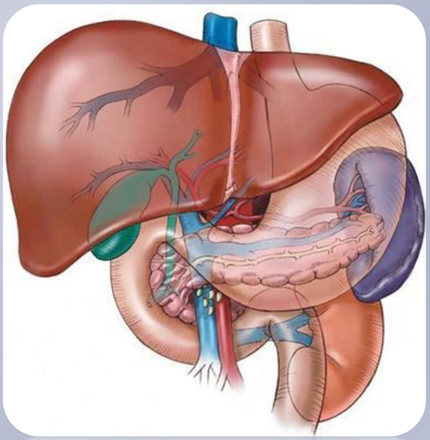
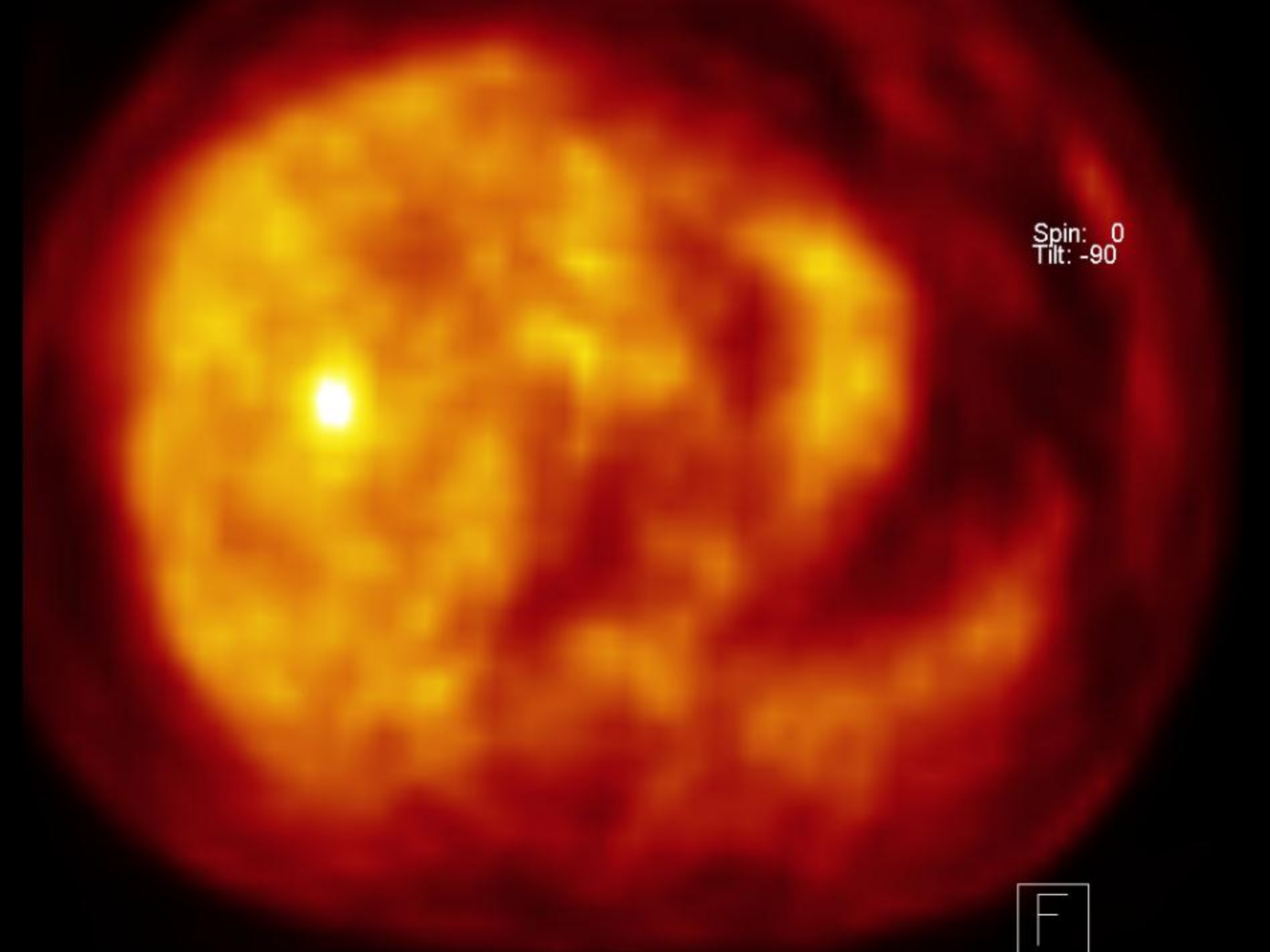


Peroperační ultrazvuk

Andrašina Tomáš

Radiologická klinika FN Brno a LF MU

Přednosta: prof. MUDr. Vlastimil Válek, CSc., MBA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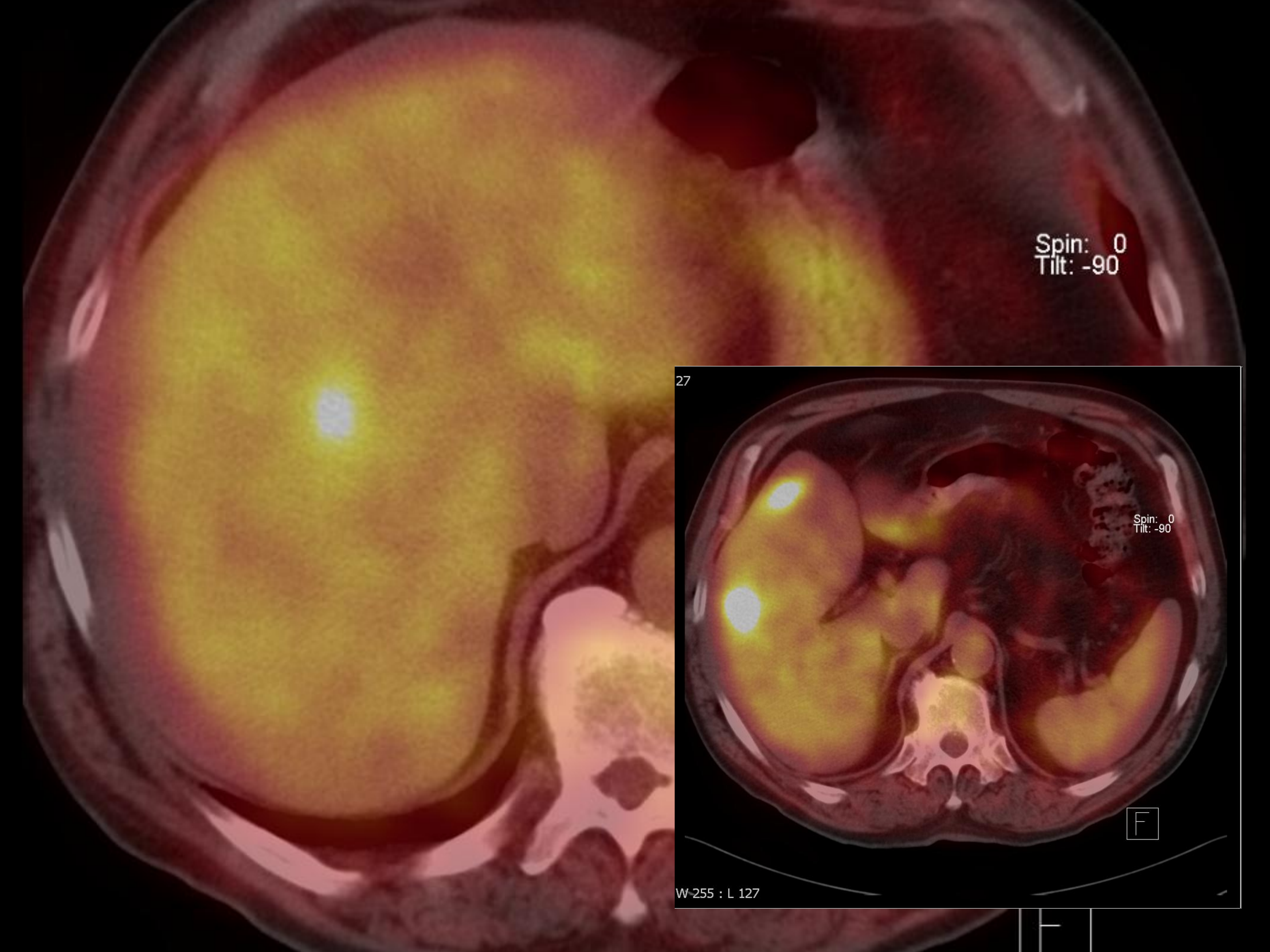
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27
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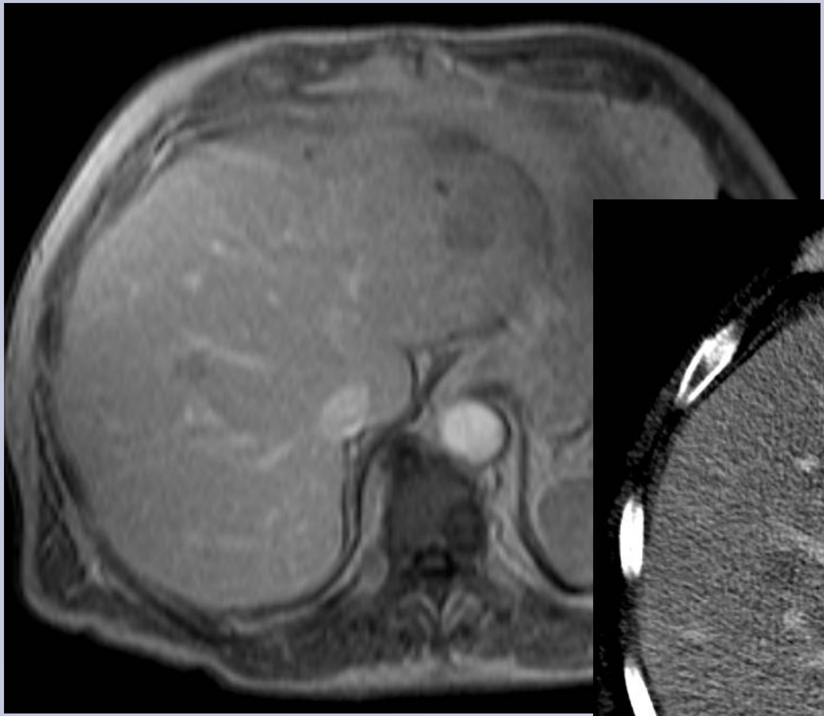
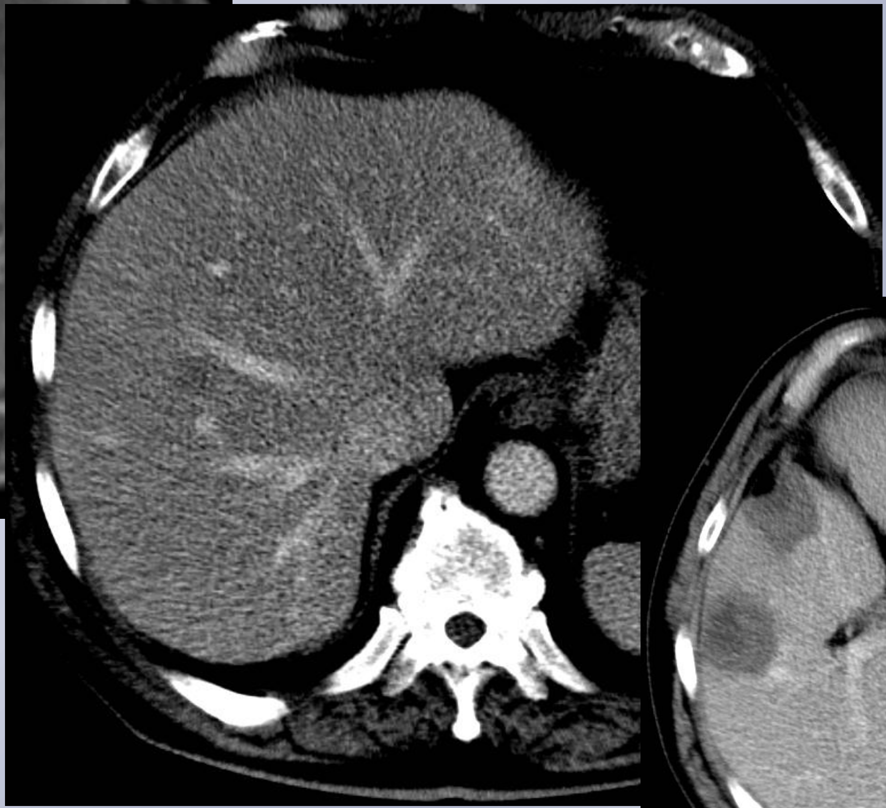
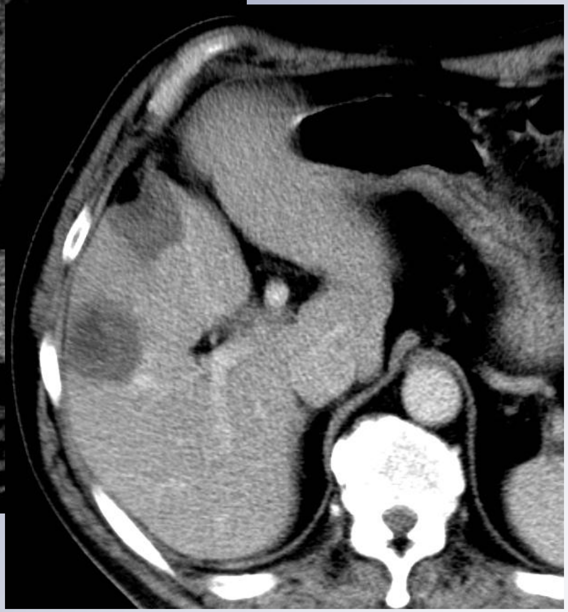
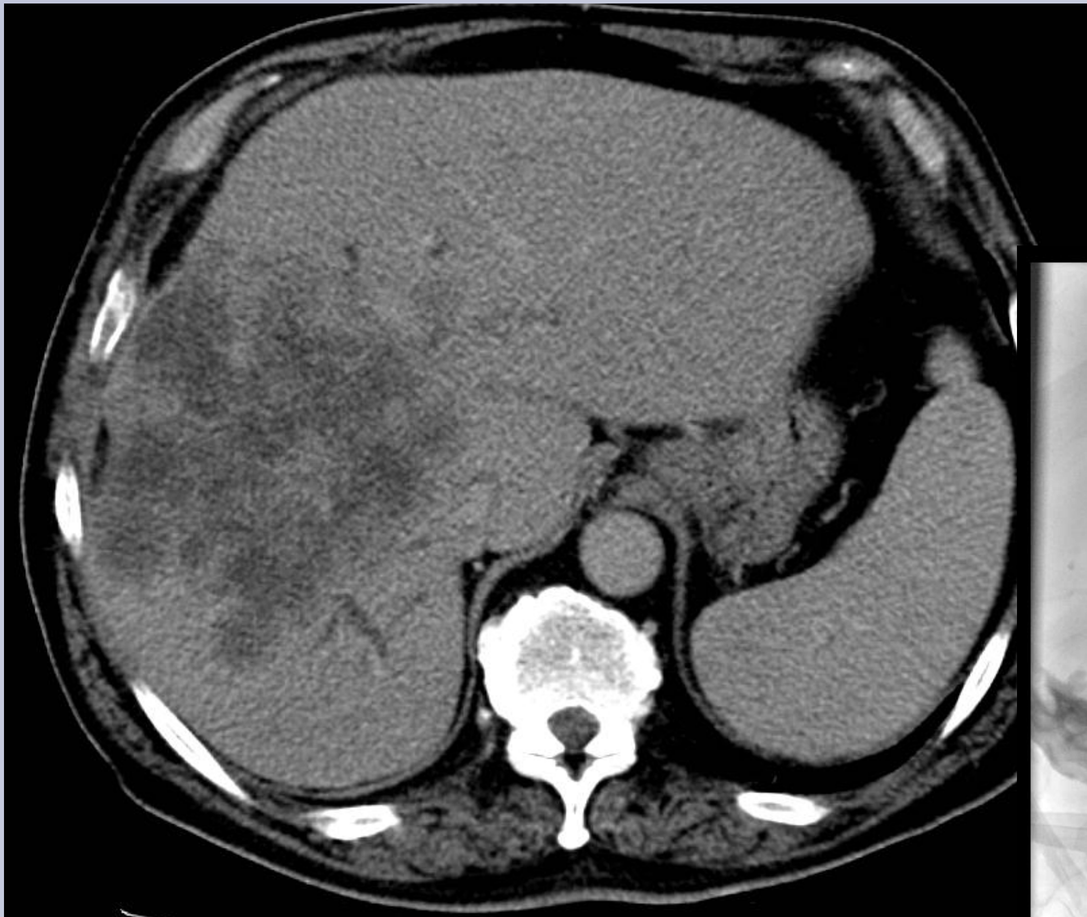
F
W 255 : L 127



