

Peroperační ultrazvuk játra, pankreas

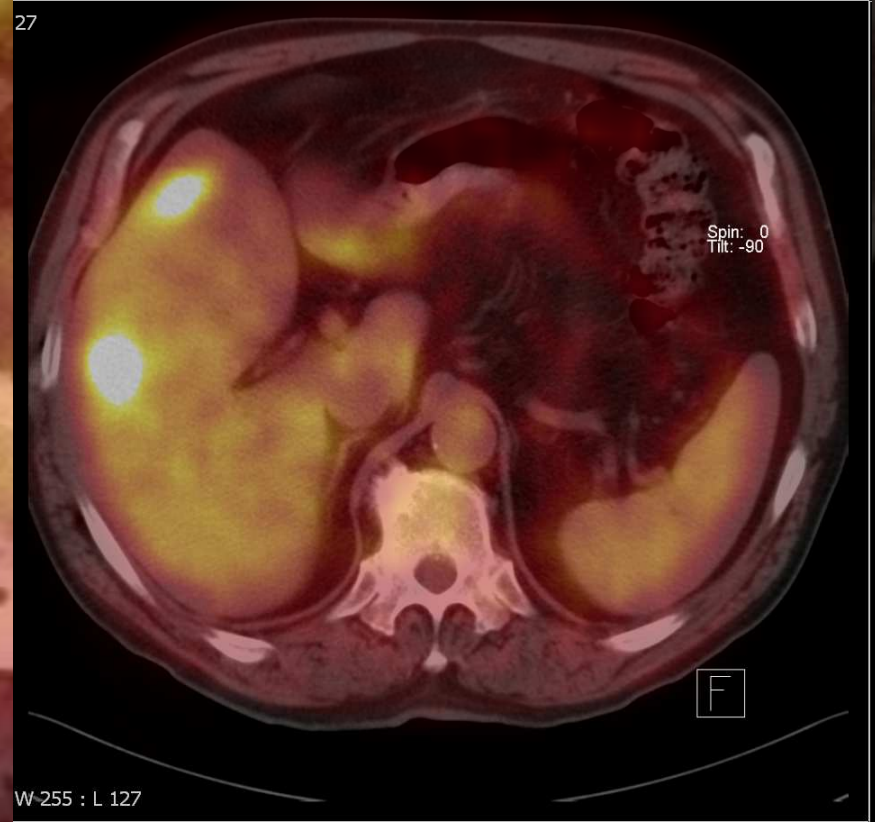
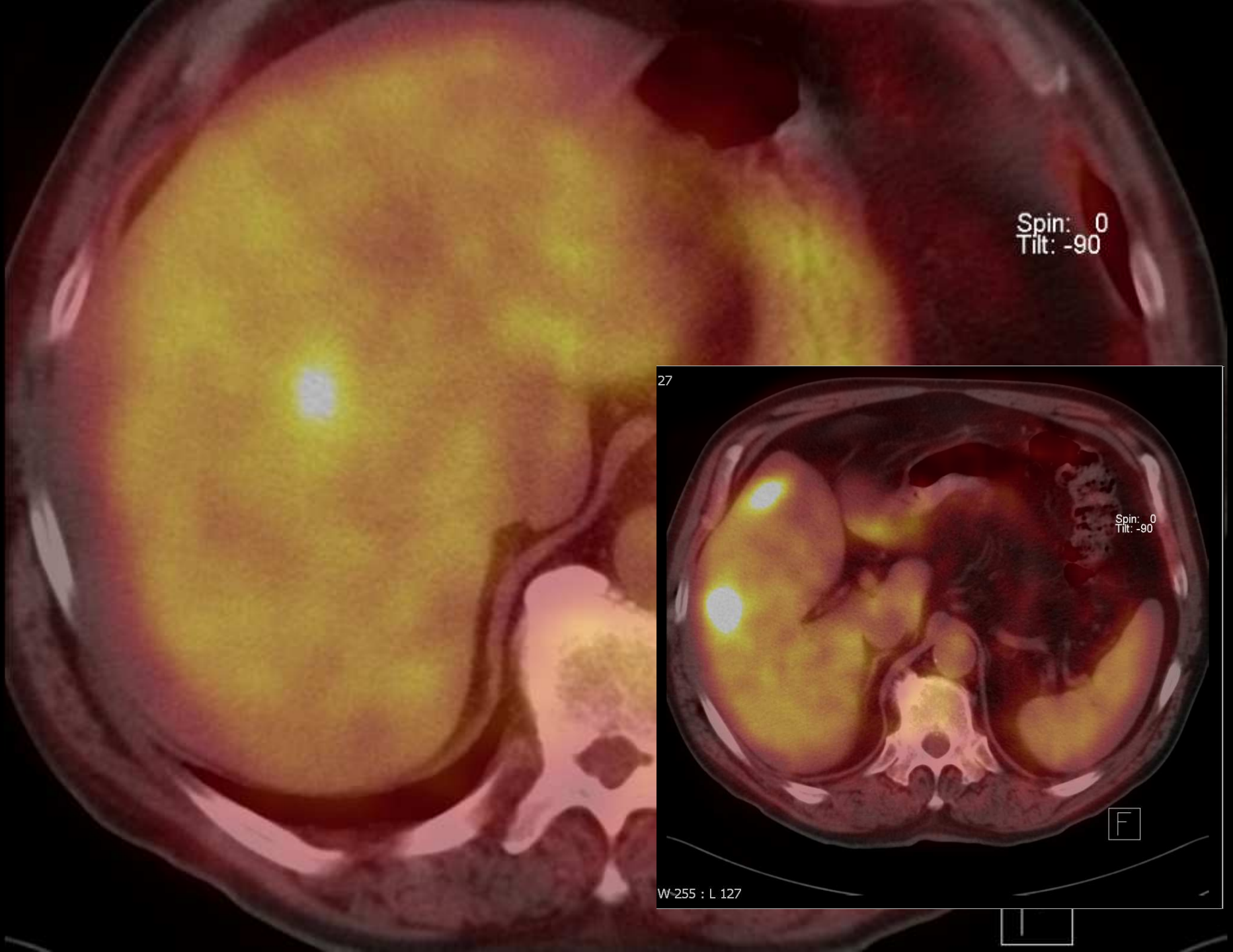


