866396 4 Kida M 2009 Pancreatic masses *Gastrointest Endosc* 69 Suppl 2 S102 S109 10.1016/j.gie.2008.12.010 19179132 5 Park SW Chung MJ Lee SH 2016 Prospective study for comparison of endoscopic ultrasound-guided tissue acquisition using 25- and 22-gauge core biopsy needles in solid pancreatic masses *PLoS One* 11 e0154401 10.1371/journal.pone.0154401 27149404 PMC4858215 6 Cumpston M Li T Page MJ 2019 Updated guidance for trusted systematic reviews: a new edition of the Cochrane Handbook for Systematic Reviews of Interventions *Cochrane Database Syst Rev* 10 ED000142 10.1002/14651858.ED000142 31643080 PMC10284251 7 Sterne JAC Savovi J Page MJ 2019 RoB 2: a revised tool for assessing risk of bias in randomised trials *BMJ* 366 l4898 10.1136/bmj.l4898 31462531 8 Stang A 2010 Critical evaluation of the Newcastle-Ottawa scale for the assessment of the quality of nonrandomized studies in meta-analyses *Eur J Epidemiol* 25 603 605 10.1007/s10654-010-9491-z 20652370 9 Whiting PF Rutjes AW Westwood ME 2011 QUADAS-2: a revised tool for the quality assessment of diagnostic accuracy studies *Ann Intern Med* 155 529 536 10.7326/0003-4819-155-8-201110180-00009 22007046 10 Yokoe M Takada T Mayumi T 2015 Japanese guidelines for the management of acute pancreatitis: Japanese Guidelines 2015 *J Hepatobiliary Pancreat Sci* 22 405 432 10.1002/jhbp.259 25973947 11 Park SK Ye BD Kim KO 2015 Guidelines for video capsule endoscopy: emphasis on Crohn's disease *Clin Endosc* 48 128 135 10.5946/ce.2015.48.2.128 25844340 PMC4381139 12 Dumonceau JM Polkowski M Larghi A 2011 Indications, results, and clinical impact of endoscopic ultrasound (EUS)-guided sampling in gastroenterology: European Society of Gastrointestinal Endoscopy (ESGE) Clinical Guideline *Endoscopy* 43 897 912 10.1055/s-0030-1256754 21842456 13 Hébert-Magee S Bae S Varadarajulu S 2013 The presence of a cytopathologist increases the diagnostic accuracy of endoscopic ultrasound-guided fine needle aspiration cytology for pancreatic adenocarcinoma: a meta-analysis *Cytopathology* 24 159 171 10.1111/cyt.12071 23711182 PMC4159090 14 Hewitt MJ McPhail MJ Possamai L Dhar A Vlavianos P Monahan KJ 2012 EUS-guided FNA for diagnosis of solid pancreatic neoplasms: a meta-analysis *Gastrointest Endosc* 75 319 331 10.1016/j.gie.2011.08.049 22248600 15 Puli SR Bechtold ML Buxbaum JL Eloubeidi MA 2013 How good is endoscopic ultrasound-guided fine-needle aspiration in diagnosing the correct etiology for a solid pancreatic mass?: a meta-analysis and systematic review *Pancreas* 42 20 26 10.1097/MPA.0b013e3182546e79 23254913 16 Micames C Jowell PS White R 2003 Lower frequency of peritoneal carcinomatosis in patients with pancreatic cancer diagnosed by EUS-guided FNA vs. percutaneous FNA *Gastrointest Endosc* 58 690 695 10.1016/S0016-5107(03)02009-1 14595302 17 van Gulik TM Reenders JW Bosma A 1997 Incidence and clinical findings of benign, inflammatory disease in patients resected for presumed pancreatic head cancer *Gastrointest Endosc* 46 417 423 10.1016/S0016-5107(97)70034-8 9402115 18 Ang TL Kwek AB Seo DW 2015 A prospective randomized study of the difference in diagnostic yield between endoscopic ultrasound-guided fine-needle aspiration (EUS-FNA) needles with and without a side port in pancreatic masses *Endosc Int Open* 3 E329 E333 10.1055/s-0034-1391964 26356802 PMC4554507 19 Facciorusso A Wani S Triantafyllou K 2019 Comparative accuracy of needle sizes and designs for EUS tissue sampling of solid pancreatic masses: a network meta-analysis *Gastrointest Endosc* 90 893 903.e7 10.1016/j.gie.2019.07.009 31310744 20 Kamata K Kitano M Yasukawa S 2016 Histologic diagnosis of pancreatic masses using 25-gauge endoscopic ultrasound needles with and without a core trap: a multicenter randomized trial *Endoscopy* 48 632 638 10.1055/s-0042-106294 27129137 21 Erickson RA Sayage-Rabie L Beissner RS 2000 Factors predicting the number of EUS-guided fine-needle passes for diagnosis of pancreatic malignancies *Gastrointest Endosc* 51 184 190 10.1016/S0016-5107(00)70416-0 10650262 22 LeBlanc JK