Intraoperativní ultrazvuk (IOUS)

Metoda – dynamická

- sonda v přímém kontaktu s cílovou oblastí – méně artefaktů , vysoké rozlišení
- lokalizace patologie, detekce menších nodulů
- navádět intervenční procedury
- optimalizovat výkon - limitovat resp. rozšířit chirurgickou resekci,
- zpřesnit staging onemocnění
- bezpečná a levná metoda

- časově náročná pro personál (30-45min) – ale impakt na management pacienta

INTRAOPERATIVE ULTRASOUND
Radiologic Clinics of North America, Volume 39, Issue 3, 1 May 2001, Pages 429-448
Anne M. Silas, Jonathan B. Kruskal, Robert A. Kane

Philips HD 11XE

UZ sondy

- frekvence vyšší než 7Mhz, komfortní velikost, doppler, CEUS

L12-3

Broadband Linear Array Transdu

- 12 to 3 MHz exter
- 35 mm effective a
- 10° of trapezoidal
- Steerable pulsed w SonoCT, XRES, Pa
- High-resolution sup superficial vascular
- Supports biopsy gu

L15-7io

Broadband Compact Linear Array Transducer

- 15 to 7 MHz extended frequency range
- 23 mm effective aperture length
- 8° of trapezoidal imaging; 23 mm effective aperture length*
- Steerable pulsed Doppler, Color Doppler, and Color Power Angio, XRES, and Panoramic imaging
- High-resolution intraoperative vascular applications

* All features not available on all systems

UZ sondy II

Toshiba Xario PVT-745BTF Transducer

Intraoperative Transducer Details:Center Frequency: 7 MHzFrequency Selection: 11.0 MHz, 8.0 MHz, 4.0 MHzTHI Frequency Selection: 9.0 MHz, 7.6 MHz, 5.8…

Toshiba Xario PVT-745BTH Transducer

Convex Intraoperative Transducer Details:Center Frequency: 7 MHzFrequency Selection: 11.0 MHz, 8.0 MHz, 4.0 MHzTHI Frequency Selection: 9.0 MHz, 7.6 M…

Toshiba Xario PLT-1202s Transducer

Hocky Stick Linear Transducer / Probe Details:Center Frequency: 12 MHzNative Frequency Selection: 14.0 MHz, 12.0 MHz, 10 MHz, 7.0 MHzFrequency Selecti…

14L5 SP Transducer

Frequency Bandwidth:	5 – 14 MHz
Exam Types:	Breast, Cerebrovascular, High Framerate, Penile, Intraoperative Abdomen, Intraoperative Vascular, Musculoskeletal, Testicle, Thyroid

Design Attributes:
- Lightweight transducer with flexible cable
- Ergonomically designed form factor
- Virtual format imaging
- Sterilizable high resolution linear array for special applications
- User-selectable MultiHertz imaging

SIEMENS

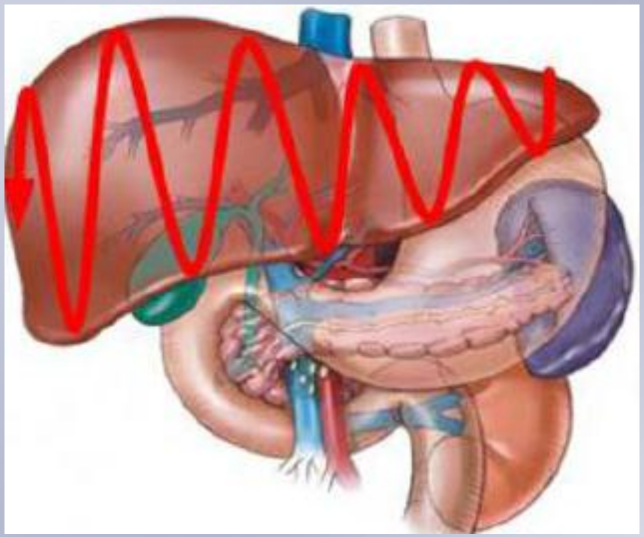

Hitachi Aloka

Laparoskopicky IOUS

Provedení

Játra

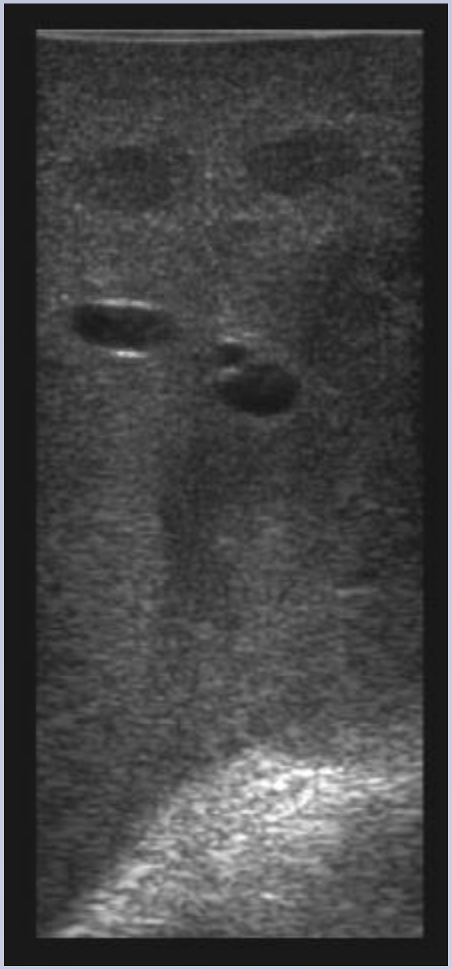
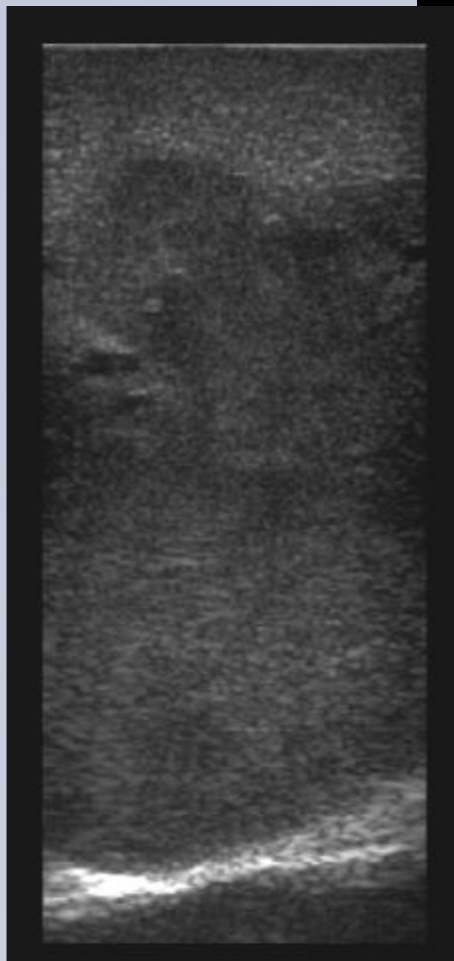
- Senzitivita k lézím i menším než 10mm 96%,
- léze od 2mm
- celý parenchym,
- vaskulární struktury – variety



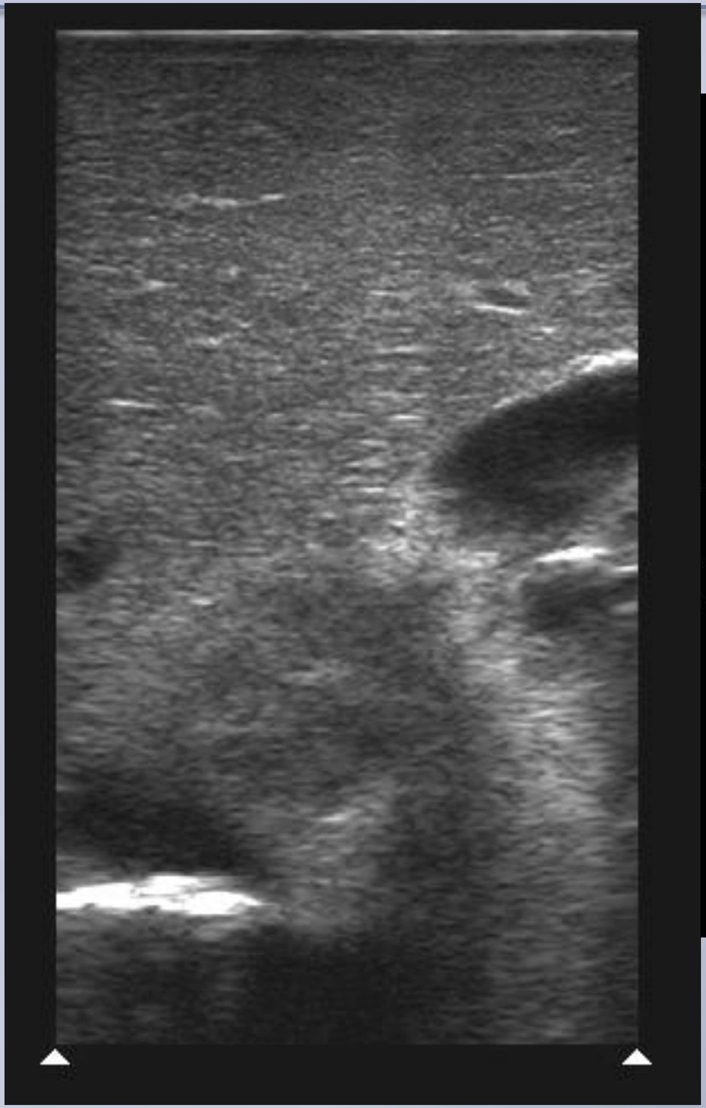
Obtížně hodnotitelné

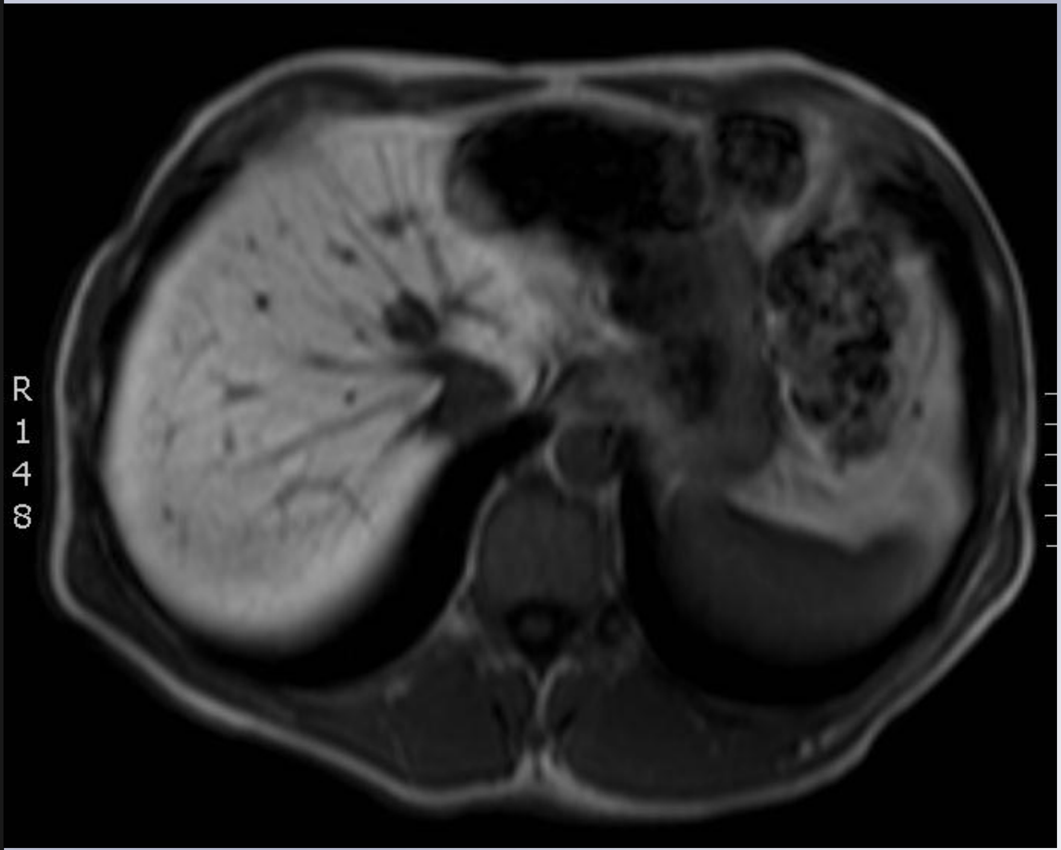
- kopula jater – vpravo (disekce ligamenta falciforme a triangulare)
- zadní subdiafragmatické oblasti
- povrchové léze u sond nízkých frekvencí (hamartomy)

mCRC


mCRC





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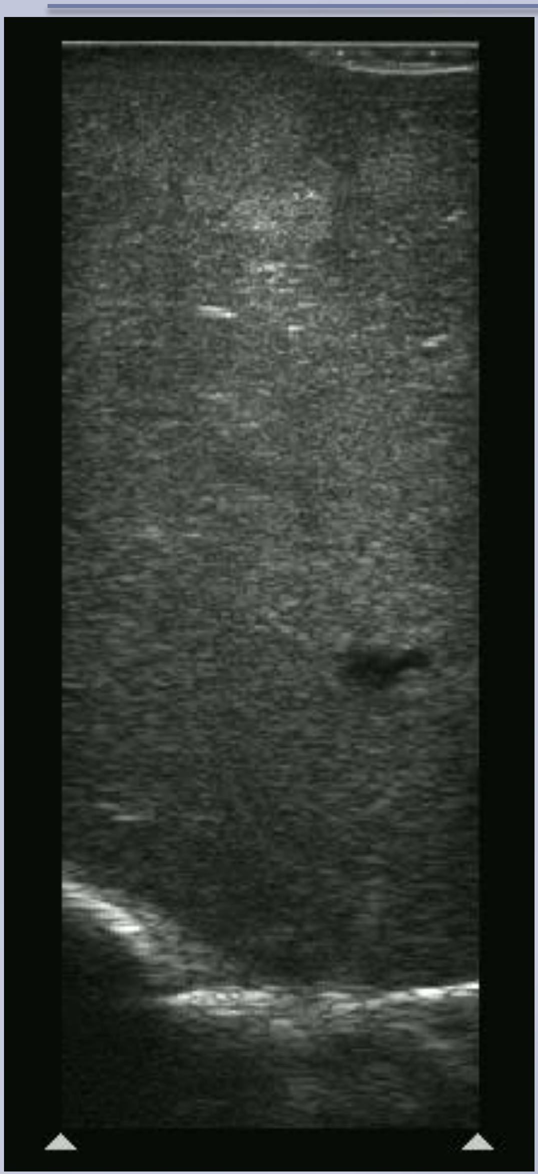