Andrašina T.

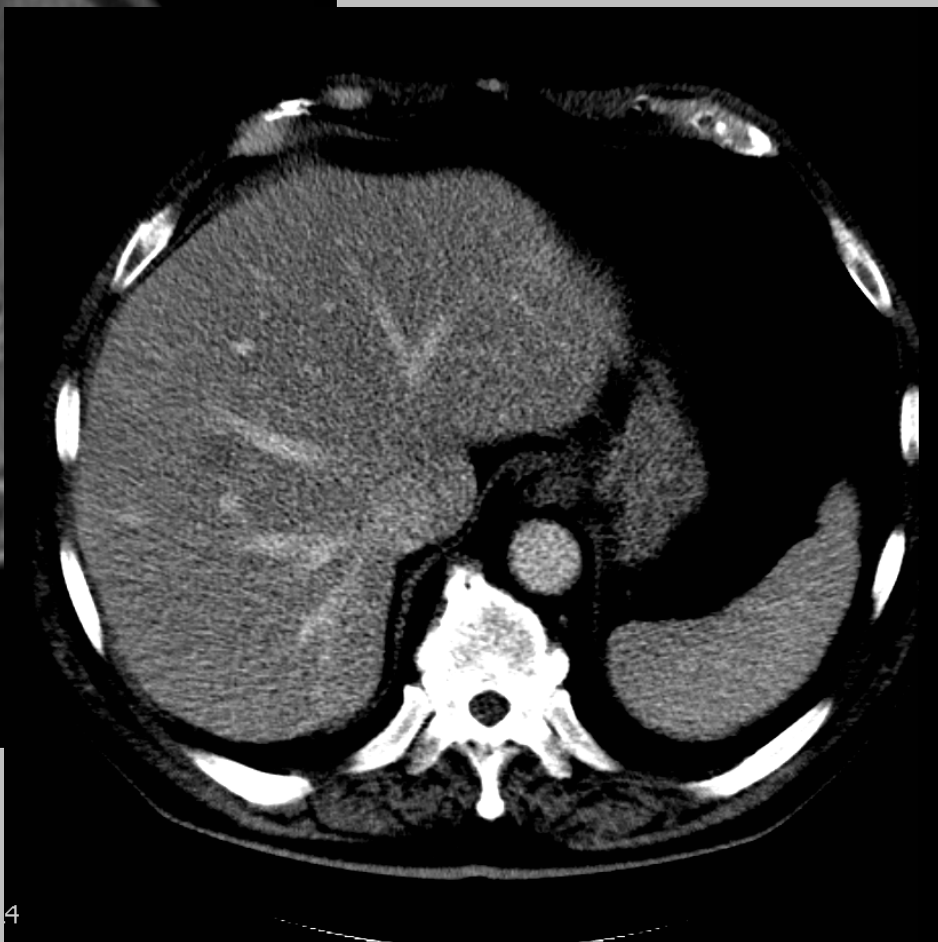
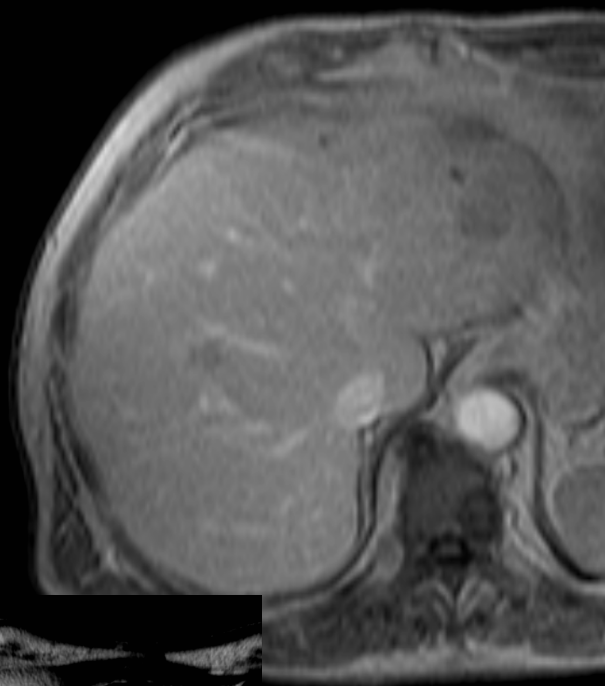
Radiologická klinika LF MU Brno a FN Brno