Ciaccia D Al-Assi MT 2004 Optimal number of EUS-guided fine needle passes needed to obtain a correct diagnosis *Gastrointest Endosc* 59 475 481 10.1016/S0016-5107(03)02863-3 15044881 23

Bang JY Hebert-Magee S Trevino J Ramesh J Varadarajulu S 2012 Randomized trial comparing the 22-gauge aspiration and 22-gauge biopsy needles for EUS-guided sampling of solid pancreatic mass lesions *Gastrointest Endosc* 76 321 327 10.1016/j.gie.2012.03.1392 22658389 PMC4148209

24 Bang JY Magee SH Ramesh J Trevino JM Varadarajulu S 2013 Randomized trial comparing fanning with standard technique for endoscopic ultrasound-guided fine-needle aspiration of solid pancreatic mass lesions *Endoscopy* 45 445 450 10.1055/s-0032-1326268 23504490 PMC4158695

25 Möller K Papanikolaou IS Toerner T 2009 EUS-guided FNA of solid pancreatic masses: high yield of 2 passes with combined histologic/cytologic analysis *Gastrointest Endosc* 70 60 69 10.1016/j.gie.2008.10.008 19394012

26 Pitman MB Centeno BA Ali SZ 2014 Standardized terminology and nomenclature for pancreatobiliary cytology: the Papanicolaou Society of Cytopathology guidelines *Diagn Cytopathol* 42 338 350 10.1002/dc.23092 24554455

27 Kliment M Urban O Cegan M 2010 Endoscopic ultrasound-guided fine needle aspiration of pancreatic masses: the utility and impact on management of patients *Scand J Gastroenterol* 45 1372 1379 10.3109/00365521.2010.503966 20626304

28 Horwhat JD Paulson EK McGrath K 2006 A randomized comparison of EUS-guided FNA versus CT or US-guided FNA for the evaluation of pancreatic mass lesions *Gastrointest Endosc* 63 966 975 10.1016/j.gie.2005.09.028 16733111

29 Eloubeidi MA Varadarajulu S Desai S Wilcox CM 2008 Value of repeat endoscopic ultrasound-guided fine needle aspiration for suspected pancreatic cancer *J Gastroenterol Hepatol* 23 567 570 10.1111/j.1440-1746.2007.05119.x 18397485

30 Layfield LJ Schmidt RL Hirschowitz SL Olson MT Ali SZ Dodd LL 2014 Significance of the diagnostic categories "atypical" and "suspicious for malignancy" in the cytologic diagnosis of solid pancreatic masses *Diagn Cytopathol* 42 292 296 10.1002/dc.23078 24578254

31 Fuccio L Hassan C Laterza L 2013 The role of K-ras gene mutation analysis in EUS-guided FNA cytology specimens for the differential diagnosis of pancreatic solid masses: a meta-analysis of prospective studies *Gastrointest Endosc* 78 596 608 10.1016/j.gie.2013.04.162 23660563

32 Iglesias-Garcia J Dominguez-Munoz JE Abdulkader I 2011 Influence of on-site cytopathology evaluation on the diagnostic accuracy of endoscopic ultrasound-guided fine needle aspiration (EUS-FNA) of solid pancreatic masses *Am J Gastroenterol* 106 1705 1710 10.1038/ajg.2011.119 21483464

