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Mini Review

Endoscopy Ultrasound from Radial to Linear, Breaking Paradigm

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Abstract

Since the introduction of Endoscopy ultrasound (EUS) in the clinical practice at the beginning 0f 80´s, the radial echo endoscope(rEUS) was used as diagnostic technique in benign and malignant Gastrointestinal lesions for many years, but its lack to take samples for cytology, of sub epithelial or extramural tumors, pancreas or lymph node, brought in to the field the curvilinear EUS(cEUS) which provide an accurate view of the needle tract; These different applications created a false paradigm that all Gastroenterology services should have both scopes, one rEUS for diagnostic and one cEUS for Fine Needle Aspiration (FNA) and therapeutic, "these necessities" compelled a big economical problem to underdeveloped countries by making highly expensive and almost impossible to acquire the scopes.

This is why since 2001, we started to use cEUS not only to perform FNA, but also as a diagnostic technique in upper, and lower Gastrointestinal GI tract but also in biliary, liver and pancreatic diseases.

We will review the literature and our experience using cEUS as a multipurpose scope Which is a cost-benefit option for all Gastroenterology Units meaning huge saving resources.

Keywords: *Endoscopic Ultrasound Radial to Linear; Paradigm*

Introduction

Endoscopy ultrasound in the gastrointestinal tract was first used in humans in the beginning of 80's; with a prototype [1] demonstrating that the procedure was safe, feasible and provide a good quality real time imaging of gastric wall and pancreas.

In 1984, Tio TL., *et al*. [2] using mechanical radial endoscopy ultrasound(rEUS) reported how this technique help in the staging of different tumors in esophagus, stomach y papilla of vater; later on, the same author showed us it´s utility in the evaluation of biliary tumors [3]. Since then Dr Tio TL published more than 60 papers including a rEUS atlas in 1984, with the time modifications appeared in both sides, endoscope from fiber optic to video and ultrasound probe from mono frequency to multi frequency and from mechanical to electronic, nevertheless this scope did not have the capability to performed biopsy.

Facts with curvilinear Endoscopic ultrasound

In 1991, Vilman P [4,5], employed a prototype by Pentax-Picker and reported the used of curvilinear cEUS in the evaluation of the upper gastrointestinal tract lesions but with more difficulties than radial EUS for diagnostic purpose, however its major application of this cEUS was for tissue sample doing fine needle aspiration (FNA).

A paradigm was created "Radial EUS is the method for diagnostic and staging, Curvilinear EUS is only for FNA" despite this, more effort was done trying to demonstrate that cEUS had the same capability as rEUS for diagnostic and staging [6,7], but always with the same conclusion that cEUS was more difficult than radial for diagnostic and staging.

Additional to cEUS-FNA, another application was introduced to cEUS such as celiac plexus neurolysis [8] and the paradigm remains popular in all teaching centers, but 15 years after the first EUS report that established rEUS as the equipment for diagnostic EUS; in 1997, Gress F., *et al*. [9], published a paper comparing rEUS Vs cEUS in staging pancreatic cancer with almost the same effectiveness.

The created paradigm according to which an Endosonography had to perform initially rEUS for staging luminal GI tract, biliary, pancreatic or hepatic lesions, followed up by cEUS-FNA, was not congruent due to the required precise vision of the targeted lesion.

Since the 80´s, this paradigm was taught, rEUS for diagnosis and cEUS for FNA and therapeutic; but in need to adapt to the wavering economy of our underdeveloped country, we were compelled to work with the available resources.

For that reason, in 2001 when our Hospital evaluated the possibility to acquire two EUS-scope (radial and linear), they soon realized the economical impossibility of this task. Therefore, only the cEUS was bought, meaning it was going to be used for all purposes: staging luminal and extra luminal lesions (with the sole exception of anal canal lesions) and FNA biopsy.

Like other endosonographers, we found that cEUS was more technically-demanding for evaluation of epithelial and sub epithelial lesions of esophagus, stomach, duodenum or rectosigmoid. This also applied to pancreas, biliary tract, gallbladder and mediastina, but later on it became just as easy as using rEUS; facing our self with the disruption of this paradigm. Indeed, the anatomy is the same what changes is the way we observe it. Once the expertise with rEUS is acquired in a short learning curve, cEUS becomes perfectly maneuverable. Moreover, cEUS can be learned independently from rEUS, meaning it is not necessary to learn rEUS to dominate cEUS.