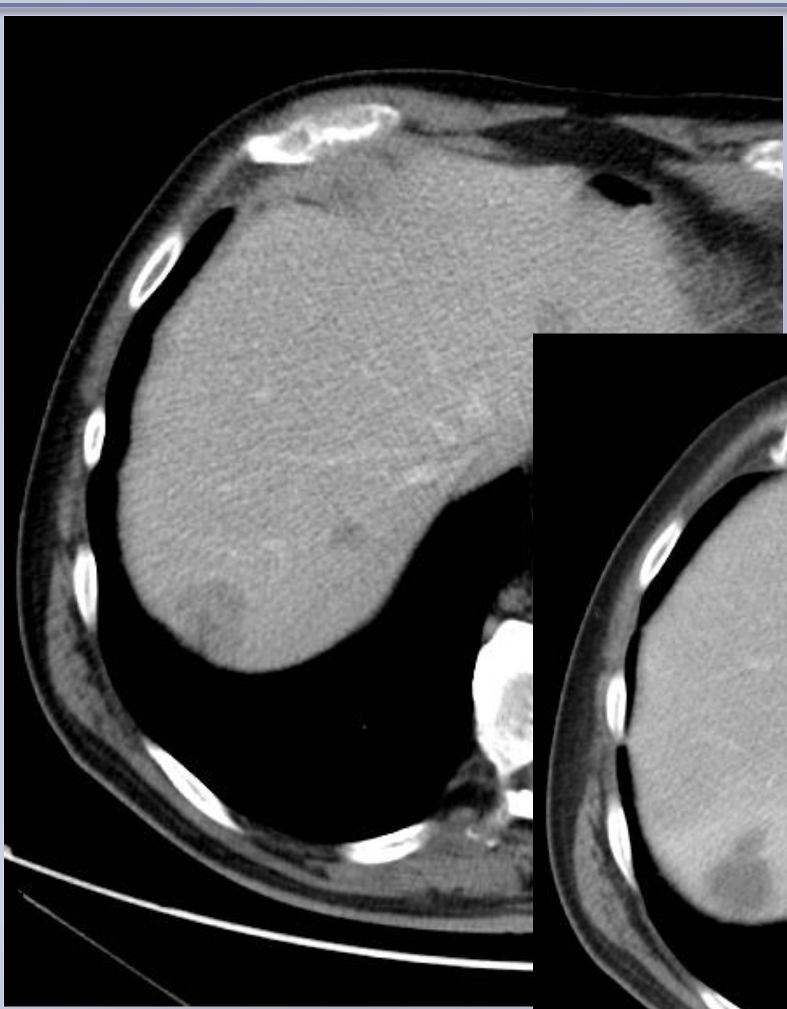

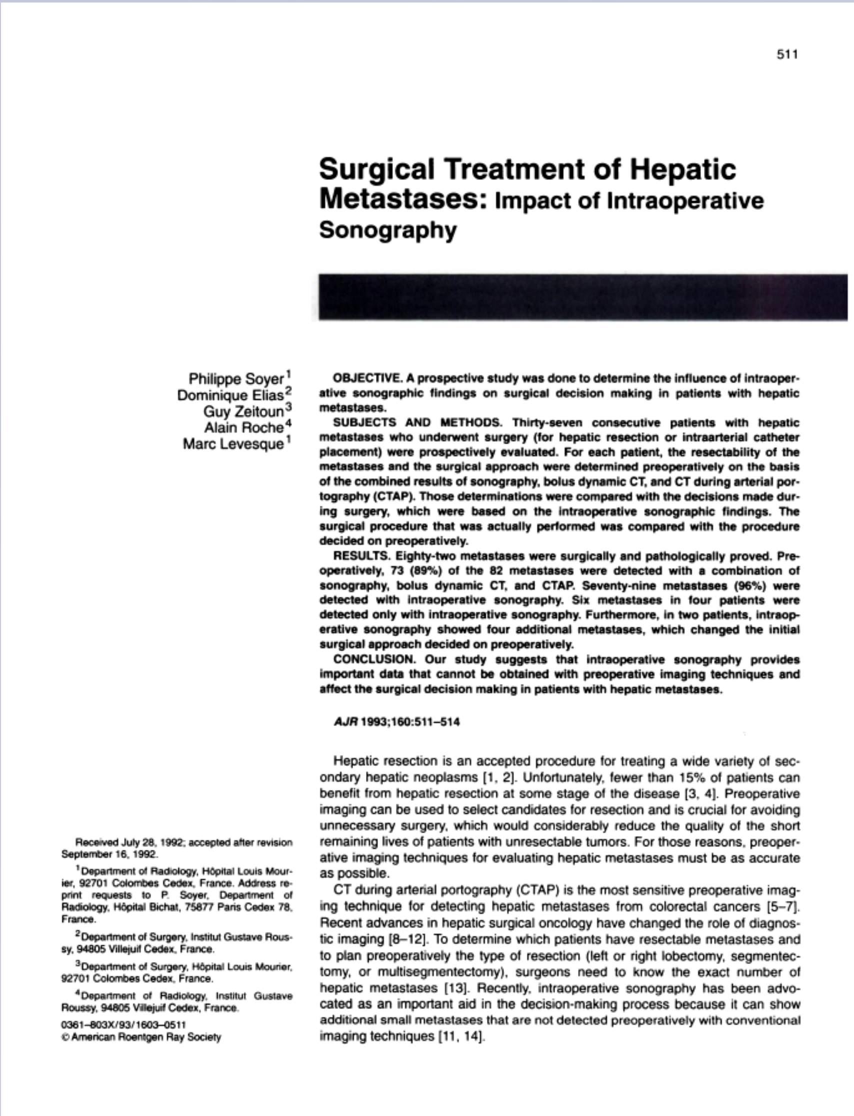

Surgical Treatment of Hepatic Metastases: Impact of Intraoperative Sonography

Philippe Soyer[1]
Dominique Elias[2]
Guy Zeitoun[3]
Alain Roche[4]
Marc Levesque[1]

OBJECTIVE. A prospective study was done to determine the influence of intraoperative sonographic findings on surgical decision making in patients with hepatic metastases.

SUBJECTS AND METHODS. Thirty-seven consecutive patients with hepatic metastases who underwent surgery (for hepatic resection or intraarterial catheter placement) were prospectively evaluated. For each patient, the resectability of the metastases and the surgical approach were determined preoperatively on the basis of the combined results of sonography, bolus dynamic CT, and CT during arterial portography (CTAP). Those determinations were compared with the decisions made during surgery, which were based on the intraoperative sonographic findings. The surgical procedure that was actually performed was compared with the procedure decided on preoperatively.

RESULTS. Eighty-two metastases were surgically and pathologically proved. Preoperatively, 73 (89%) of the 82 metastases were detected with a combination of sonography, bolus dynamic CT, and CTAP. Seventy-nine metastases (96%) were detected with intraoperative sonography. Six metastases in four patients were detected only with intraoperative sonography. Furthermore, in two patients, intraoperative sonography showed four additional metastases, which changed the initial surgical approach decided on preoperatively.

CONCLUSION. Our study suggests that intraoperative sonography provides important data that cannot be obtained with preoperative imaging techniques and affect the surgical decision making in patients with hepatic metastases.

AJR 1993;160:511–514

Hepatic resection is an accepted procedure for treating a wide variety of secondary hepatic neoplasms [1, 2]. Unfortunately, fewer than 15% of patients can benefit from hepatic resection at some stage of the disease [3, 4]. Preoperative imaging can be used to select candidates for resection and is crucial for avoiding unnecessary surgery, which would considerably reduce the quality of the short remaining lives of patients with unresectable tumors. For those reasons, preoperative imaging techniques for evaluating hepatic metastases must be as accurate as possible.

CT during arterial portography (CTAP) is the most sensitive preoperative imaging technique for detecting hepatic metastases from colorectal cancers [5–7]. Recent advances in hepatic surgical oncology have changed the role of diagnostic imaging [8–12]. To determine which patients have resectable metastases and to plan preoperatively the type of resection (left or right lobectomy, segmentectomy, or multisegmentectomy), surgeons need to know the exact number of hepatic metastases [13]. Recently, intraoperative sonography has been advocated as an important aid in the decision-making process because it can show additional small metastases that are not detected preoperatively with conventional imaging techniques [11, 14].

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[4]Department of Radiology, Institut Gustave Roussy, 94805 Villejuif Cedex, France.

0361–803X/93/1603–0511
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- První použití 1960
- V literatuře od 80-let
- 1992 Soyer - další metastázy

Clinical Radiology (1996) **51,** 157–159

Intraoperative Ultrasound in Colorectal Cancer Patients Undergoing Apparently Curative Surgery: Correlation With Two Year Follow-up

E. LEEN, W. J. ANGERSON*, P. O'GORMAN, T. G. COOKE* and C. S. McARDLE

*Department of Radiology, *University Department of Surgery, Royal Infirmary, Glasgow, UK*

Conventional ultrasound (US) and computerized tomography (CT) are well recognized to be limited in the detection of small liver metastases. In this study, we assessed the use of intraoperative ultrasound (IOUS) in the detection of 'occult' liver metastases in colorectal cancer patients undergoing apparently curative surgery of the primary colonic carcinoma.

Ninety three colorectal cancer patients undergoing apparently curative surgery on the basis of preoperative US, CT and laparotomy were studied. All patients underwent IOUS examination of the liver. After two year follow-up, 27 of these 93 patients developed overt liver metastases and of these 27, only five had been detected by IOUS examinations at the time of laparotomy.

The results suggest that IOUS is relatively insensitive in the detection of occult colorectal liver metastases. Its routine use as a screening tool during primary surgery is therefore not recommended. Leen, E., Angerson, W.J., O'Gorman, P., Cooke, T.G. & McArdle, C.S. (1996). *Clinical Radiology* **51,** 157–159. Intraoperative Ultrasound in Colorectal Cancer Patients Undergoing Apparently Curative Surgery: Correlation With Two Year Follow-up

Accepted for Publication 3 November 1995

Over 50% of colorectal cancer patients undergoing apparently curative resection of the primary tumour will die within 5 years [1]. Previous studies have shown that the majority of these patients have 'occult' liver metastases, i.e. those undetectable by the surgeon at laparotomy or on conventional pre-operative imaging. The presence or absence of these metastases is a major determinant of death from disseminated disease [2].

Conventional imaging techniques such as CT and ultrasound (US) are limited in the detection of small liver metastases [3]. Intraoperative ultrasound (IOUS) and computerized tomographic arterio-portography (CT-AP) are comparatively more sensitive and are well established staging procedures when hepatic resection is being considered [4,5]. However, CT-AP is too invasive to be used routinely as a screening tool, requiring as it does the catheterization of the superior mesenteric artery for the injection of contrast agent to enhance the intra-hepatic portal system.

In this study we assessed the use of IOUS in the detection of 'occult' liver metastases in patients undergoing an apparently curative surgery.

PATIENTS AND METHODS

Of 183 consecutive colorectal cancer patients studied, 90 had histological evidence of liver metastases. The remaining 93 (46 Dukes' C, 45 Dukes' B and two Dukes' A) were considered to have undergone potentially curative surgery on the basis of the laparotomy findings, pre-operative ultrasonography (US) and computerized tomography (CT). Intra-operative ultrasound examination was carried out in those 93 patients immediately after manual exploration of the abdominal cavity.

Ultrasound Scan Technique

Conventional ultrasound scan of the liver was performed by a group of five experienced senior radiologists using an Ultramark 9 (HDI) scanner with a 3.5 MHz linear phased array probe. All patients were fasted over night prior to the examination and the liver was scanned in both transverse and longitudinal sections through the intercostal or subcostal route in the right upper quadrant and epigastrium, with the patients lying in the supine or left lateral decubitus position.

CT Scan Technique

Non-enhanced scans of the liver were first performed in all patients using a GE 9800 CT scanner (Milwaukee, Wisconsin, USA), with contiguous 10 mm thick slices and 2 s scan time. Enhanced CT scans were then obtained following a bolus intravenous injection of 150 ml of Ultravist 370 (Iopromide; Schering Health Care, West Sussex, UK) via an injector (Angiomat CT, Digital Injector System, Liebel-Flarsham, Cincinnati, Ohio, USA) (45 s delay between initiation of injection and the first scan) with contiguous 10 mm thick slices and 2 s scan time.

IOUS Technique

In patients undergoing apparently curative resection of the primary tumour, IOUS was performed by an

Correspondence to: Dr E. Leen, Department of Radiology, Royal Infirmary, Alexandra Parade, Glasgow, G31 2ER, UK.

© 1996 The Royal College of Radiologists.

- 1995 LEEN
- IOUS nevhodný jako screeningova metoda při operaci primárního tumoru (jen 25% metastáz odhaleno při operaci)

- ! Technika , mobilizace

Usefulness of Intraoperative Sonography for Revealing Hepatic Metastases from Colorectal Cancer in Patients Selected for Surgery After Undergoing FDG PET

Bartosz Rydzewski[1]
Farrokh Dehdashti[1,2]
Brigid A. Gordon[1]
Sharlene A. Teefey[1]
Steven M. Strasberg[2,3]
Barry A. Siegel[1,2]

OBJECTIVE. The purpose of this study was to compare the diagnostic performance of preoperative positron emission tomography (PET) with FDG and intraoperative sonography with the standard of histologic examination of resected liver specimens in evaluating patients for curative resection of liver metastases from colorectal cancer.

MATERIALS AND METHODS. We retrospectively identified 47 patients with recurrent colorectal cancer who underwent surgical exploration for possible curative resection of hepatic metastases. All patients underwent CT or MR imaging and FDG PET preoperatively and intraoperative sonography. The performance of the imaging techniques was evaluated through review of the radiologic reports and correlation with surgical and histopathologic findings.

RESULTS. Eighty-seven malignant hepatic lesions were identified by histopathologic analysis of liver specimens, and 23 benign hepatic abnormalities were documented histopathologically or by uroradiologic imaging. For hepatic sections characterized as containing metastases by radiologic imaging, the positive predictive value for FDG PET was 93% (54/58); for intraoperative sonography, 87% (52/60); and for conventional imaging, 83% (43/52). For individual lesions characterized as probably malignant, the positive predictive value for FDG PET was 93% (62/68); for intraoperative sonography, 89% (63/71); and for conventional imaging, 78% (46/59). The findings at intraoperative sonography led to a change in the clinical treatment of only one patient (2%).