Přednosta: prof. MUDr. Vlastimil Válek, CSc., MBA

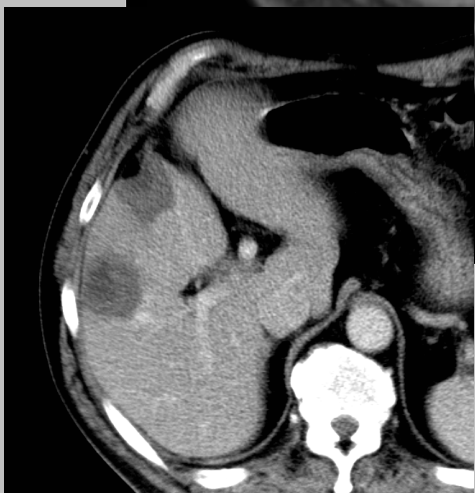




5



4



17



W 492 : L 283

21



W 274 : L 79

1



W 4095 : L 2047

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 menežment 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

L12-3

Broadband Linear Array Transducer



- 12 to 3 MHz extended frequency range
- 35 mm effective aperture length
- 10° of trapezoidal imaging
- Steerable pulsed wave Doppler, Color Doppler, and Color Power Angio, SonoCT, XRES, Pa
- High-resolution superficial vascular imaging
- Supports biopsy guidance

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

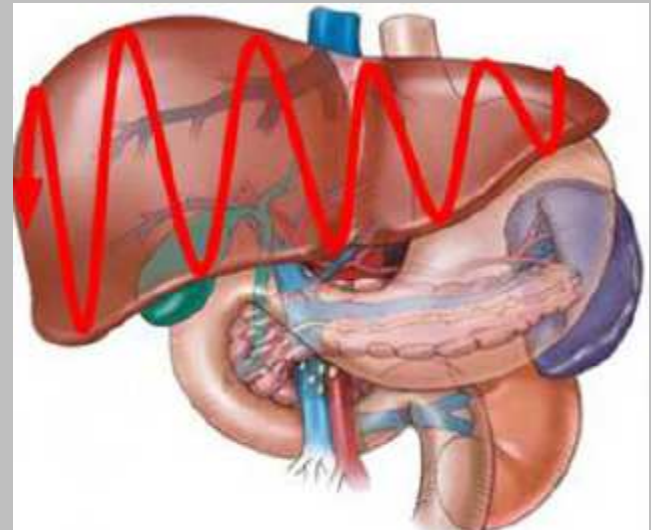
* All features not available on all systems

Provedení



Játra

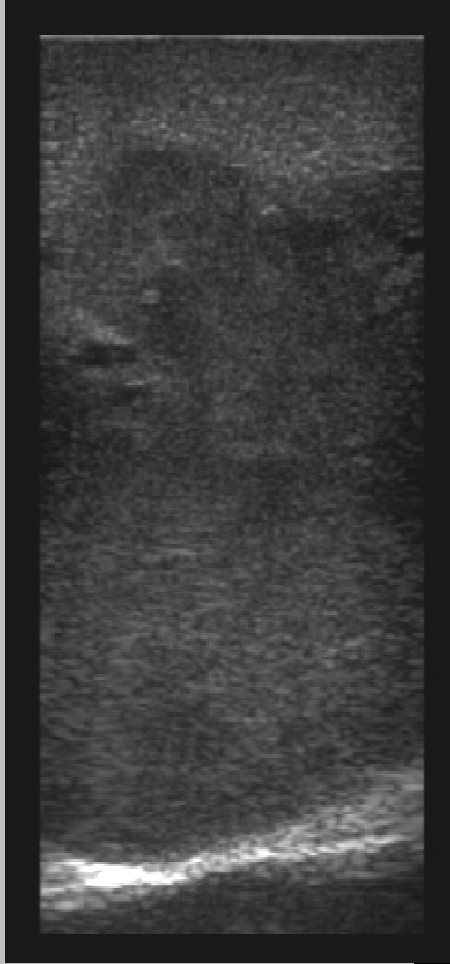
- Senzitivita k lézím i menším než 10mm 96%,
- léze od 2mm
- celý parenchym,
- vaskulární struktury – variety