33 Wani S Mullady D Early DS 2015 The clinical impact of immediate on-site cytopathology evaluation during endoscopic ultrasound-guided fine needle aspiration of pancreatic masses: a prospective multicenter randomized controlled trial *Am J Gastroenterol* 110 1429 1439 10.1038/ajg.2015.262 26346868

34 Ganc RL Carbonari AP Colaiacovo R 2015 Rapid on-site cytopathological examination (ROSE) performed by endosonographers and its improvement in the diagnosis of pancreatic solid lesions *Acta Cir Bras* 30 503 508 10.1590/S0102-865020150070000009 26270143

35 Cermak TS Wang B DeBrito P Carroll J Haddad N Sidawy MK 2012 Does on-site adequacy evaluation reduce the nondiagnostic rate in endoscopic ultrasound-guided fine-needle aspiration of pancreatic lesions? *Cancer Cytopathol* 120 319 325 10.1002/cncy.21201 22517672

36 Kong F Zhu J Kong X 2016 Rapid on-site evaluation does not improve endoscopic ultrasound-guided fine needle aspiration adequacy in pancreatic masses: a meta-analysis and systematic review *PLoS One* 11 e0163056 10.1371/journal.pone.0163056 27657529 PMC5033338

37 Matynia AP Schmidt RL Barraza G Layfield LJ Siddiqui AA Adler DG 2014 Impact of rapid on-site evaluation on the adequacy of endoscopic-ultrasound guided fine-needle aspiration of solid pancreatic lesions: a systematic review and meta-analysis *J Gastroenterol Hepatol* 29 697 705 10.1111/jgh.12431 24783248

38 Kim JH Park SW Kim MK 2016 Meta-analysis for cyto-pathological outcomes in endoscopic ultrasonography-guided fine-needle aspiration with and without the stylet *Dig Dis Sci* 61 2175 2184 10.1007/s10620-016-4130-5 27010546

39 Sahai AV Paquin SC Gariépy G 2010 A prospective comparison of endoscopic ultrasound-guided fine needle aspiration results obtained in the same lesion, with and without the needle stylet *Endoscopy* 42 900 903 10.1055/s-0030-1255676 20725886

40 Wani S Early D Kunkel J 2012 Diagnostic yield of malignancy during EUS-guided FNA of solid lesions with and without a stylet: a prospective, single blind, randomized, controlled trial *Gastrointest Endosc* 76 328 335 10.1016/j.gie.2012.03.1395 22695205

41 Puri R Vilman P Siftoiu A 2009 Randomized controlled trial of endoscopic ultrasound-guided fine-needle sampling with or without suction for better cytological diagnosis *Scand J Gastroenterol* 44 499 504 10.1080/00365520802647392 19117242

42 Lee JK Choi JH Lee KH 2013 A prospective, comparative trial to optimize sampling techniques in EUS-guided FNA of solid pancreatic masses