CONCLUSION. The results indicate that FDG PET effectively screens potential candidates for curative liver resection. Although intraoperative sonography helps to determine the anatomic location of metastases thus facilitating surgical resection, its adjunctive use in patients screened preoperatively by FDG PET has limited impact on treatment selection.

The 5-year survival rate for patients with hepatic metastases from colorectal carcinoma, either untreated or treated with systemic chemotherapy alone, is essentially nil [1]. An alternative mode of treatment, surgical resection of hepatic metastases, has acceptable morbidity and mortality rates and has been shown to improve survival [2]. In patients who undergo successful hepatic resec-

essential for planning the surgical procedure [7]. Thus, considerable attention has been directed toward defining the most efficient preoperative method for selecting patients who may benefit from surgical resection of their metastases. Such a method would decrease the morbidity and mortality rates associated with unnecessary surgery in patients with advanced disease.

Both CT during arterial portography (CT por-

Received April 13, 2001; accepted after revision

- 2002 vysoká senzitivita – nízká specificita vůči PET
- změna managementu jen u 2% (1 pacient)

CONCLUSION. The results indicate that FDG PET effectively screens potential candidates for curative liver resection. Although intraoperative sonography helps to determine the anatomic location of metastases thus facilitating surgical resection, its adjunctive use in patients screened preoperatively by FDG PET has limited impact on treatment selection.

Radiology

Dushyant V. Sahani, MD
Sanjeeva P. Kalva, MD
Kenneth K. Tanabe, MD
Sikandar M. Hayat, MD
Mary J. O'Neill, MD
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Sanjay Saini, MD
Peter R. Mueller, MD

Intraoperative US in Patients Undergoing Surgery for Liver Neoplasms: Comparison with MR Imaging[1]

PURPOSE: To retrospectively compare intraoperative ultrasonography (US) and preoperative magnetic resonance (MR) imaging with contrast material enhancement for the depiction of liver lesions in patients undergoing hepatic resection.

MATERIALS AND METHODS: A radiologist (D.V.S.) and a surgeon (K.K.T.) retrospectively identified 79 patients (36 female and 43 male patients; age range, 10–78 years; mean age, 57 years) who had undergone surgical resection for primary liver tumor or metastasis and had also undergone preoperative contrast-enhanced MR imaging within 6 weeks before surgery. MR imaging was performed with a 1.5-T system. Dedicated intraoperative US of the liver was performed or supervised by a gastrointestinal radiologist using a 7.5-MHz linear-array transducer, after adequate hepatic mobilization by the surgeon. Histopathologic evaluation of the 159 resected hepatic lesions served as the reference standard. The lesion distribution included colon cancer metastasis (n = 122), hepatocellular carcinoma (n = 23), cholangiocarcinoma (n = 6), cavernous hemangioma (n = 4), focal nodular hyperplasia (n = 2), hamartoma (n = 1), and metastatic embryonal sarcoma (n = 1).

RESULTS: Of 159 lesions, 138 (86.7%) were identified at both MR imaging and intraoperative US. Twelve additional lesions (7.5%) in 10 patients were detected only at intraoperative US (eight metastases, one hepatocellular carcinoma, one cholangiocarcinoma, one hemangioma, and one biliary hamartoma). Both modalities failed to depict nine lesions (5.6%) (four metastases, four hepatocellular carcinomas, and one cholangiocarcinoma). The sensitivities of MR imaging and intraoperative US for liver lesion depiction were 86.7% and 94.3%, respectively. Surgical management was altered on the basis of the intraoperative US findings in only three of 10 patients (4%).

CONCLUSION: Contrast-enhanced MR imaging is as sensitive as intraoperative US in depicting liver lesions before hepatic resection.
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Index terms:
Liver, surgery
Liver neoplasms, 76.314, 76.323, 76.33
Liver neoplasms, MR, 76.1214, 76.121412, 761.121416, 761.12143
Liver neoplasms, US, 76.12981
Magnetic resonance (MR), comparative studies, 76.121411, 76.121412, 76.12143
Ultrasound (US), comparative studies, 76.12981
Ultrasound (US), intraoperative, 76.12982

Published online before print
10.1148/radiol.2323030896
Radiology 2004; 232:810–814

Abbreviations:
HCC = hepatocellular carcinoma
IVC = inferior vena cava

[1] From the Departments of Radiology (D.V.S., S.P.K., S.M.H., M.J.O., E.F.H., S.S., P.R.M.) and Surgery (K.K.T.), Massachusetts General Hospital, White 270, 55 Fruit St, Boston, MA 02114. From the 2001 RSNA scientific assembly. Received June 6, 2003; revision requested July 17; final revision received January 30, 2004; accepted February 17. **Address correspondence to** D.V.S. (e-mail: *dsahani@partners.org*).

Authors stated no financial relationship to disclose.

Author contributions:
Guarantors of integrity of entire study, D.V.S., K.K.T., S.S.; study concepts, D.V.S., M.J.O.; study design, D.V.S., M.J.O., P.R.M.; literature research, D.V.S., S.P.K., S.M.H.; clinical studies, D.V.S., K.K.T., S.M.H., S.P.K.; data acquisition and analysis/interpretation, S.M.H., D.V.S., S.P.K.; statistical analysis, E.F.H.; manuscript preparation and revision/review, D.V.S., S.P.K.; manuscript editing, M.J.O., P.R.M.; manuscript definition of intellectual content and final version approval, D.V.S.
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The potential benefit of hepatic resection for selected patients with primary and secondary hepatic malignancies is well established. In patients who undergo successful hepatic resection with curative intent, the expected 5-year survival rate is approximately 33%, and the 5-year disease-free survival rate is 22% (1). In general, hepatic resection is appropriate in patients with metastatic disease limited to the liver and located in regions of the liver that allow complete resection.

Intraoperative ultrasonography (US) is a useful adjunct during surgery for identifying liver lesions (2). Several studies have shown that intraoperative US often reveals important information not seen at preoperative imaging and that these additional, unsuspected findings change surgical planning in up to 51% of patients (3–5). As a result, intraoperative US is now used routinely to assist in planning for liver resection, mainly to enable detection of additional tumors and evaluation of the relationship of tumors to major vascular structures.

- 2004
- Senzitivita : MRi 86,7%, IOUS 94,3
- Změna managementu pacienta 4% (3pacienti)
- IOUS vs MRI
- benefit – plánování resekčního výkonu – hepatické žíly
- - zjištění trombu , vztah tumor cévy
- - skríning pacientov s MR

CE-IOUS

EUROPEAN JOURNAL OF CANCER 6 (2008) 16–23

available at www.sciencedirect.com

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journal homepage: www.ejconline.com

ELSEVIER

EJC

Use of contrast-enhanced intraoperative ultrasonography during liver surgery for colorectal cancer liver metastases – Its impact on operative outcome. Analysis of a prospective cohort study ☆

Guido Torzilli[a,*], Florin Botea[a], Fabio Procopio[a], Matteo Donadon[a], Luca Balzarini[b], Fabio Lutman[b], Fabrizio Calliada[c], Marco Montorsi[a]

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Liver tumours, staging
Liver tumours, surgery
Contrast-enhanced ultrasound

ABSTRACT

Background: Preliminary reports led to discordant conclusions concerning the use of contrast-enhanced intraoperative ultrasonography (CE-IOUS) during surgery for colorectal liver metastases (CLM). The aim of this study was to evaluate the impact of CE-IOUS in patients undergoing surgery for CLM using an advanced preoperative imaging work-up, and well-established reference standards.

Materials and methods: Forty-seven consecutive patients underwent liver resection using IOUS and CE-IOUS for CLM. All patients underwent preoperative computed tomography (CT) and magnetic resonance imaging (MRI) within 2 weeks prior to surgery. CE-IOUS was performed by injecting intravenously 4.8 ml of sulphur-hexafluoride microbubbles (SonoVue, Bracco, Italy). Reference standards were histology, and 6-month imaging follow-up.

Results: IOUS discovered 43 additional lesions in 20 patients. CE-IOUS found 10 additional lesions not seen at IOUS in four patients, and confirmed all the IOUS findings. Fourteen CLM in 10 patients appeared within 6 months after surgery. Sensitivity, specificity, positive predictive value, negative predictive value and accuracy were, respectively: 66%, 0%, 98%, 0% and 65% for CT + MRI; 88%, 100%, 100%, 8%, 88% for IOUS and 93%, 100%, 100%, 13%, 93% for IOUS + CE-IOUS. In nine patients CE-IOUS afforded better definition of tumour margins thus helping in resection guidance.

Conclusions: CE-IOUS improves IOUS findings both for detection and for resection guidance. The combination of IOUS and CE-IOUS should be considered routinely in patients operated for CLM.

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Torzilli 2008
staging MR/CT

IOUS
43 dalších lézí /47pac.

CE-IOUS
10 dalších lézí
↑ senzitivita a specificita

Indikace

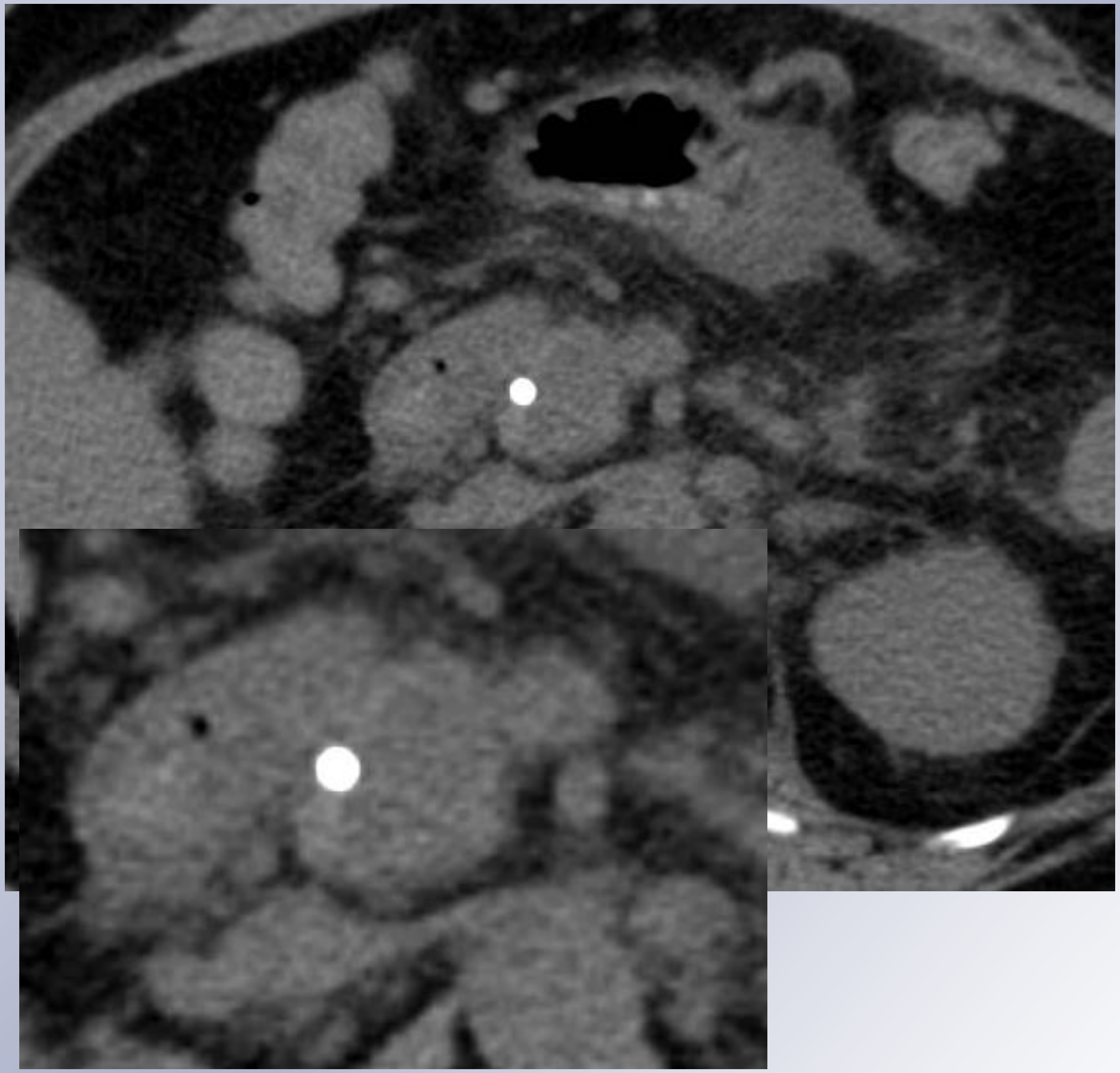
- jaterní resekce

- význam zvyšuje
  - dlouhá doba od preoperativního stagingu jaterních metastáz

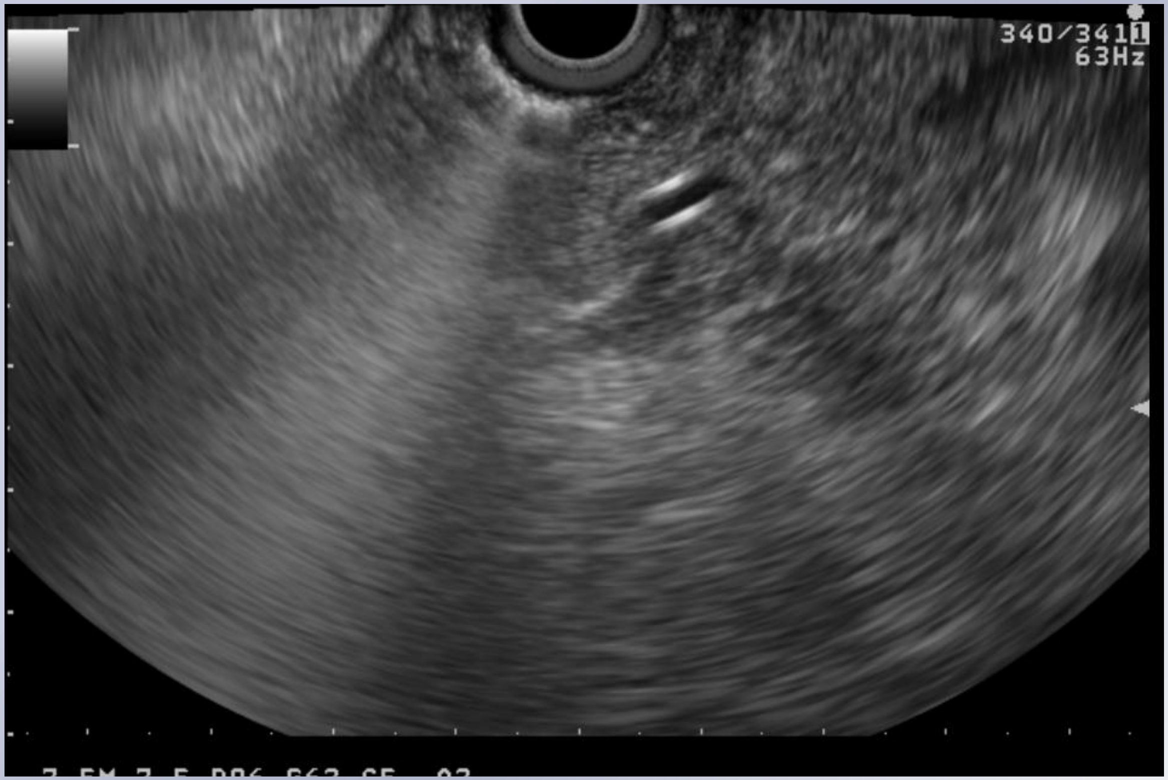
  - užití jen kontrastního CT v stagingu