Medical Literature

A review of the available medical literature using the key words endoscopy ultrasound in PubMed, which includes radial and linear EUS, we found 63956 reports. However, closing the search to linear EUS, only few papers have been written on the use of cEUS as a diagnostic tool, more specifically 121 out of 341 papers. This means that, despite it has passed more than 30 years since endoscopy ultrasound was introduced in medical practice, only few Endosonographers experimented its usage as a multipurpose scope.

Nevertheless, there are some descriptions of the use of cEUS in the evaluation of GI lesions in different locations, such as EGJ, stomach, bile duct, gallbladder and pancreas. All with good performance [10-19].

Discussion

Curvilinear EUS is an excellent tool with Endosonographers resistance to use it for diagnostic purposes. In fact, cEUS has been used for benign and malignant extrahepatic bile duct and pancreatic pathology as it was shown by Giovannini., *et al*. [20] many years ago, whom demonstrated the different applications of this technique in normal, benign and malignant biliary, pancreas, ampulla of vater and pancreatic duct diseases, and concluded that cEUS was a positive method in the evaluation of pancreato biliary area.

Atsushi Irisawa [21] published a paper in 2011 in which he conducted a survey using a questionnaire to elucidate the current status of radial and curved-linear arrayed EUS in ten Japanese high-volume hospitals. Two types of EUS methods were available; only one institution used cEUS as primary scope for diagnostic and biopsy pancreatic diseases.

Moreover, another investigation in 2000 appeared using cEUS in suspected bile duct stones [22] with overall sensitivity, specificity, positive and negative predictive values and accuracy of 100%; 94.7%; 91.7%; 100%, and 96.7%, respectively for bile duct stones. The

gallbladder is also feasible to evaluate by c-EUS. Sharma M., *et al*. [23] in 2018 described the techniques of imaging the gallbladder by linear EUS from three different stations.

Overall, these studies mean that cEUS capabilities as a good method for diagnostic EUS is still trying to be demonstrated. In our Gastrointestinal Endoscopy Unit, we have tested cEUS since 2001 for different areas like: evaluation of esophageal and gastric sub epithelial tumor, staging early gastric and EGJ cancer, staging pancreatic tumor and ampulla of vater neoplasia, staging rectal lesions, FNA, and therapeutic purposes, such as the cases with celiac ganglion neurolysis, pancreatic pseudocyst drainage, among others, all of them with good results [20-30].

Conclusion

The paradigm that only radial Endoscopic Ultrasound should be used as a diagnostic scope and linear-EUS as a therapeutic scope has been disassembled. cEUS has been under the stigma of a therapeutic scope but nowadays an increasing number of Endosonography use it for diagnostic EUS, instead of employing rEUS, obtaining the same results as the latter but for the majority, its use is implicit in the daily clinical practice. There has been an increased necessity to handle the cEUS with extreme ability due to its growing field in therapeutic Endosonography. This is very relevant because according to Wei Xu., *et al* [24], learning rEUS first did not reduce the learning curve of cEUS or vice versa, due to the fact that they are a totally different techniques, suggesting that the training method might be changed.

Since 2001, the use of c-EUS in our unit has been the first choice for any lesion in the GI tract and bilio pancreatic area, except for cases of anal canal. Therefore, our fellows are first learning cEUS, without being previously taught on rEUS, providing excellent results.

Based on this experience we believe that the EUS fellow programs needs to be reviewed in each academic center where this technique is taught, addressing to get Endosonography experts in curvilinear endoscopic ultrasound, where the field in therapeutic is wide but with a plus that we can use this scope in diagnostic procedure. This approach will represent considerable savings for endoscopy units and fellows will develop their needed skills and the made advances may contribute to more investment and development by manufacturers.

The present and the future, especially in therapeutic, is of cEUS, where new applications are constantly appearing. If an endoscopy unit is thinking of acquiring an EUS scope, possibly the best option would be to go for a cEUS, which is the best cost-benefit choice. Some examples of our experience with cEUS as a diagnostic scope are shown in the figures below [25-36].