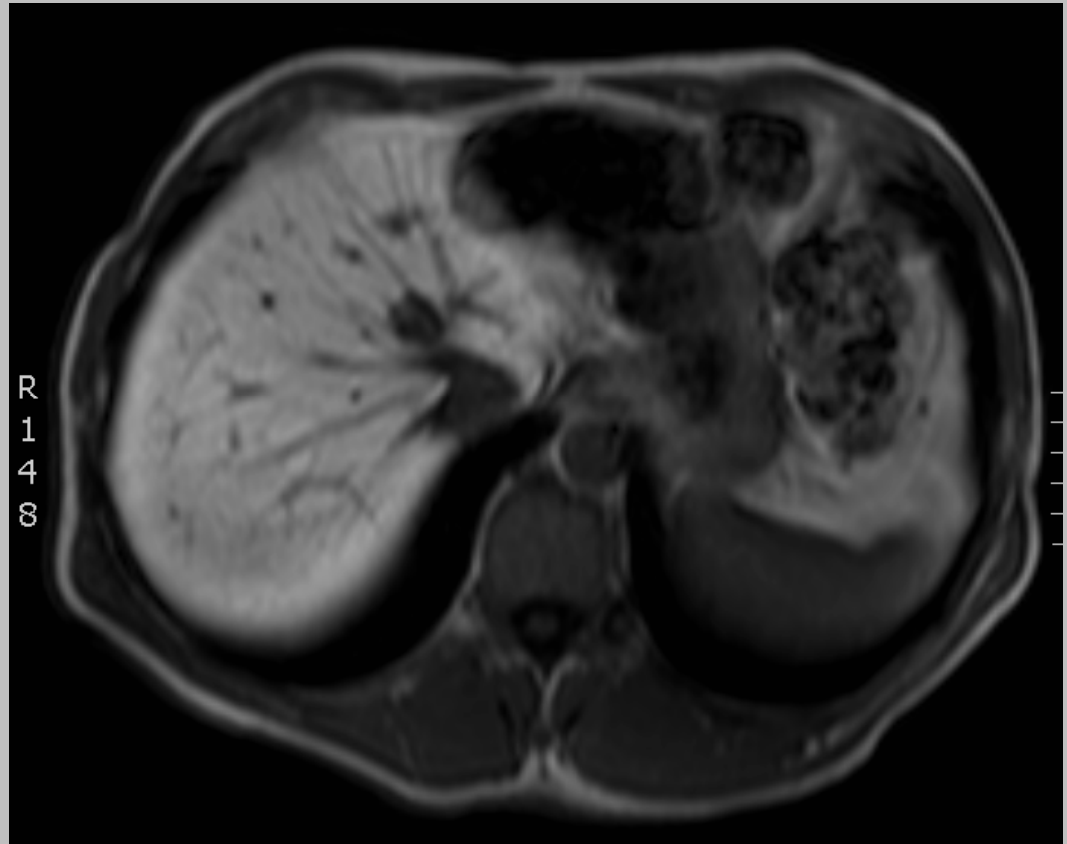
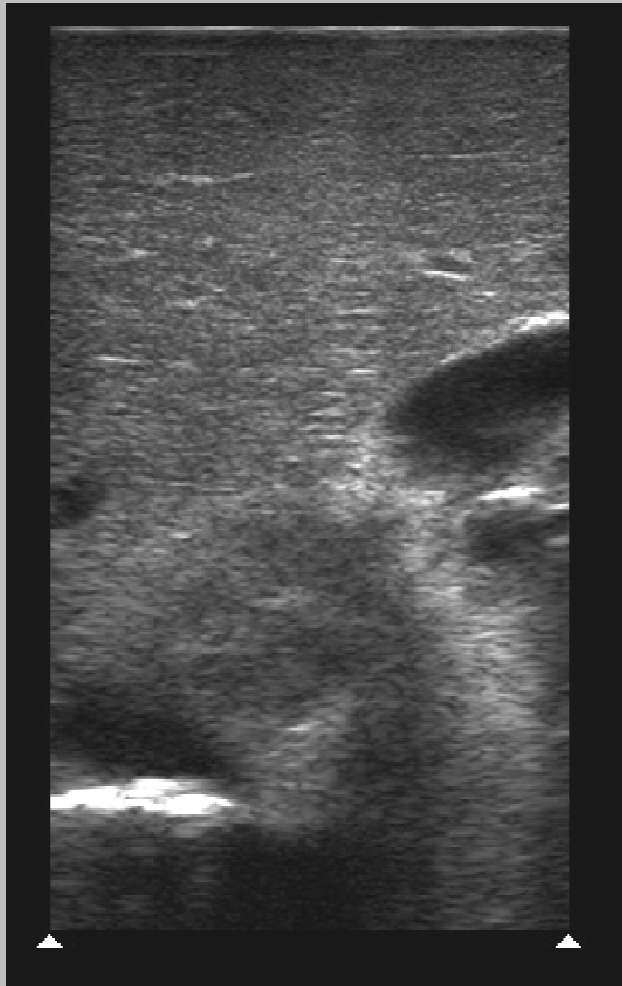
Obtížně hodnotitelné