  - užití PET u pacientů s neoadjuvantní chemoterapií (snižující senzitivitu)

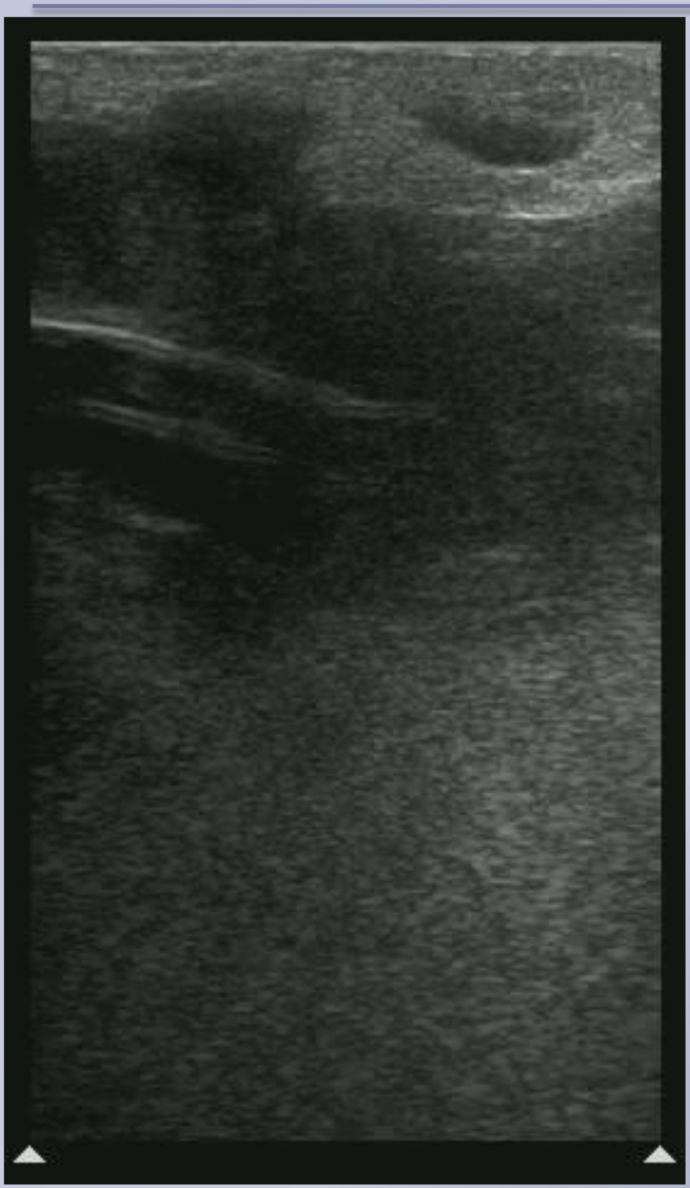
Pankreas - chronická pankreatitída

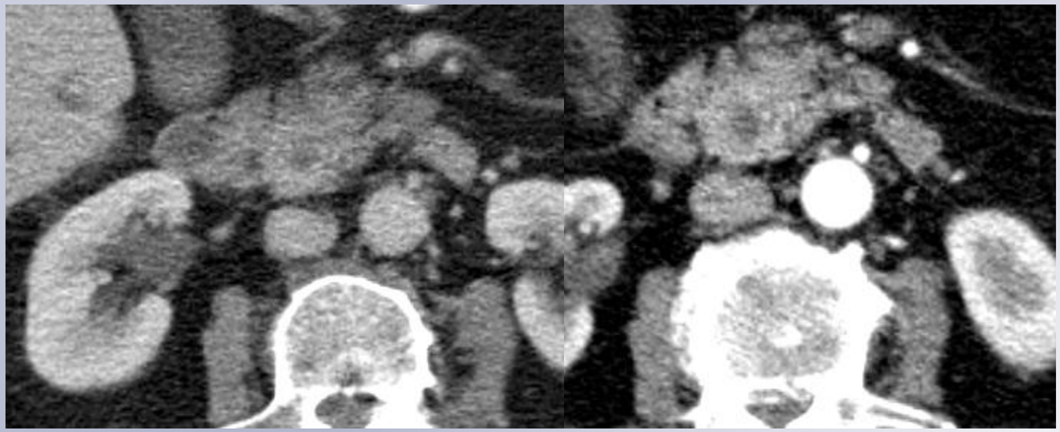


Chronická pankreatitída

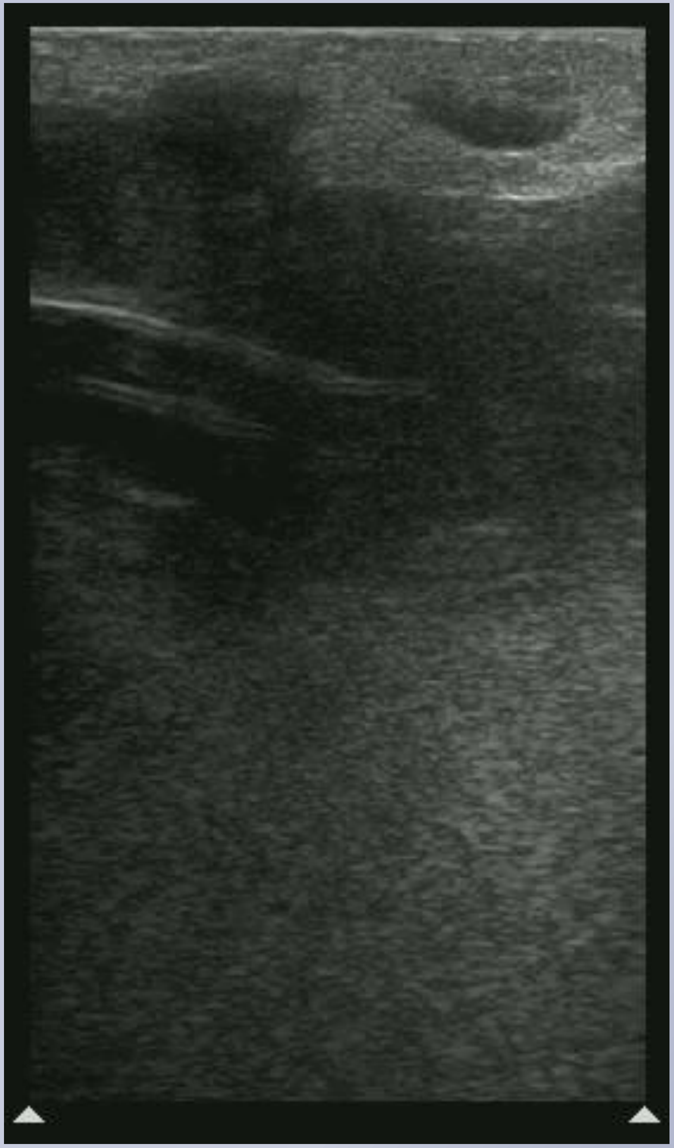


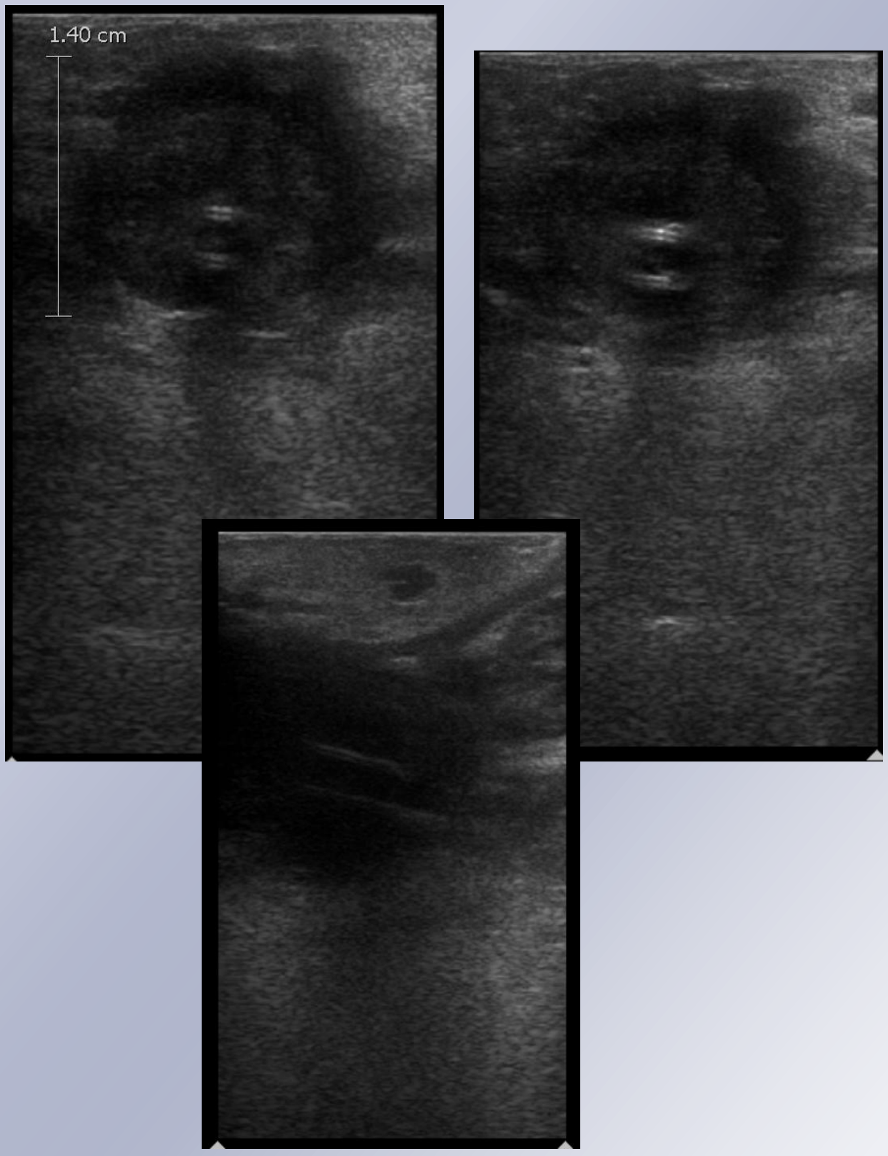
Choledochus - DBD



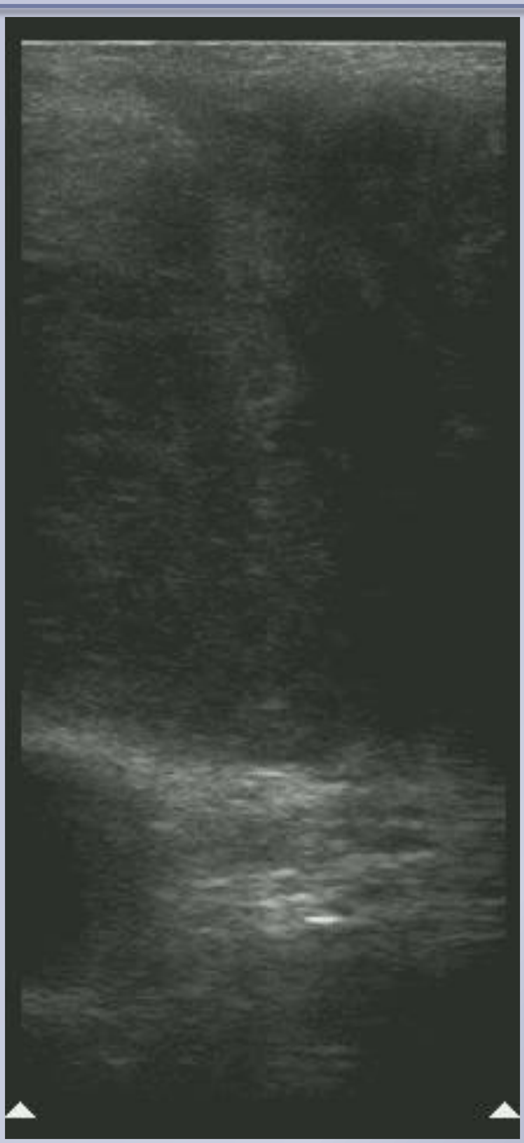


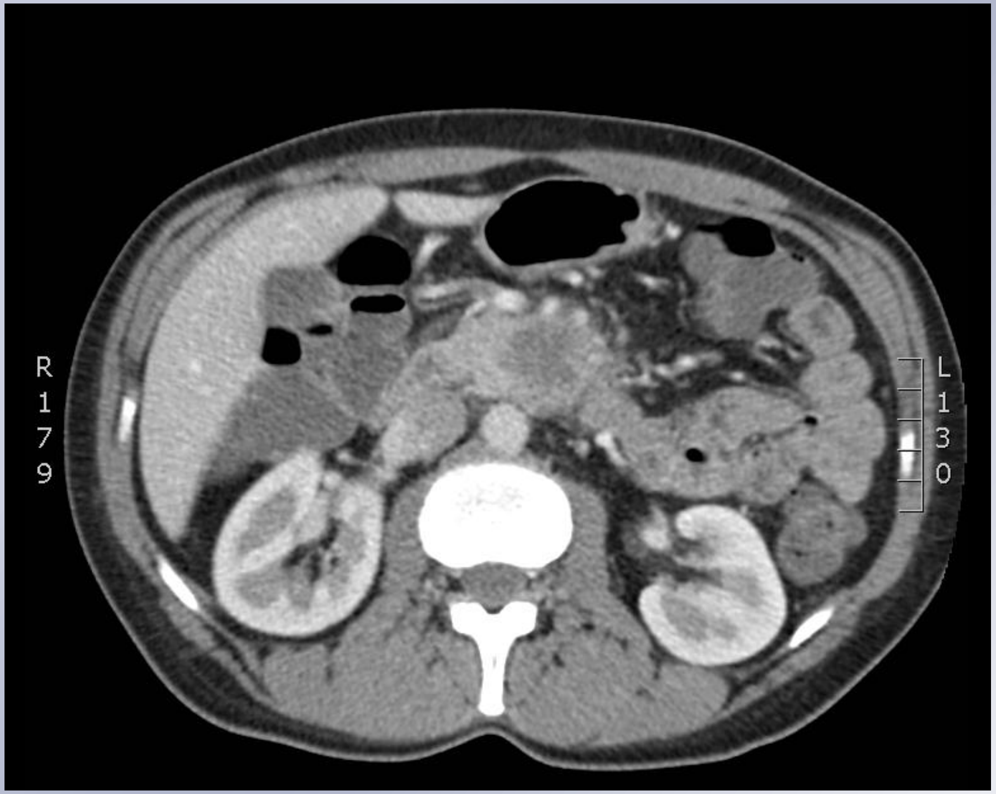
Choledochus - DBD



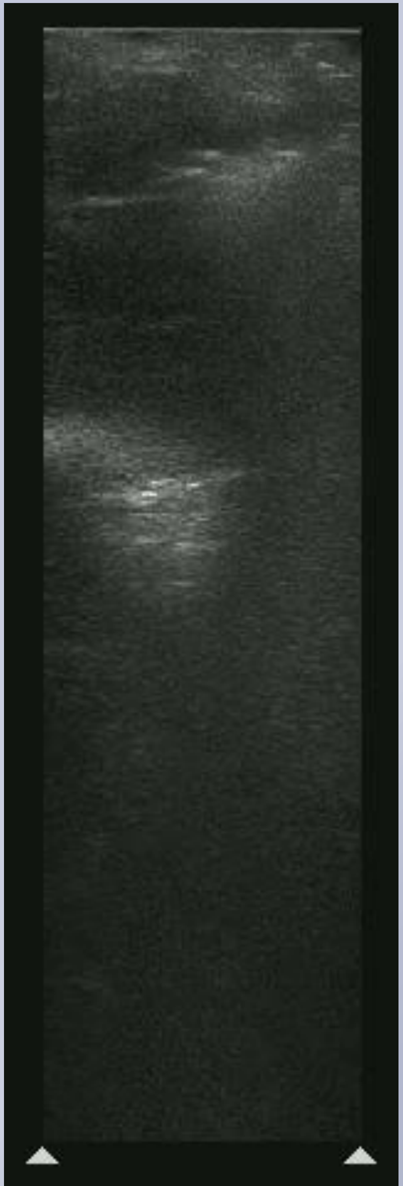