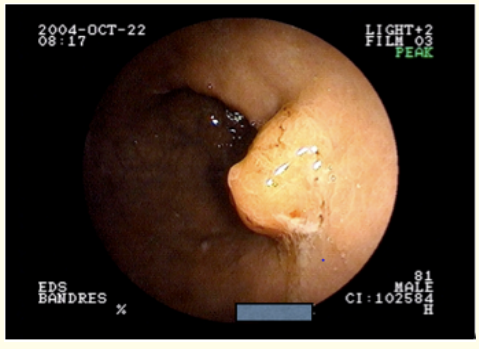

Figure 1: *Elevated body gastric lesion IIa.*

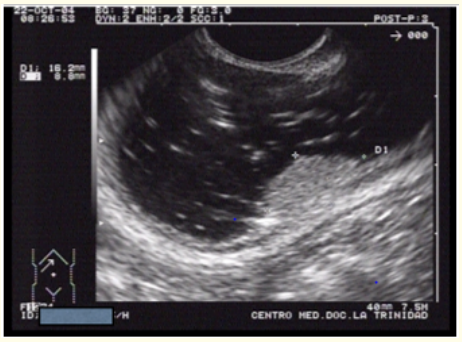

Figure 2: *c-EUS in 7,5 MHz showing the lesion T1m.*

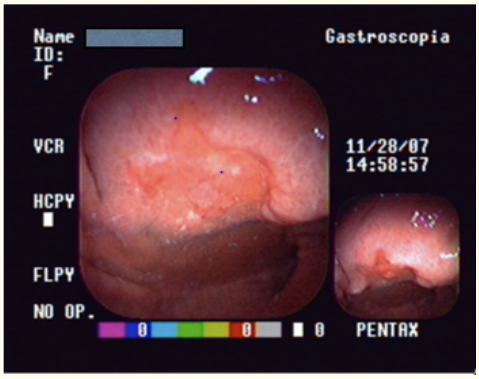

Figure 3: *Gastric Lesion Type IIc.*

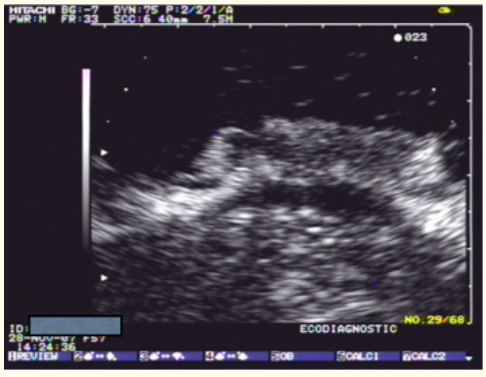

Figure 4: *cEUS in 7,5MHz, understaged as T1SM3 but P-staging was T2.*

Figure 5: *SM lesion of gastric fundus from Muscularis propia.*

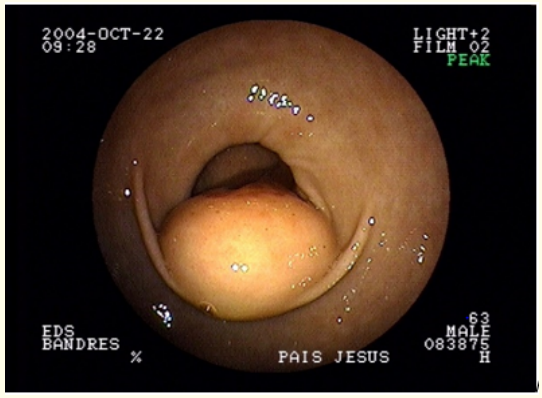

Figure 6: *Sub epithelial lesion of gastric body.*

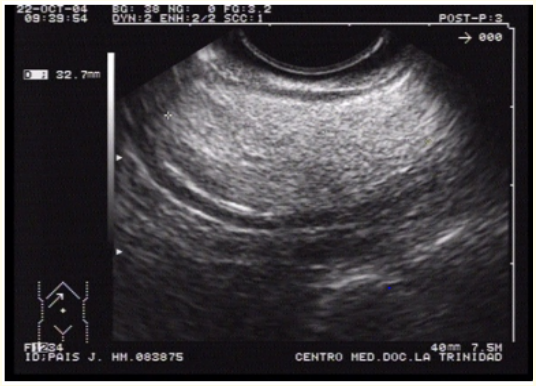

Figure 7: *cEUS of gastric body lesion: lipoma.*

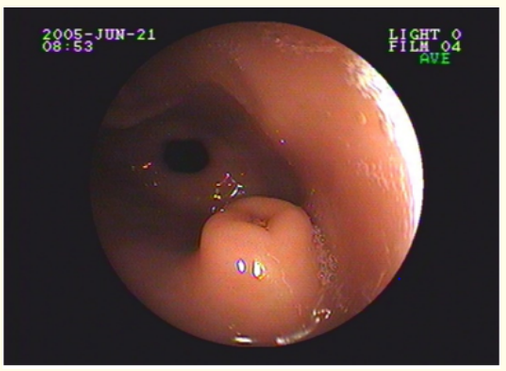

Figure 8: *Sub epithelial antral lesion grater curvature.*

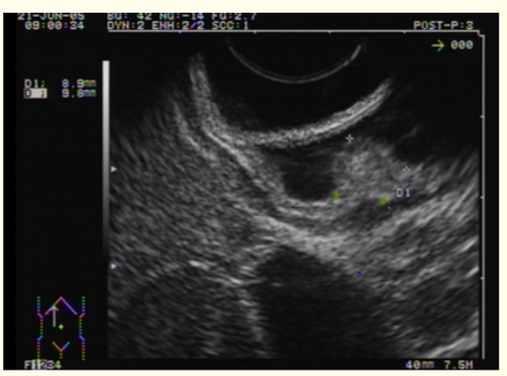

Figure 9: *cEUS 7,5MHz: SM lesion.*

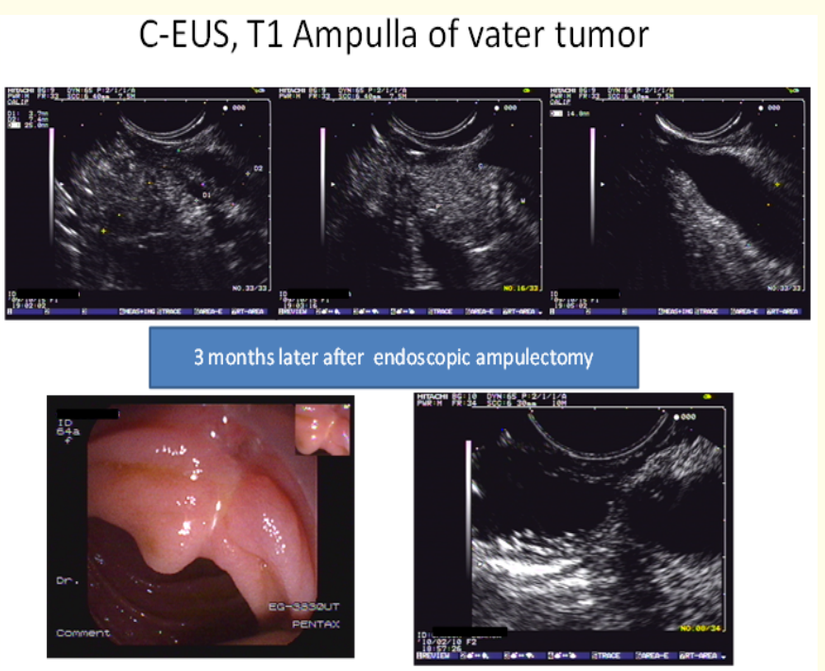

Figure 10

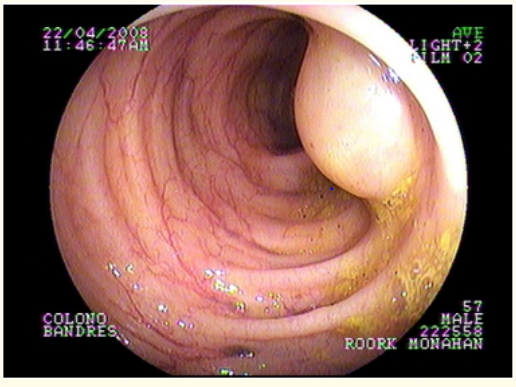

Figure 11: *Sub epithelial tumor in sigmoid colon.*

Figure 12: *cEUS, 7,5MHz: Cystic lesion.*

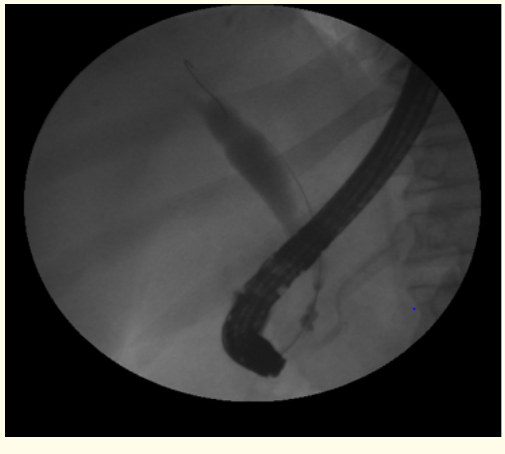

Figure 13: *ERCP small CBD stenosis Cholangiocarcinoma.*

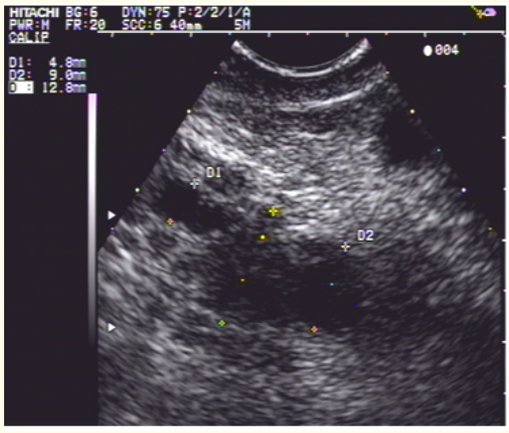

Figure 14: *cEUS: CBD T2; N1.*

Figure 15: *cEUS in ultra-small focal hepatic lesion + FNA cEUS.*

Figure 16: *Bile duct w/small stone.*

Figure 17: *Gall bladder stones by cEUS.*

Bibliography