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

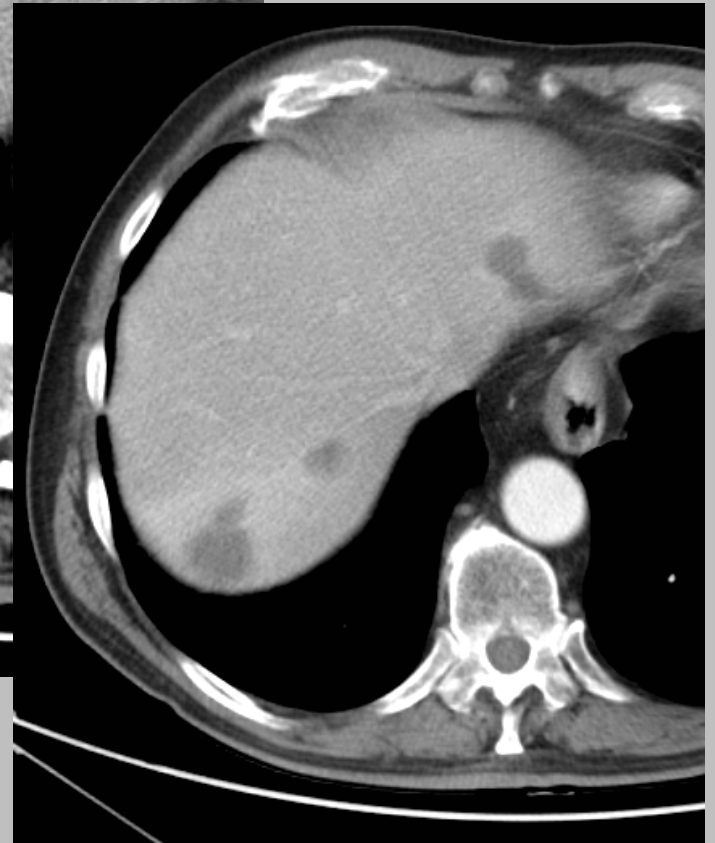
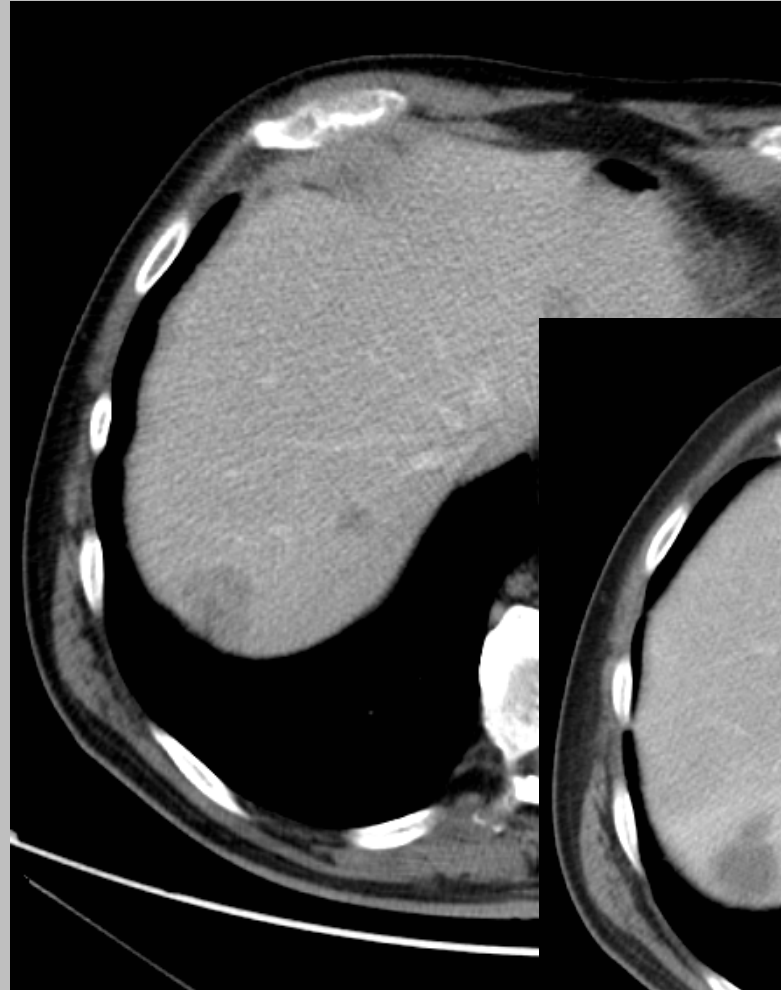
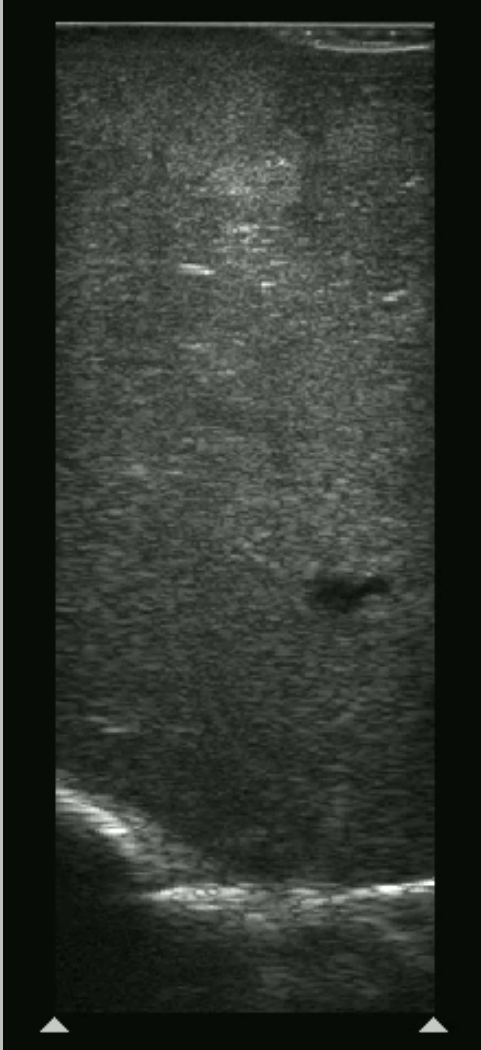
mCRC



mCRC



mCRC



Surgical Treatment of Hepatic Metastases: Impact of Intraoperative Sonography

Philippe Soyer¹
Dominique Elias²
Guy Zeitoun³
Alain Roche⁴
Marc Levesque¹

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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- V literatuře od 80-let
- 1992 Soyer - další metastázy

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 overnight 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

- 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

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Farrokh Dehdashti^{1,2}
Brigid A. Gordon¹
Sharlene A. Teehey¹
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 woradiologic 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 resection, 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 Dop-

Received April 13, 2001; accepted after revision
August 14, 2001.

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.