Gastrointest Endosc 77 745 751 10.1016/j.gie.2012.12.009 23433878 43 Kudo T Kawakami H Hayashi T 2014 High and low negative pressure suction techniques in EUS-guided fine-needle tissue acquisition by using 25-gauge needles: a multicenter, prospective, randomized, controlled trial Gastrointest Endosc 80 1030 1037.e1 10.1016/j.gie.2014.04.012 24890422 44 Nakai Y Isayama H Chang KJ 2014 Slow pull versus suction in endoscopic ultrasound-guided fine-needle aspiration of pancreatic solid masses Dig Dis Sci 59 1578 1585 10.1007/s10620-013-3019-9 24429514 45 Matsubayashi H Matsui T Yabuuchi Y 2016 Endoscopic ultrasonography guided-fine needle aspiration for the diagnosis of solid pancreaticobiliary lesions: clinical aspects to improve the diagnosis World J Gastroenterol 22 628 640 10.3748/wjg.v22.i2.628 26811612 PMC4716064 46 Lee KY Cho HD Hwangbo Y 2019 Efficacy of 3 fine-needle biopsy techniques for suspected pancreatic malignancies in the absence of an on-site cytopathologist Gastrointest Endosc 89 825 831.e1 10.1016/j.gie.2018.10.042 30403966 47 Bor R Vasas B Fábián A 2019 Prospective comparison of slow-pull and standard suction techniques of endoscopic ultrasound-guided fine needle aspiration in the diagnosis of solid pancreatic cancer BMC Gastroenterol 19 6 10.1186/s12876-018-0921-9 30626331 PMC6327397 48 Park SW Lee SS Song TJ 2020 The diagnostic performance of novel torque technique for endoscopic ultrasound-guided tissue acquisition in solid pancreatic lesions: a prospective randomized controlled trial J Gastroenterol Hepatol 35 508 515 10.1111/jgh.14840 31425640 49 Matsubayashi H Sasaki K Ono S 2018 Pathological and molecular aspects to improve endoscopic ultrasonography-guided fine-needle aspiration from solid pancreatic lesions Pancreas 47 163 172 10.1097/MPA.0000000000000986 29346217 50 Kocjan G Chandra A Cross P 2009 BSCC code of practice--fine needle aspiration cytology Cytopathology 20 283 296 10.1111/j.1365-2303.2009.00709.x 19754835 51 Thierry R Marie-Christine R Marièle M Richard B Anca M 2012 Modified technique of toluidine blue staining in rapid on-site evaluation Diagn Cytopathol 40 847 848 10.1002/dc.21753 21681975 52 Lee YN Moon JH Kim HK 2014 A triple approach for diagnostic assessment of endoscopic ultrasound-guided fine needle aspiration in pancreatic solid masses and lymph nodes Dig Dis Sci 59 2286 2293 10.1007/s10620-014-3119-1 24737383 53 Arbyn M Bergeron C Klinkhamer P Martin-Hirsch P Siebers AG Bulten J 2008 Liquid compared with conventional cervical cytology: a systematic review and meta-analysis Obstet Gynecol 111 167 177 10.1097/01.AOG.0000296488.85807.b3 18165406 54 Siddiqui MT Gokaslan ST Saboorian MH Ashfaq R 2005 Split sample comparison of ThinPrep and conventional smears in endoscopic retrograde cholangiopancreatography-guided pancreatic fineneedle aspirations Diagn Cytopathol 32 70 75 10.1002/dc.20174 15637676 55 Qin SY Zhou Y Li P Jiang HX 2014 Diagnostic efficacy of cell block immunohistochemistry, smear cytology, and liquid-based cytology in endoscopic ultrasound-guided fine-needle aspiration of pancreatic lesions: a single-institution experience PLoS One 9 e108762 10.1371/journal.pone.0108762 25259861 PMC4178202 56 LeBlanc JK Emerson RE Dewitt J 2010 A prospective study comparing rapid assessment of smears and ThinPrep for endoscopic ultrasound-guided fine-needle aspirates Endoscopy 42 389 394 10.1055/s-0029-1243841 20101566 57 Lee JK Choi ER Jang TH 2011 A prospective comparison of liquid-based cytology and traditional smear cytology in pancreatic endoscopic ultrasound-guided fine needle aspiration Acta Cytol 55 401 407 10.1159/000330811 21986165 58 Lee KJ Kang YS Cho MY Kim JW 2016 Comparison of cytologic preparation methods in endoscopic ultrasound-guided fine needle aspiration for diagnosis of pancreatic adenocarcinoma Pancreatolgy 16 824 828 10.1016/j.pan.2016.05.006 27279466 59 Ieni A Barresi V Todaro P Caruso RA Tuccari G 2015 Cell-block procedure in endoscopic ultrasound-guided-fine-needle-aspiration of gastrointestinal solid neoplastic lesions World J Gastrointest Endosc 7 1014 1022 10.4253/wjge.v7.i11.1014 26322154 PMC4549658 60 Noda Y Fujita N Kobayashi G 2010 Diagnostic efficacy of the cell block method in comparison with smear cytology of tissue samples obtained by endoscopic ultrasound-guided fine-needle aspiration J Gastroenterol 45 868 875 10.1007/s00535-010-0217-5 20177713 61 Rusch M Nakitandwe J Shurtleff S 2018 Clinical cancer genomic profiling by three-platform sequencing of whole genome, whole exome and transcriptome Nat Commun 9 3962 10.1038/s41467-018-06485-7 30262806 PMC6160438 62 Gao L Antic T Hyjek E 2013 Immunohistochemical analysis of Ecadherin and zeste homolog 2 expression in endoscopic ultrasoundguided fine-needle aspiration of pancreatic adenocarcinoma Cancer Cytopathol 121 644 652 10.1002/cncy.21310 23674382 63 Dim DC Jiang F Qiu Q 2014 The usefulness of S100P, mesothelin, fascin, prostate stem cell antigen, and 14-3-3 sigma in diagnosing pancreatic adenocarcinoma in cytological specimens obtained by endoscopic