Adenoca pankreatu

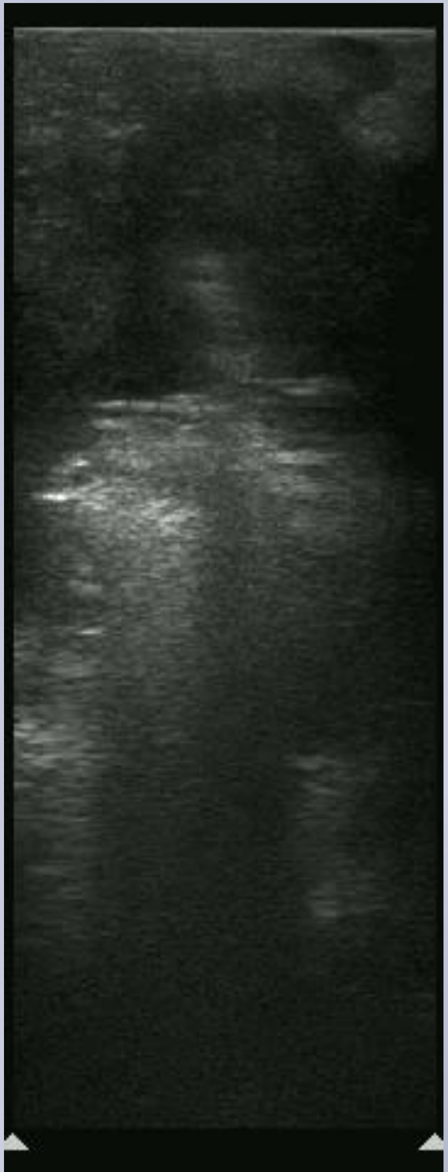


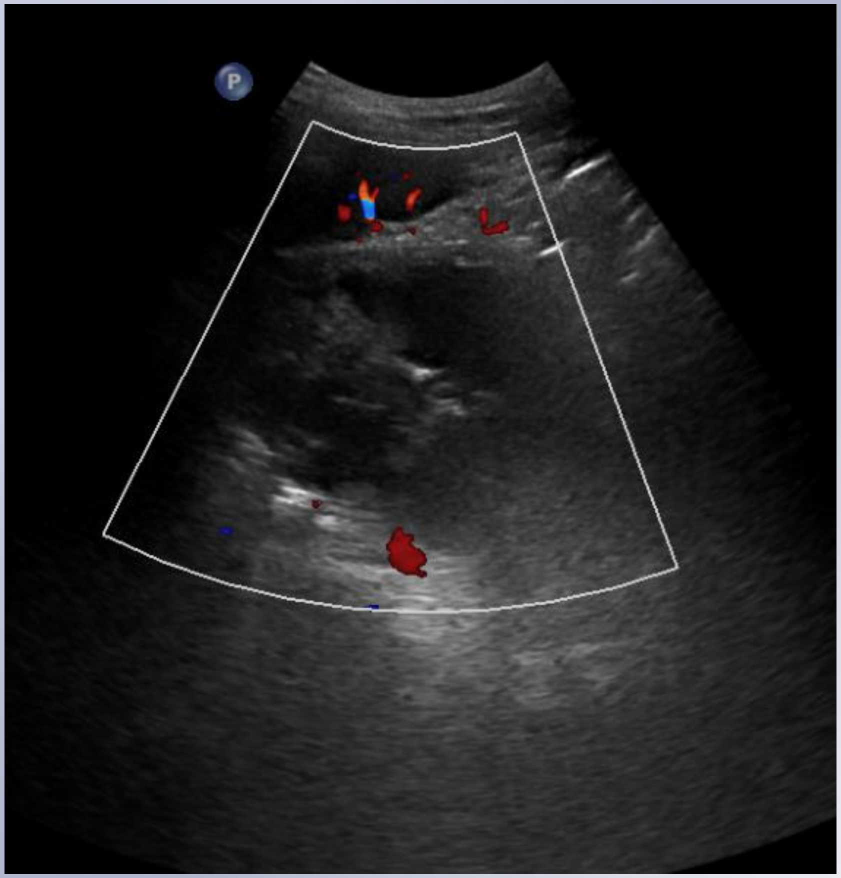


Zavedení jehly pod UZ kontrolou

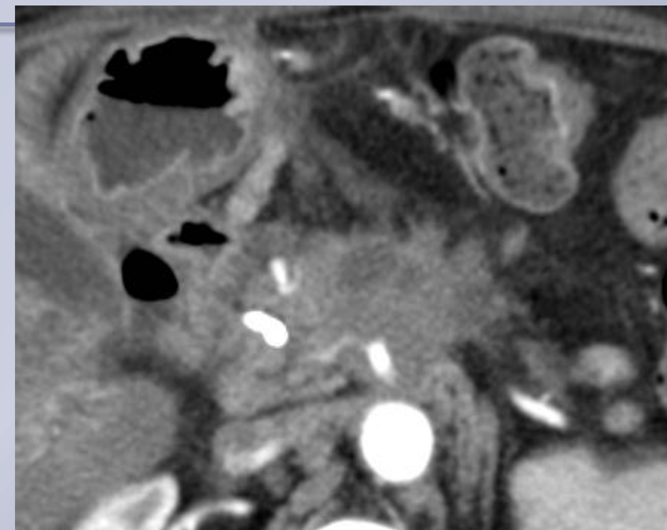


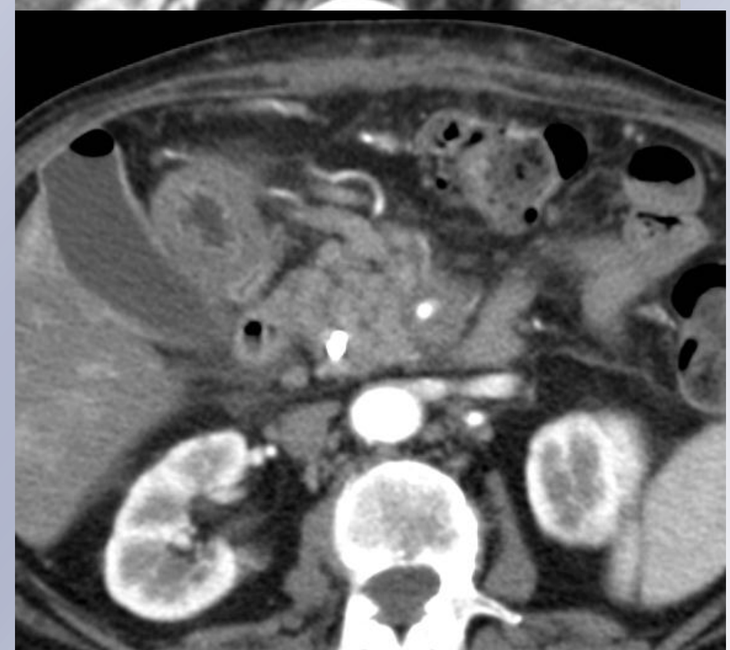
St.p. RFA



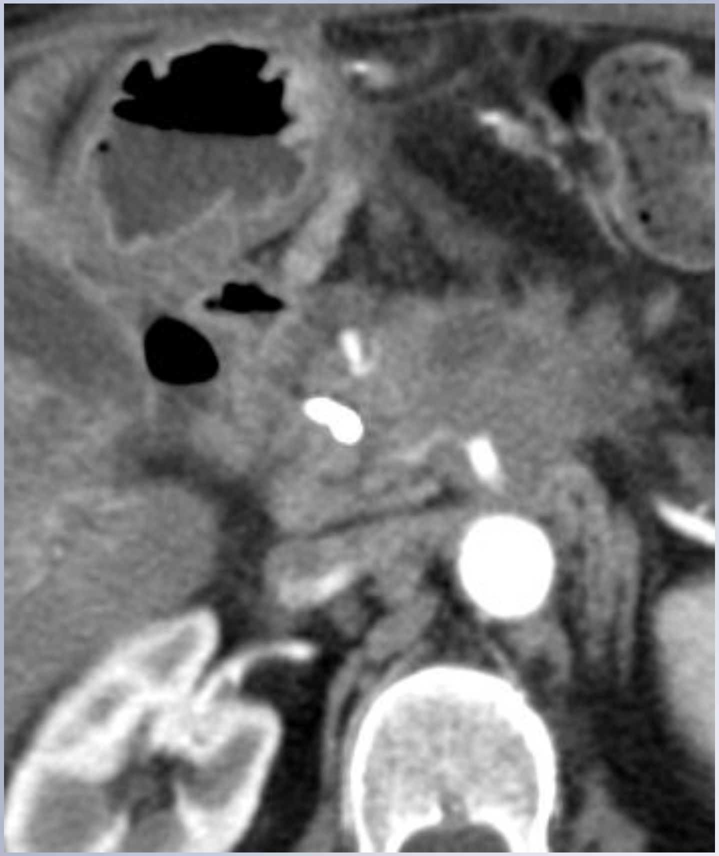


Infiltrace AMS

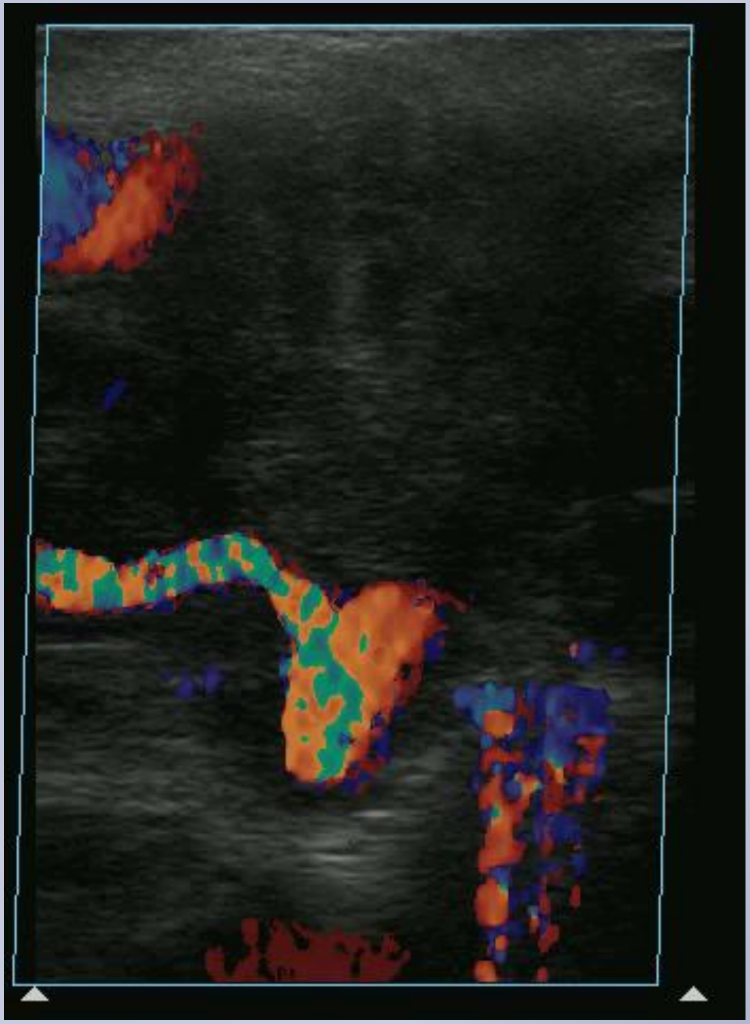




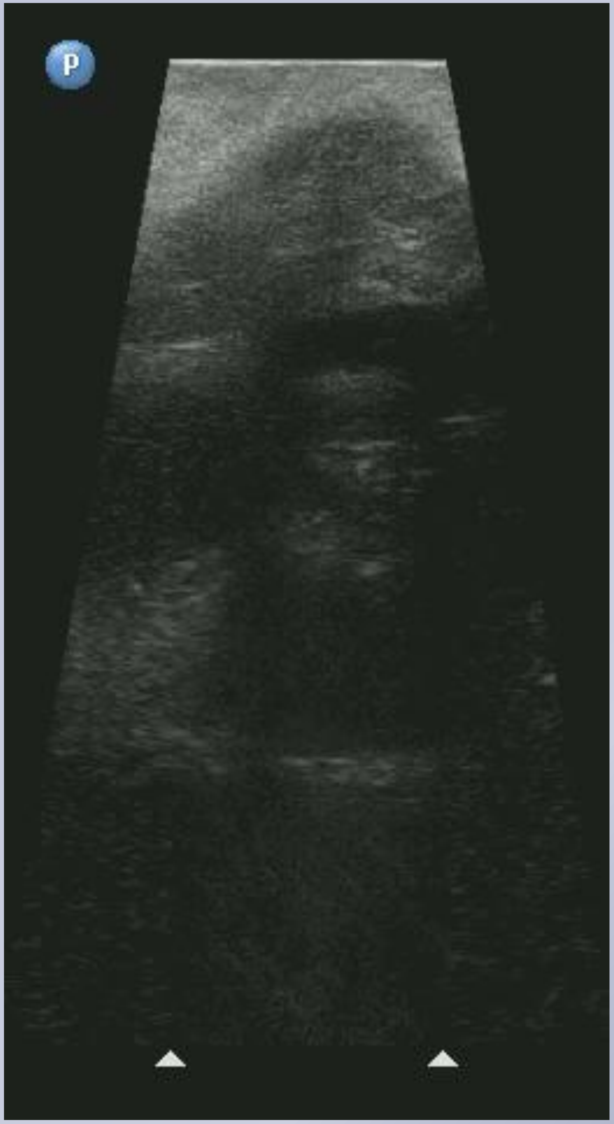
Akcesorní hepatická tepna

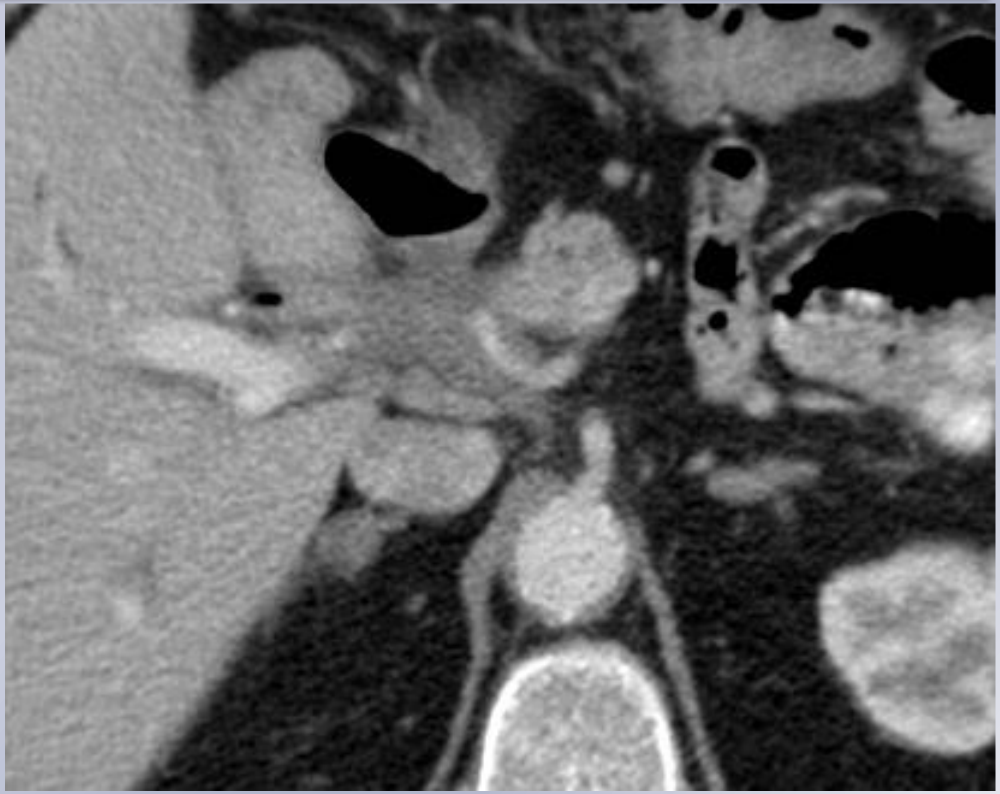


Color Doppler vs.CEUS (4-2MHz)