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

Dushyant V. Sahani, MD
Sanjeeva P. Kalva, MD
Kenneth K. Tanabe, MD
Sikandar M. Hayat, MD
Mary J. O'Neill, MD
Elkan F. Halpern, PhD
Sanjay Saini, MD
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Liver neoplasms, MR, 76.1214, 76.121412, 76.121416, 76.12143
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

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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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Intraoperative US in Patients Undergoing Surgery for Liver Neoplasms: Comparison with MR Imaging¹

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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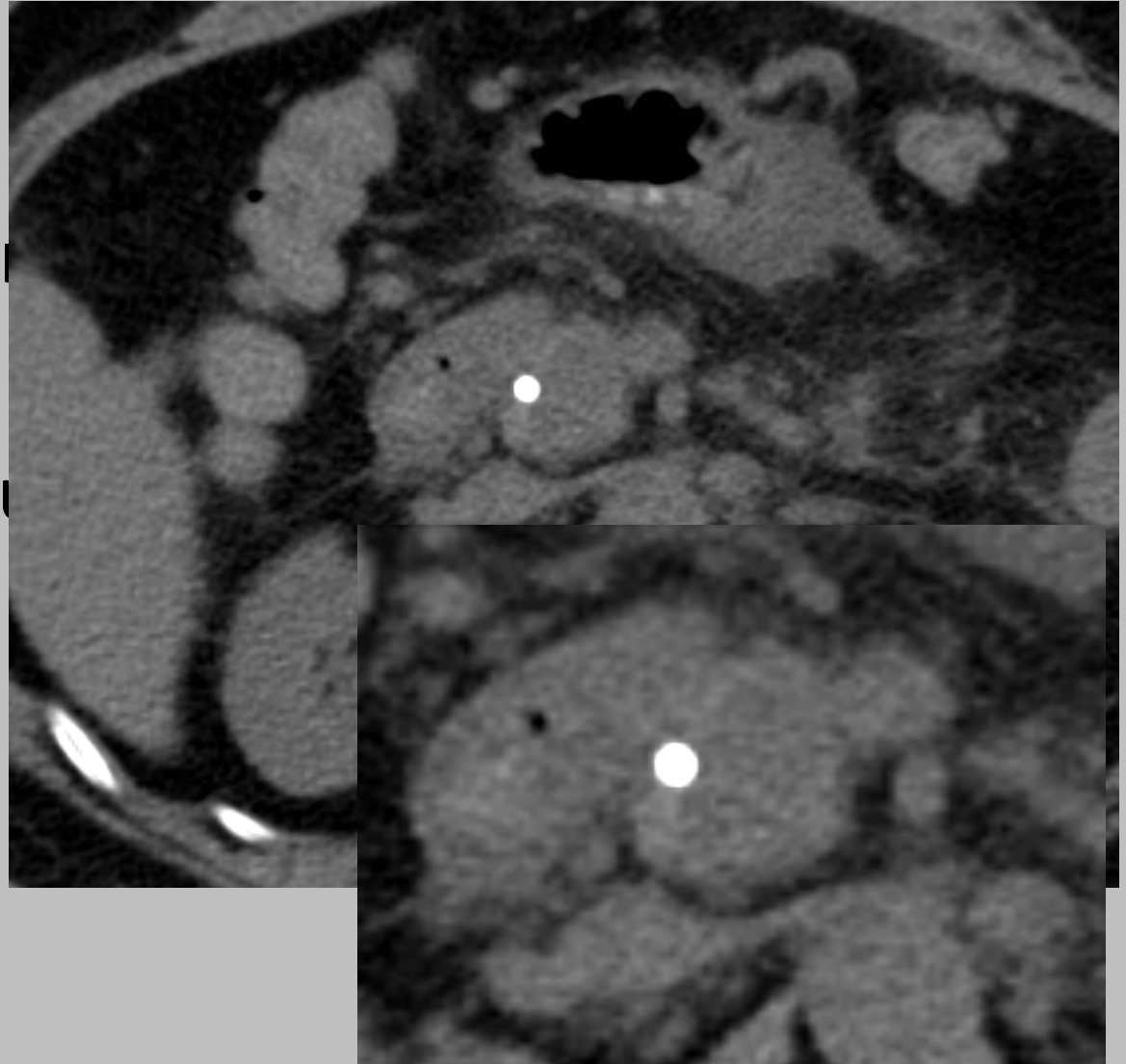
The potential benefit of hepatic resection for selected patients with primary and secondary hepatic malignancies is well established. In patients who undergo successful hepatic resection with curative intent, the expected 5-year survival rate is approximately 33%, and the 5-year disease-free survival 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 menezementu pacienta 4% (3pacienti)
- IOUS vs MRI
- benefit – plánování resekčního výkonu – hepatické žíly
- - zjištění trombu , vztah tumor cévy