ultrasound guided fine-needle aspiration *Diagn Cytopathol* 42 193 199 10.1002/dc.21684 21538952

64 Hasegawa T Yamao K Hijioka S 2014 Evaluation of Ki-67 index in EUS-FNA specimens for the assessment of malignancy risk in pancreatic neuroendocrine tumors *Endoscopy* 46 32 38 10.1055/s-0033-1344958 24218309 65 O'Brien MJ Takahashi M Brugal G 1998 Digital imagery/telecytology. International Academy of Cytology Task Force summary. *Diagnostic cytology towards the 21st century: an international expert conference and tutorial Acta Cytol* 42 148 164 10.1159/000331540 9479334 66 Kim B Chhieng DC Crowe DR 2006 Dynamic telecytopathology of on site rapid cytology diagnoses for pancreatic carcinoma *Cytojournal* 3 27 10.1186/1742-6413-3-27 17156485 PMC1713251 67 Nasuti JF Gupta PK Baloch ZW 2002 Diagnostic value and cost-effectiveness of on-site evaluation of fine-needle aspiration specimens: review of 5,688 cases *Diagn Cytopathol* 27 1 4 10.1002/dc.10065 12112806 68 Alsharif M Carlo-Demovich J Massey C 2010 Telecytopathology for immediate evaluation of fine-needle aspiration specimens *Cancer Cytopathol* 118 119 126 10.1002/cncy.20074 20544707 69 Marotti JD Johncox V Ng D Gonzalez JL Padmanabhan V 2012 Implementation of telecytology for immediate assessment of endoscopic ultrasound-guided fine-needle aspirations compared to conventional on-site evaluation: analysis of 240 consecutive cases *Acta Cytol* 56 548 553 10.1159/000339546 23075898 70 Brosens LA Hackeng WM Offerhaus GJ Hruban RH Wood LD 2015 Pancreatic adenocarcinoma pathology: changing "landscape" *J Gastrointest Oncol* 6 358 374 10.3978/j.issn.2078-6891.2015.032 26261723 PMC4502163 71 Matsubayashi H Watanabe H Ajioka Y 2000 Different amounts of Kras mutant epithelial cells in pancreatic carcinoma and mass-forming pancreatitis *Pancreas* 21 77 85 10.1097/00006676-200007000-00055 10881936 72 Kleeff J Korc M Apte M 2016 Pancreatic cancer *Nat Rev Dis Primers* 2 16022 10.1038/nrdp.2016.22 27158978 73 Levy MJ Oberg TN Campion MB 2012 Comparison of methods to detect neoplasia in patients undergoing endoscopic ultrasound-guided fine-needle aspiration *Gastroenterology* 142 1112 1121.e2 10.1053/j.gastro.2012.02.002 22326996 74 Ribeiro A Peng J Casas C Fan YS 2014 Endoscopic ultrasound guided fine needle aspiration with fluorescence in situ hybridization analysis in 104 patients with pancreatic mass *J Gastroenterol Hepatol* 29 1654 1658 10.1111/jgh.12575 24628622 75 Koorstra JB Hustinx SR Offerhaus GJ Maitra A 2008 Pancreatic carcinogenesis *Pancreatol* 8 110 125 10.1159/000123838 18382097 PMC2663569 76 Jhala NC Eltoun IA Eloubeidi MA 2007 Providing on-site diagnosis of malignancy on endoscopic-ultrasound-guided fine-needle aspirates: should it be done? *Ann Diagn Pathol* 11 176 181 10.1016/j.anndiagpath.2006.03.005 17498591 77 Oshima M Okano K Muraki S 2013 Immunohistochemically detected expression of 3 major genes (CDKN2A/p16, TP53, and SMAD4/DPC4) strongly predicts survival in patients with resectable pancreatic cancer *Ann Surg* 258 336 346 10.1097/SLA.0b013e3182827a65 23470568 78 Lee J Jang KT Ki CS 2007 Impact of epidermal growth factor receptor (EGFR) kinase mutations, EGFR gene amplifications, and KRAS mutations on survival of pancreatic adenocarcinoma *Cancer* 109 1561 1569 10.1002/cncr.22559 17354229 79 Kobayashi M Mizuno S Murata Y 2014 Gemcitabine-based chemoradiotherapy followed by surgery for borderline resectable and locally unresectable pancreatic ductal adenocarcinoma: significance of the CA19-9 reduction rate and intratumoral human equilibrative nucleoside transporter 1 expression *Pancreas* 43 350 360 10.1097/MPA.000000000000059 24622063 PMC4210173 80 Fujita H Ohuchida K Mizumoto K 2011 High EGFR mRNA expression is a prognostic factor for reduced survival in pancreatic cancer after gemcitabine-based adjuvant chemotherapy *Int J Oncol* 38 629 641 10.3892/ijo.2011.908 21243324 81 Ma G Sun Y Fu S 2015 Evaluation of S100A4 mRNA in EUS-FNA specimens for the assessment of chemosensitivity to gemcitabine from patients with unresectable pancreatic cancer *Int J Clin Exp Pathol* 8 13284 13288 26722531 PMC4680476 82 Preis M Gardner TB Gordon SR 2011 MicroRNA-10b expression correlates with response to neoadjuvant therapy and survival in pancreatic ductal adenocarcinoma *Clin Cancer Res* 17 5812 5821 10.1158/1078-0432.CCR-11-0695 21652542 PMC3167031 83 Duconseil P Gilibert M Gayet O 2015 Transcriptomic analysis predicts survival and sensitivity to anticancer drugs of patients with a pancreatic adenocarcinoma *Am J Pathol* 185 1022 1032 10.1016/j.ajpath.2014.11.029 25765988 84 Wakatsuki T Irisawa A Imamura H 2010 Complete response of anaplastic pancreatic carcinoma to paclitaxel treatment selected by chemosensitivity testing *Int J Clin Oncol* 15 310 313 10.1007/s10147-010-0038-9 20195681 85 Wang KX Ben QW Jin ZD 2011 Assessment of morbidity and mortality associated with EUS-guided FNA: a systematic review *Gastrointest Endosc* 73 283 290 10.1016/j.gie.2010.10.045 21295642 86 Eloubeidi MA Gress FG Savides TJ 2004 Acute pancreatitis after EUS-guided FNA of solid pancreatic masses: a