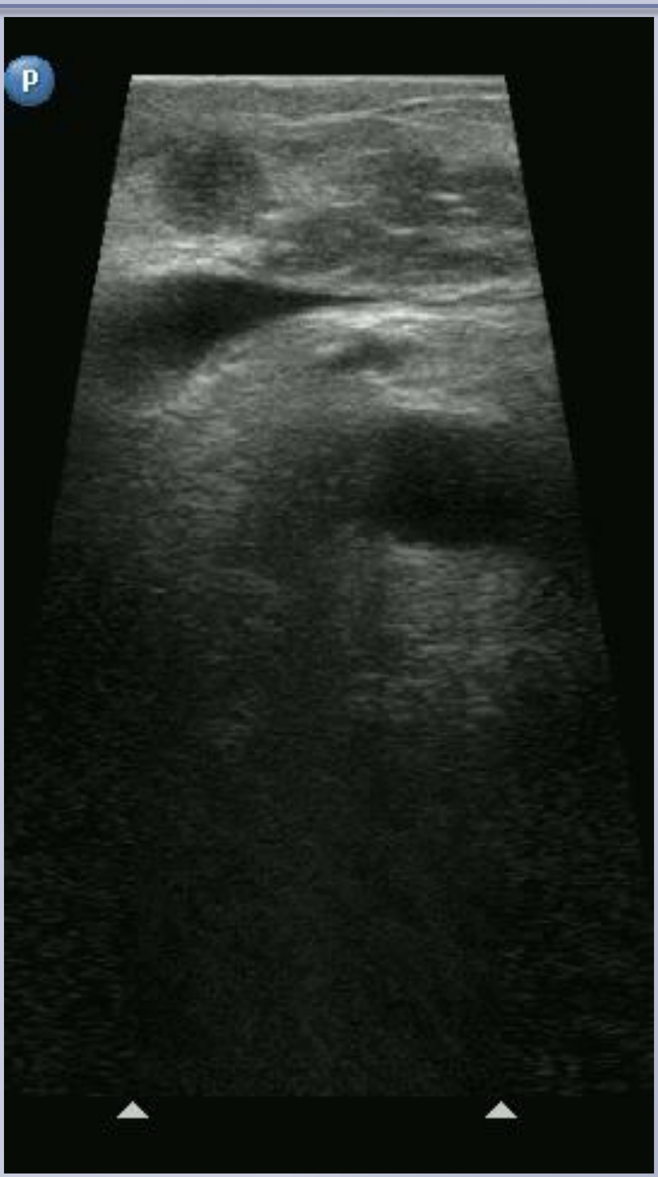


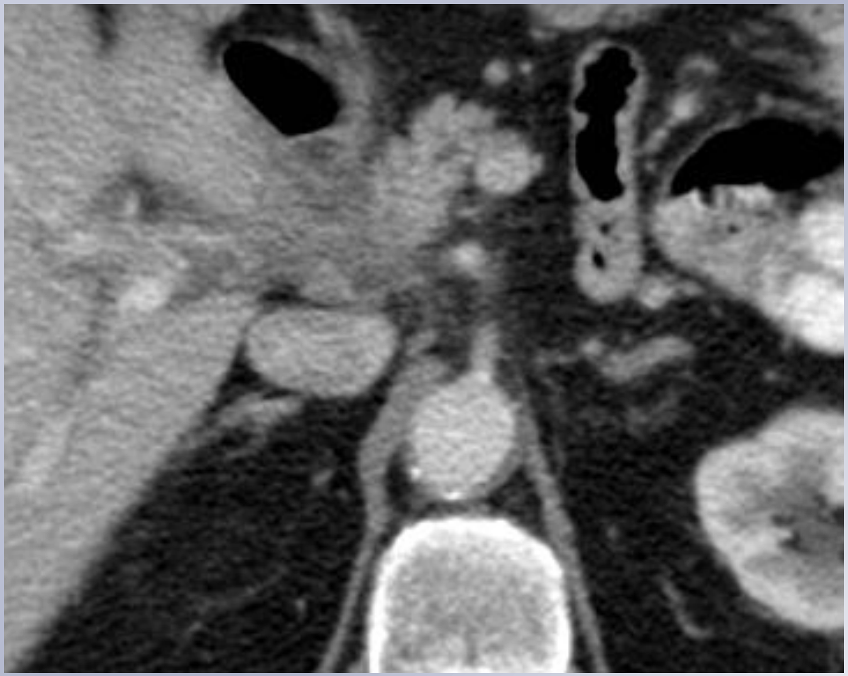
Adenoca pankreatu



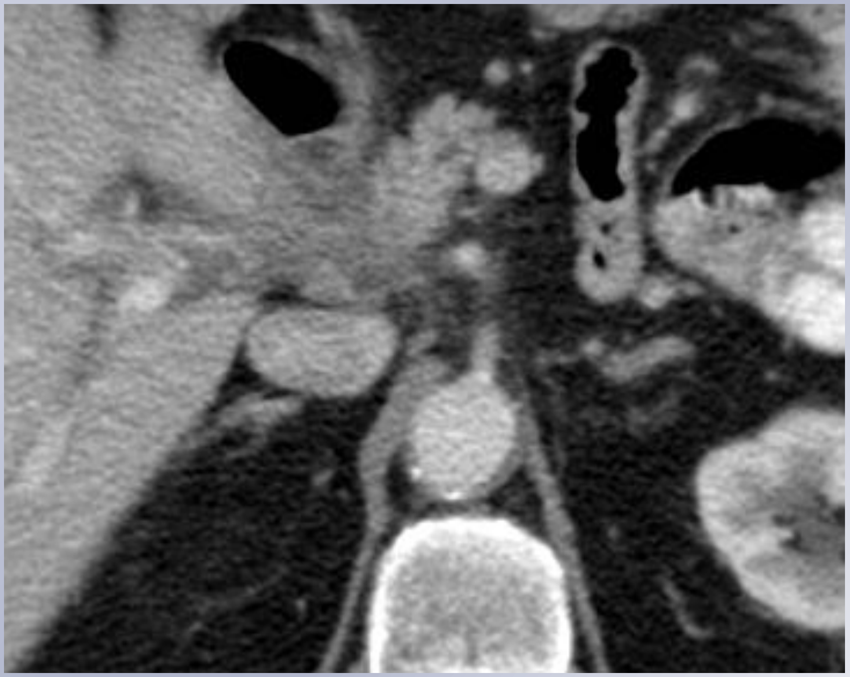


Adenoca pankreatu

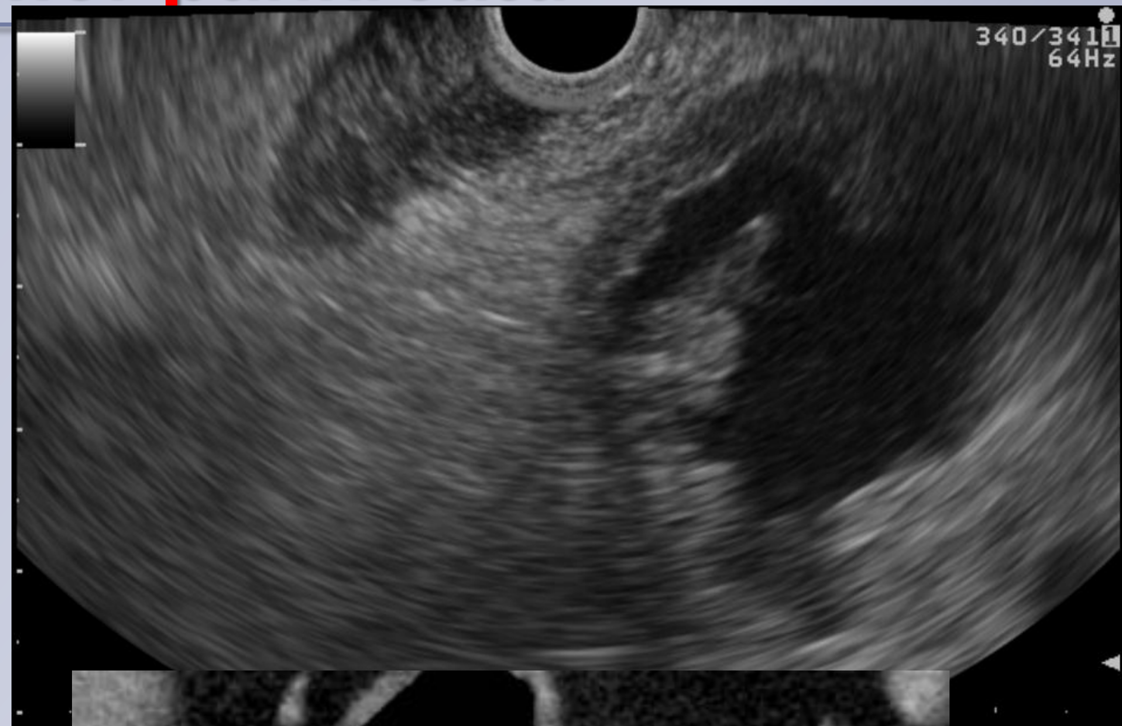




Adenoca pankreatu

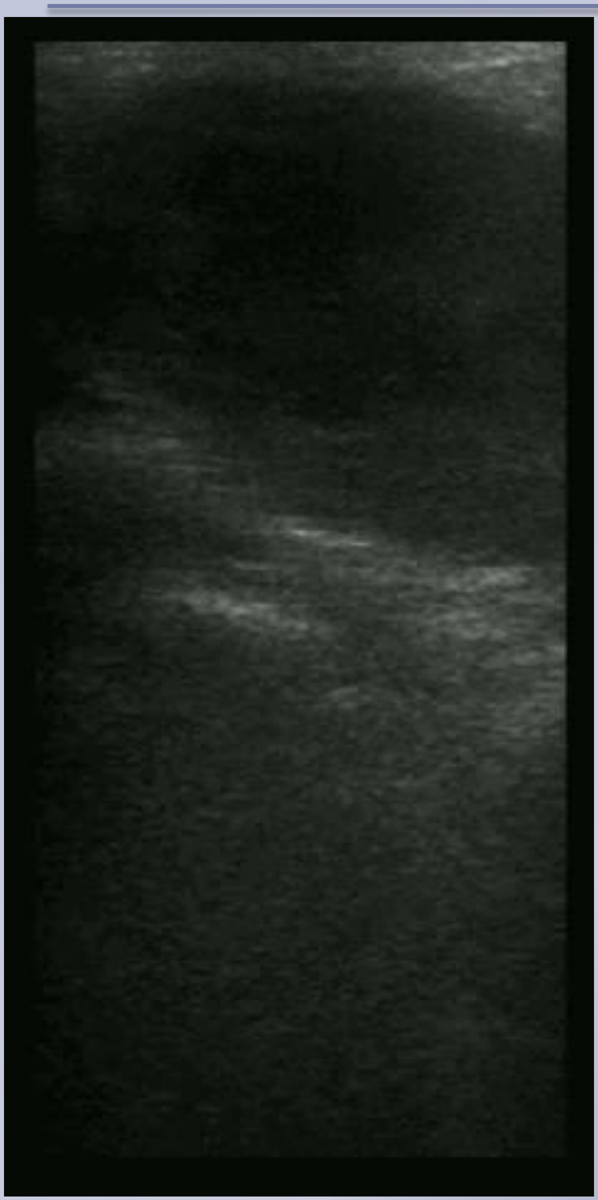


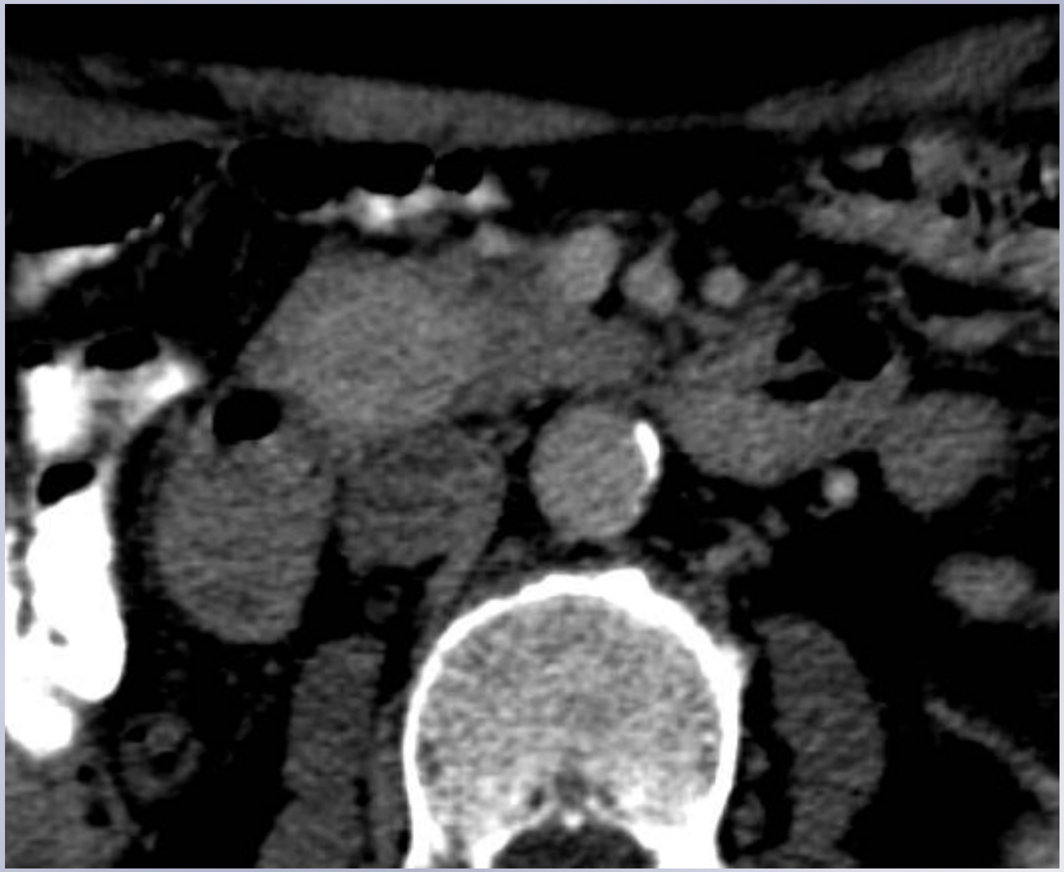
Mucinózní tumor pankreatu



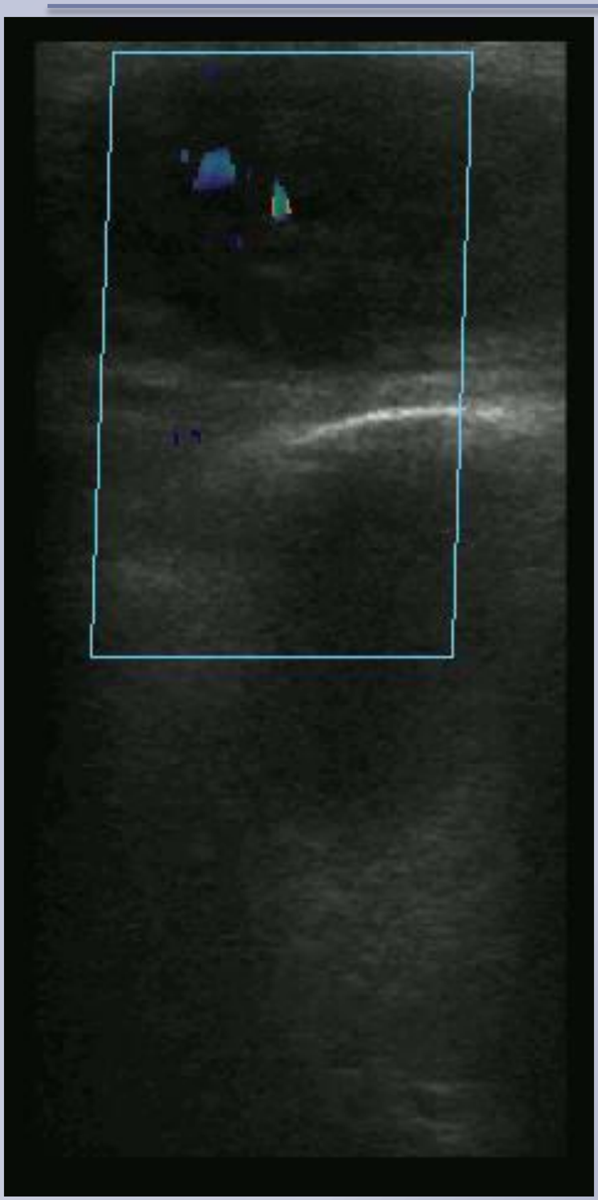
Jaterní postižení

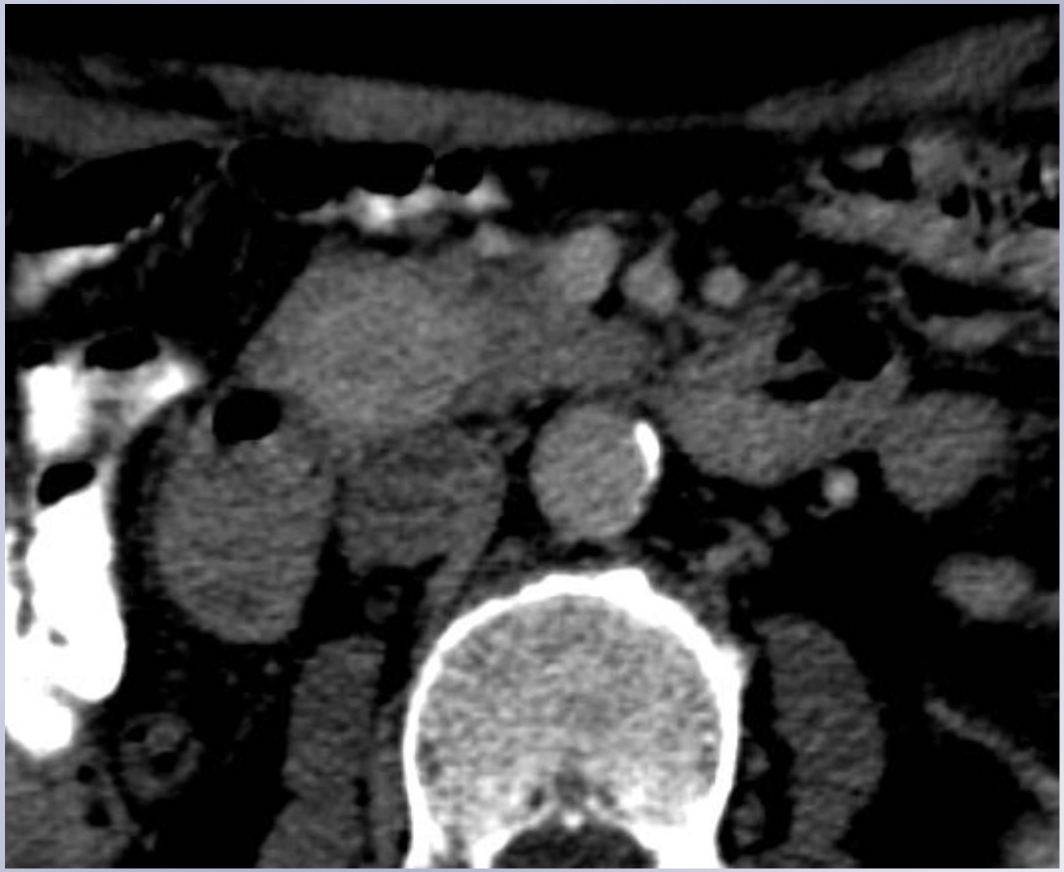
Neuroendokrinní tumor pankreatu



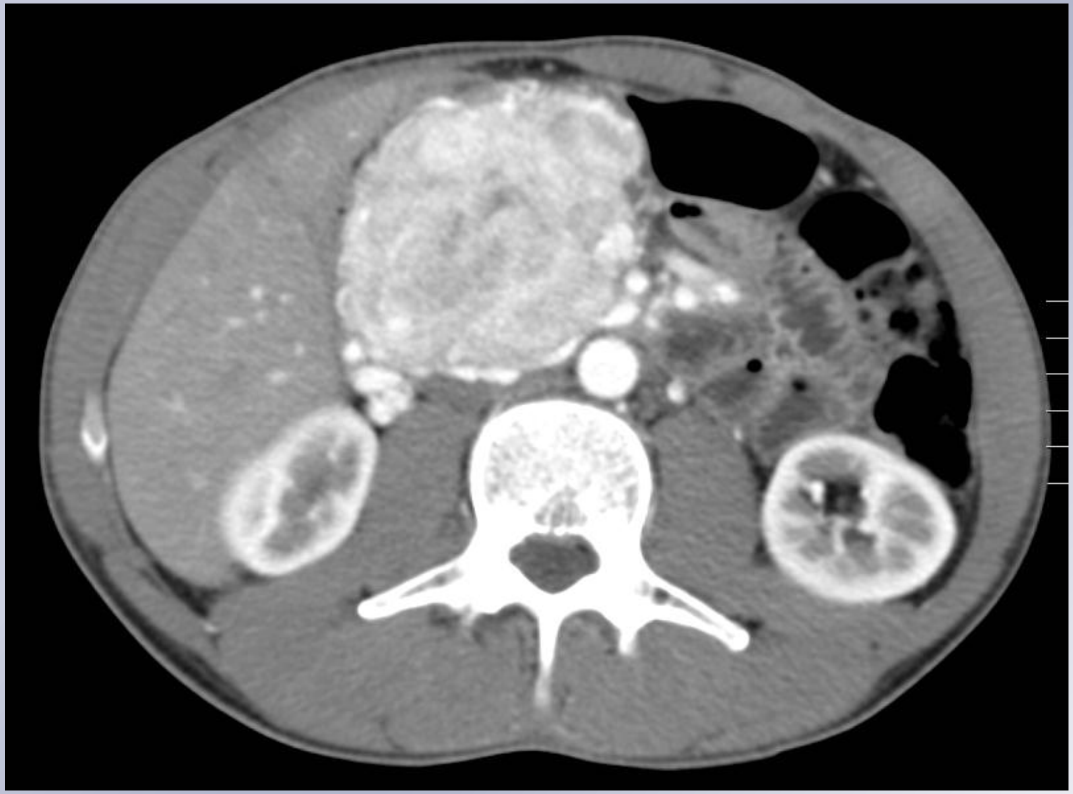


Neuroendokrinní tumor pankreatu

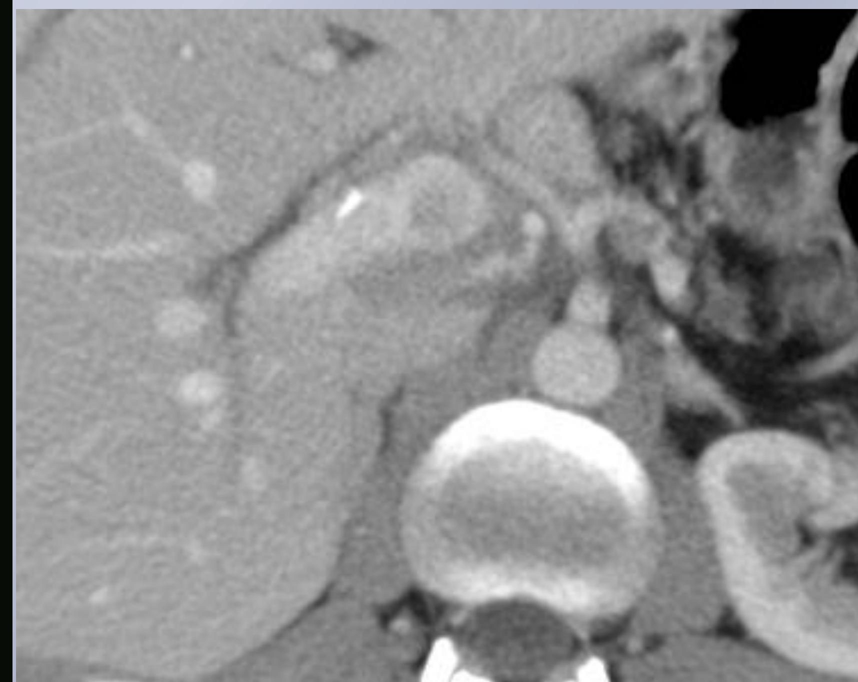




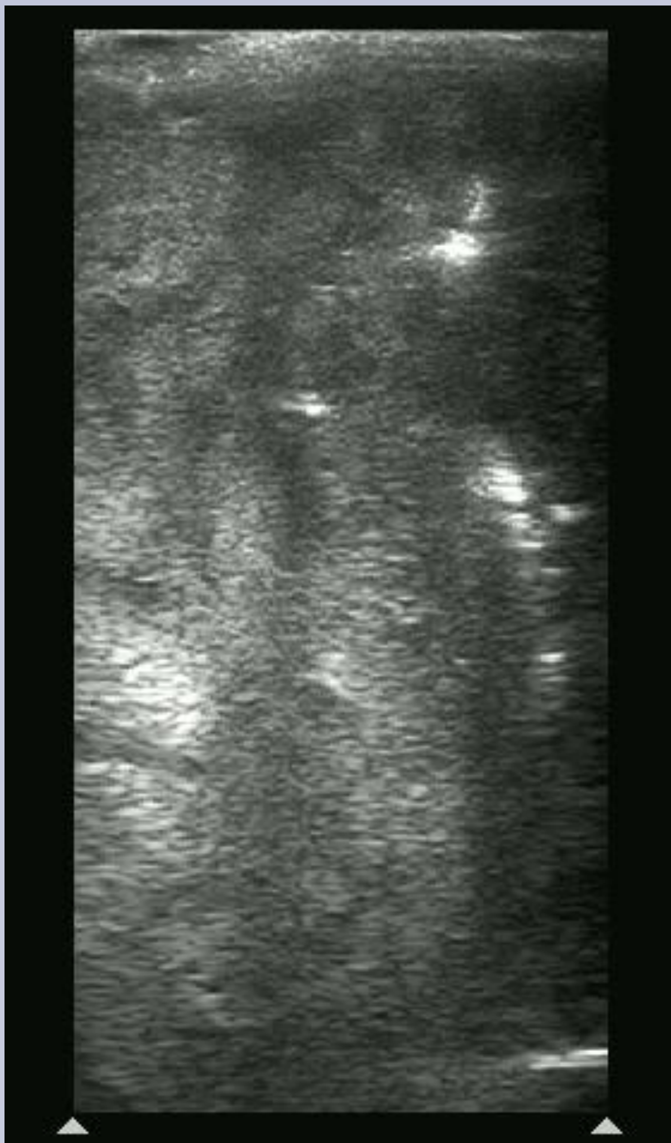
Neuroendokrinní tumor pankreatu II



Neuroendokrinní tumor pankreatu II



Ireverzibilní elektroporace



Závěr - játra

- IOUS může změnit management u 15-1% pacientů s mCRC
- Až u 50% pacientů můžou být další léze
  (40% z nich nejsou palpovatelné)
- Zásadní když pacient nemá PET CT či MRi
- technicky jednoduché provedení,minimálně prodlužuje čas operačního výkonu a operace

Závěr - pankreas

- objektivizace nálezu na pankreatu – rozsah postižení
- detekce drobných tumorů (např. inzulinom)