- - skríníng pacientov s MR

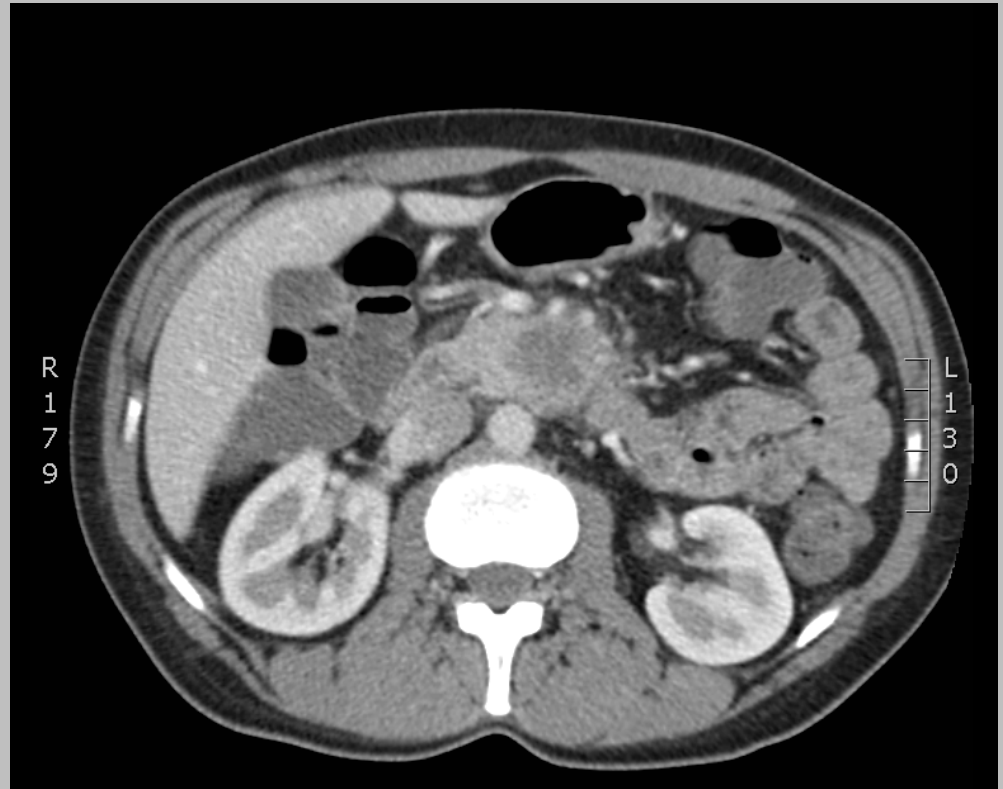
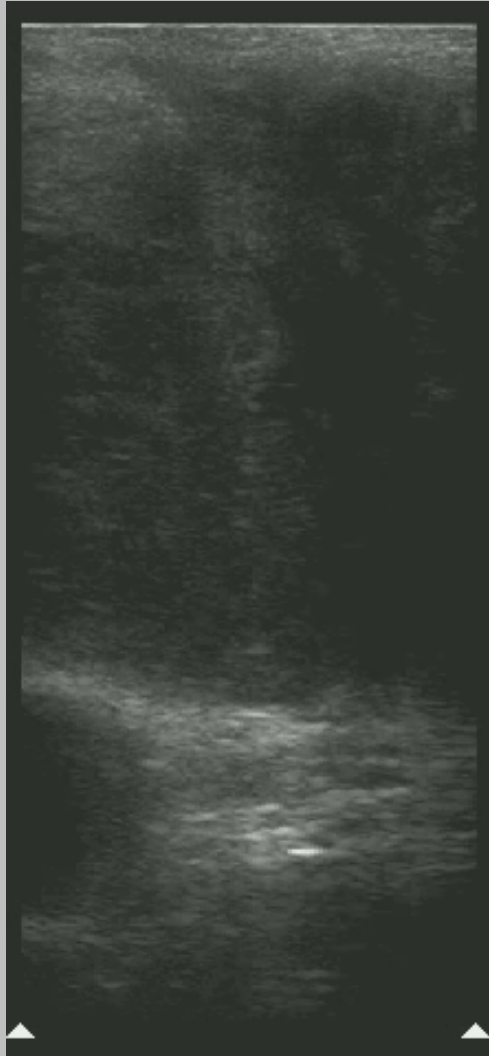
Pankreas - chronická pankreatitída