pooled analysis from EUS centers in the United States *Gastrointest Endosc* 60 385 389 10.1016/S0016-5107(04)01714-6 15332028 87 Rodríguez-D'Jesús A Fernández-Esparrach G Marra-Lopez C 2016 Adverse events of EUS-guided FNA of pancreatic cystic and solid lesions by using the lexicon proposed in an ASGE workshop: a prospective and comparative study *Gastrointest Endosc* 83 780 784 10.1016/j.gie.2015.08.035 26301408 88 Fernández-Esparrach G Ginès A García P 2007 Incidence and clinical significance of hyperamylasemia after endoscopic ultrasound-guided fine-needle aspiration (EUS-FNA) of pancreatic lesions: a prospective and controlled study *Endoscopy* 39 720 724 10.1055/s-2007-966719 17661248 89 Gress FG Barawi M Kim D Grendell JH 2002 Preoperative localization of a neuroendocrine tumor of the pancreas with EUS-guided fine needle tattooing *Gastrointest Endosc* 55 594 597 10.1067/mge.2002.122580 11923783 90 Katanuma A Maguchi H Yane K 2013 Factors predictive of adverse events associated with endoscopic ultrasound-guided fine needle aspiration of pancreatic solid lesions *Dig Dis Sci* 58 2093 2099 10.1007/s10620-013-2590-4 23423501 PMC3695684 91 Fujii LL Levy MJ 2014 Basic techniques in endoscopic ultrasound-guided fine needle aspiration for solid lesions: adverse events and avoiding them *Endosc Ultrasound* 3 35 45 10.4103/2303-9027.123006 24949409 PMC4063261 92 Janssen J König K Knop-Hammad V Johanns W Greiner L 2004 Frequency of bacteremia after linear EUS of the upper GI tract with and without FNA *Gastrointest Endosc* 59 339 344 10.1016/S0016-5107(03)02707-X 14997128 93 Guarner-Argente C Shah P Buchner A Ahmad NA Kochman ML Ginsberg GG 2011 Use of antimicrobials for EUS-guided FNA of pancreatic cysts: a retrospective, comparative analysis *Gastrointest Endosc* 74 81 86 10.1016/j.gie.2011.03.1244 21704808 94 Banerjee S Shen B Asge Standards of Practice Committee 2008 Antibiotic prophylaxis for GI endoscopy *Gastrointest Endosc* 67 791 798 10.1016/j.gie.2008.02.068 18374919 95 Polkowski M Larghi A Weynand B 2012 Learning, techniques, and complications of endoscopic ultrasound (EUS)-guided sampling in gastroenterology: European Society of Gastrointestinal Endoscopy (ESGE) Technical Guideline *Endoscopy* 44 190 206 10.1055/s-0031-1291543 22180307 96 Hamada T Yasunaga H Nakai Y 2014 Severe bleeding and perforation are rare complications of endoscopic ultrasound-guided fine needle aspiration for pancreatic masses: an analysis of 3,090 patients from 212 hospitals *Gut Liver* 8 215 218 10.5009/gnl.2014.8.2.215 24672664 PMC3964273 97 Dumonceau JM Deprez PH Jenssen C 2017 Indications, results, and clinical impact of endoscopic ultrasound (EUS)-guided sampling in gastroenterology: European Society of Gastrointestinal Endoscopy (ESGE) Clinical Guideline - Updated January 2017 *Endoscopy* 49 695 714 10.1055/s-0043-109021 28511234 98 Affi A Vazquez-Sequeiros E Norton ID Clain JE Wiersema MJ 2001 Acute extraluminal hemorrhage associated with EUS-guided fine needle aspiration: frequency and clinical significance *Gastrointest Endosc* 53 221 225 10.1067/mge.2001.111391 11174300 99 Varadarajulu S Eloubeidi MA 2004 Frequency and significance of acute intracystic hemorrhage during EUS-FNA of cystic lesions of the pancreas *Gastrointest Endosc* 60 631 635 10.1016/S0016-5107(04)01891-7 15472697 100 Veitch AM Vanbiervliet G Gershlick AH 2016 Endoscopy in patients on antiplatelet or anticoagulant therapy, including direct oral anticoagulants: British Society of Gastroenterology (BSG) and European Society of Gastrointestinal Endoscopy (ESGE) guidelines *Gut* 65 374 389 10.1136/gutjnl-2015-311110 26873868 PMC4789831 101 Minaga K Kitano M Enoki E Kashida H Kudo M 2016 Needle-tract seeding on the proximal gastric wall after EUS-guided fine-needle aspiration of a pancreatic mass *Am J Gastroenterol* 111 1515 1515 10.1038/ajg.2016.307 27808133 102 Eloubeidi MA Decker GA ASGE Standards of Practice Committee 2016 The role of endoscopy in the evaluation and management of patients with solid pancreatic neoplasia *Gastrointest Endosc* 83 17 28 10.1016/j.gie.2015.09.009 26706297 103 Yane K Kuwatani M Yoshida M 2020 Non-negligible rate of needle tract seeding after endoscopic ultrasound-guided fine-needle aspiration for patients undergoing distal pancreatectomy for pancreatic cancer *Dig Endosc* 32 801 811 10.1111/den.13615 31876309 104 Eloubeidi MA Tamhane A 2005 EUS-guided FNA of solid pancreatic masses: a learning curve with 300 consecutive procedures *Gastrointest Endosc* 61 700 708 10.1016/S0016-5107(05)00363-9 15855975 105 Mertz H Gautam S 2004 The learning curve for EUS-guided FNA of pancreatic cancer *Gastrointest Endosc* 59 33 37 10.1016/S0016-5107(03)02028-5 14722544 106 Harewood GC Wiersema LM Halling AC Keeney GL Salamao DR Wiersema MJ 2002 Influence of EUS training and pathology interpretation on accuracy of EUS-guided fine needle aspiration of pancreatic masses *Gastrointest Endosc* 55 669 673 10.1067/mge.2002.123419 11979248 107 Eisen GM Dominitz JA Faigel DO 2001 Guidelines for credentialing and granting privileges for endoscopic ultrasound *Gastrointest Endosc* 54 811 814