1. Dimagno EP., *et al*. "Human Endoscopic ultrasonography". *Gastroenterology* 83.4 (1982): 824-829.

2. Tio TL and Tygat GN. "Endoscopic ultrasonography in the asssesment of intra and transmural infiltration of tumors in the oesophagus, stomach and papilla of vater and in the detection of extra oesophageal lesions". *Endoscopy* 16.6 (1984): 203-210.

3. Tio TL and Tygat GN. "Endoscopic ultrasonography of the bile duct malignancy and the preoperative assessment of local respectability". *Scandinavian Journal of Gastroenterology Supplement* 21.123 (1986): 151-157.

4. Vilman P., *et al*. "Endoscopic ultrasound examination of the upper gastrointestinal tract using a curved-array transducer. A preliminary report". *Surgical Endoscopy* 5.2 (1991): 79-82.

5. Vilman P and Hancke S. "Endoscopic ultrasound scanning of the upper gastrointestinal tract. Preliminary results". *Ugeskrift for Laeger* 153.6 (1991): 422-425.

6. Giovannini M., *et al*. "Electronic sectorial ultrasound endoscopy in benign, malignant tumoral pathology of the stomach. Results in 30 patients". *Gastroenterologie Clinique Et Biologique* 17.1 (1993): 26-32.

7. Vilman P and Hancke S. "Endoscopic ultrasound scanning of the upper gastrointestinal tract using a curve linear array transducer: "The linear anatomy"". *Gastrointestinal Endoscopy Clinics of North America* 5.3 (1995): 507-521.