- morfologie tumoru (cystické léze)
- plánování resekčního výkonu a cílení intervence
- uzliny peripankreaticky

Odlišení zánět-tumor ?

Děkuji za pozornost

- tandrasina@fnbrno.cz

Děkuji za pozornost

Pro intraoperativní sonografii je

- a) optimální využití sond s vyšší frekvencí než 7Mhz
- b) optimální využití sond s nižší frekvencí než 7Mhz
- c) možné použít jen sondy dedikované k peroperačnímu užití
- d) nemožné provést v rámci laparoskopie

U ložiskových lézí jater má intraoperativní sonografie

- a) nejvyšší specificitu a senzitivitu z diagnostických metod
- b) vysokou senzitivitu ale specificitu srovnatelnou s transabdominální sonografií
- c) senzitivitu závislou na typu operačního výkonu (liberalizace jater)
- d) vyšší specificitu při použití kontrastních látek
- e) pomůže anatomicky lokalizovat lézí k resekci

Intraoperativní ultrazvuk

- a) nemá význam u dobře palpovatelných a povrchových metastáz jater
- b) vůči předoperačnímu PET vyšetření ma malou přídatnou hodnotu u metastáz CRC do jater
- c) sterilní sonogafický gel je nutné z operačního pole v co největší míře odstránit