10.1016/S0016-5107(01)70082-X 11726873 108 Klapman JB Logrono R Dye CE Waxman I 2003 Clinical impact of on-site cytopathology interpretation on endoscopic ultrasound-guided fine needle aspiration Am J Gastroenterol 98 1289 1294 10.1111/j.1572-0241.2003.07472.x 12818271 109 Faulx AL Lightdale JR ASGE Standards of Practice Committee 2017 Guidelines for privileging, credentialing, and proctoring to perform GI endoscopy Gastrointest Endosc 85 273 281 10.1016/j.gie.2016.10.036 28089029 110 DiMaio CJ Mishra G ASGE Training Committee 2012 EUS core curriculum Gastrointest Endosc 76 476 481 10.1016/j.gie.2012.04.437 22898403 111 Wani S Coté GA Keswani R 2013 Learning curves for EUS by using cumulative sum analysis: implications for American Society for Gastrointestinal Endoscopy recommendations for training Gastrointest Endosc 77 558 565 10.1016/j.gie.2012.10.012 23260317 112 Wani S Han S Simon V 2019 Setting minimum standards for training in EUS and ERCP: results from a prospective multicenter study evaluating learning curves and competence among advanced endoscopy trainees Gastrointest Endosc 89 1160 1168.e9 10.1016/j.gie.2019.01.030 30738985 PMC6527477 113 Sarker SK Albrani T Zaman A Kumar I 2010 Procedural performance in gastrointestinal endoscopy: live and simulated World J Surg 34 1764 1770 10.1007/s00268-010-0579-0 20440616 Fig. 1 Endoscopic ultrasound image of different solid pancreatic tumors (arrows of A-F). (A) Solid lesion located in the pancreatic head, corresponding to pancreatic ductal adenocarcinoma. (B) Pancreatic neuroendocrine tumor located in the pancreatic tail. (C) Insulinoma located in the pancreatic tail. (D) Solid pseudopapillary tumor located in the pancreatic tail. (E) Mass-forming chronic pancreatitis located in the pancreatic neck. (F) Mass-forming autoimmune pancreatitis located in the pancreatic head with bile duct obstruction. PV, portal vein; CBD, common bile duct.