8. Wiersema MJ and Wiersema LM. "Endosonography- Guided celiac plexus neurolysis". *Gastrointestinal Endoscopy* 44.6 (1996):656-662.

9. Gress F., et al. "Radial scanning and linear array endosconography for staging pancreatic cancer: A prospective randomized comparison". *Gastrointestinal Endoscopy* 45.2 (1997): 138-142.

10. Shimoyama S., *et al.* "Accuracy of linear array EUS for preoperative staging of gastric cardia cancer". *Gastrointestinal Endoscopy* 60.1 (2004): 50-55.

11. Yanai H., *et al*. "Diagnostic Utility of 20 megahertz linear endoscopic ultrasonography in early gastric cancer". *Gastrointestinal Endoscopy* 44.1(1996): 29-33.

12. Mortensen MB., *et al*. "Preoperative assessment of resecatability in gastroesophageal carcinoma by linear array endoscopic ultrasonography". *Scandinavian Journal of Gastroenterology* 29.4 (1994): 341-345.

13. Giovannini M., *et al.* "Electronic sectorial ultrasound endoscopy in benign and malignant tumoral pathology of the stomach. Results in 30 patients". *Gastroenterologie Clinique Et Biologique* 17.1 (1993): 26-32.

14. Tsendsuren T., *et al*. "Usefulness of endoscopic ultrasonography in the preoperative TNM staging of gastric cancer". *World Journal of Gastroenterology* 12.1 (2006): 43-47.

15. Matthes K., *et al*. "EUS staging of upper malignancies: results of a prospective randomized trial". *Gastrointestinal Endoscopy* 64.4 (2006): 496-502.

16. Kaneko M., *et al*. "Prospective randomized, comparative study of delineation capability of radial scanning and curve linear array endoscopic ultrasound for pancreaticobiliary region". *Endoscopy International open* 2.3 (2014): E160-E170.

17. Sharna M., *et al.* "Imaging of common bile duct by linear endoscopic ultrasound". *World Journal of Gastrointestinal Endoscopy* 7.15 (2015): 1170-1180.

18. Dhir V., et al. "Feasibility of a complete pancreatobiliary linear endoscopic ultrasound examination from the stomach". *Endoscopy* 50.1 (2018): 22-32.

19. Sharma M., *et al*. "Imaging of gall bladder by endoscopic ultrasound". *World Journal of Gastrointestinal Endoscopy* 10.1 (2018): 10-15.

20. Giovannini M., *et al*. "Endoscopic ultrasonography with a linear-type echoendoscope in the evaluation of 94 patients with pancreatobiliary disease". *Endoscopy* 26.7 (1994): 579-585.

21. Atsushi Irisawa. "Current role of radial and curved-linear arrayed EUS scopes for diagnosis of pancreatic abnormalities in Japan". *Digestive Endoscopy* 23.1 (2011): 9-11.

22. Lien-Fu Lin., *et al*. "Linear endoscopic ultrasound for clinically suspected bile duct stones". *Journal of the Chinese Medical Association* 75.6 (2012) e251-e254.

23. Malay Sharma *et al*. "Imaging of gall bladder by endoscopic ultrasound". *World Journal of Gastrointestinal Endoscopy* 10.1 (2018): 10-15.

24. Wei Xu., *et al*. "Prior Radial-Scanning Endoscopic Ultrasonography Training Did Not Contribute to Subsequent Linear-Array Endoscopic Ultrasonography Study Performance in the Stomach of a Porcine Model". *Gut and Liver* 9.3 (2015): 353-357.

25. Bandres D., *et al.* "Wilkie´s Syndrome. Diagnosed by Curvilinear Array Endoscopy Ultrasound. Unsuspected Entity". XVI International meeting on Endoscopic Ultrasound. San Francisco USA 69.2 (2008): S234.

26. Bandres D., *et al*. "Curvilinear Endoscopy Ultrasound in the Evaluation of Early Gastric Neoplasia". XVI International meeting on Endoscopic Ultrasound. San Francisco. USA 69.2 (2008): S234.

27. Bandres D., *et al*. "FNA in Solid pancreatic lesions in a Venezuelan Academic center". XVI International meeting on Endoscopic Ultrasound. San Francisco USA (2008).

28. Bandres D., *et al*. "Endoscopic Ultrasound-Guided fine needle aspiration of focal hepatic lesions". DDW USA (2012).

29. Bandres D., *et al*. "Endoscopy Ultrasound-Guided fine needle aspiration in patients with suspected cholangiocarcinoma: A Venezuelan experience". 77th Annual meeting of American College of Gastroenterology, Las Vegas USA (2012).

30. Bandres D., *et al*. "Ampulla of vater tumor stagying by curvilinear endoscopic ultrasound. A Venezuelan experience". *Journal of gastroenterology and hepatology* 28.3 (2013): 493.

31. Bandres D., *et al*. "Curvilinear endoscopic ultrasound in the assessment of subepithelial gastric lesions". *Journal of gastroenterology and hepatology* 28(2013): 517.

32. Ortega D., *et al*. "Endoscopy ultrasound guided pancreatic mass biopsy with procore needle. Panamerican Gastroenterology congress". Cartagena, Colombia (2016).

33. Bandres D., *et al*. "Endoscopy ultrasound Diagnosis of isolated rectal varix". Venezuelan gastrointestinal endoscopy congress (2017).

34. Bournigal J., *et al.* "Dynamic Elastografíy by endoscopy ultrasound in the evaluation of pancreatic mass. A case report". Venezuelan gastrointestinal endoscopy congress (2017).

35. Bandres D., *et al*. "Pancreatic pseudocyst drainage by endoscopy ultrasound". Venezuelan gastrointestinal endoscopy congress (2017).

36. Alcantara M., *et al*. "Cholangioresonance Vs endoscopy ultrasound in the diagnosis of acute biliary Stone obstruction and acute biliary pancreatitis". Venezuelan anual gastroenterology congress Congreso (2017).

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