Task Force Team for the Guideline for EUS-guided Tissue Acquisition of Pancreatic Solid Tumor

Summary and Strength of Recommendations for EUS-guided Tissue Acquisition of Pancreatic Solid Tumor

EUS, endoscopic ultrasound; FNA, fine-needle aspiration; FNB, fine needle biopsy; ROSE, rapid on-site evaluation; CT, computed tomography.

Available Needles in the Market of Korea for Endoscopic Ultrasound-guided Tissue Acquisition of Pancreatic Solid Tumors (modified from Ang et al. 18)

a A newly marketed needle designed with a core trap and bevel system to increase diagnostic yield and enhance procurement of histologic core, while other gauge needles (19, 22, and 25 gauge) have a reversed bevel system; b A newly marketed needle designed with a core trap and bi-bevel system to increase diagnostic yield and enhance procurement of histologic core.

Standardized Terminology and Nomenclature of Pancreatobiliary Cytology Specimens in 2014 (modified from Pitman et al. 26)

CEA, carcinoembryonic antigen; KRAS, Kirsten rat sarcoma viral oncogene homolog; GNAS, guanine nucleotide-binding protein/ α -subunit.

Specific Indicators of Immunohistochemistry Staining (modified from Bor et al. 47)

Procedure-related Adverse Events from Endoscopic Ultrasound-guided Tissue Acquisition for Pancreatic Lesions