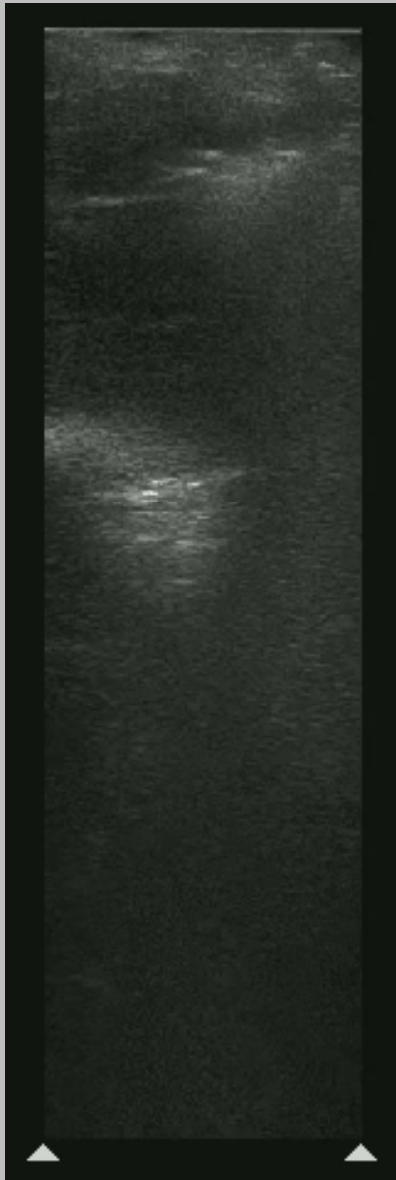
Chronická pankreatitída



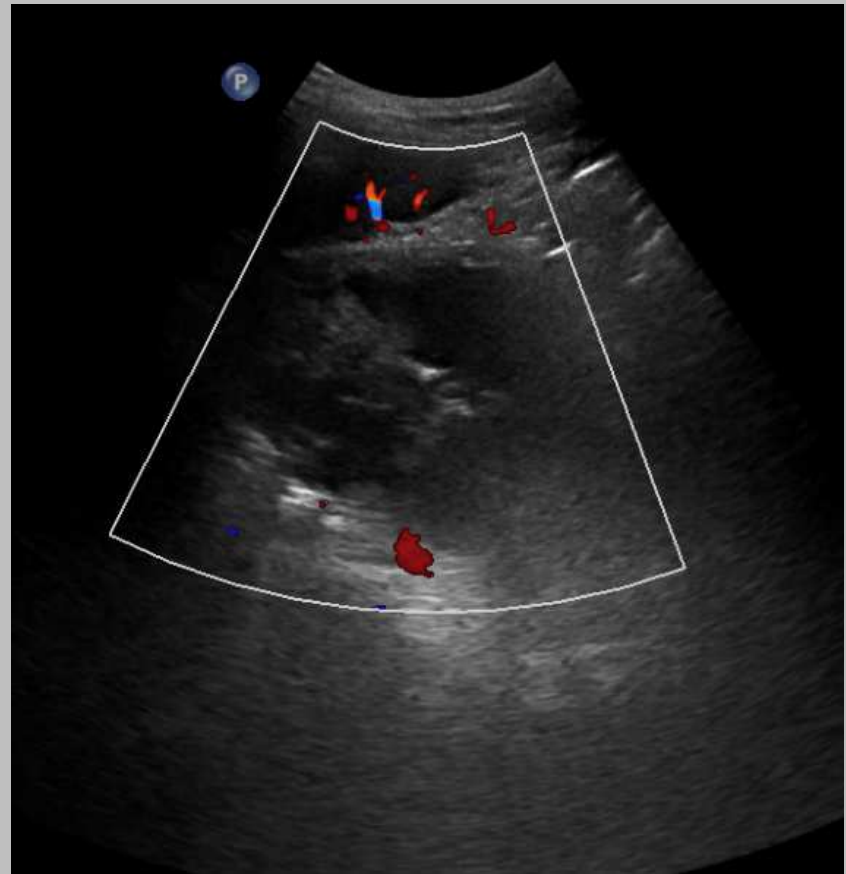
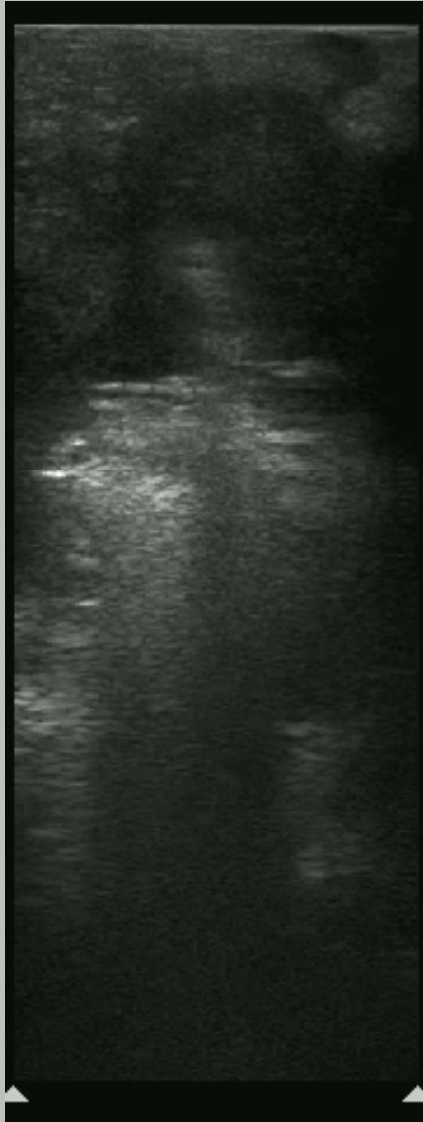
Adenoca pankreatu



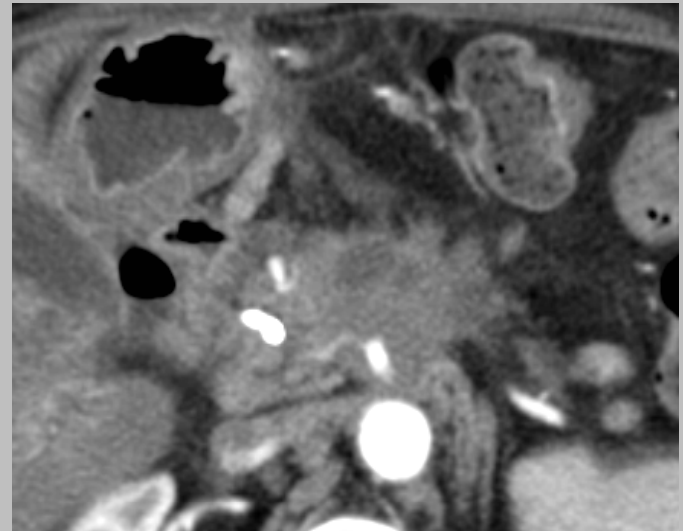
Zavedení jehly pod UZ kontrolou



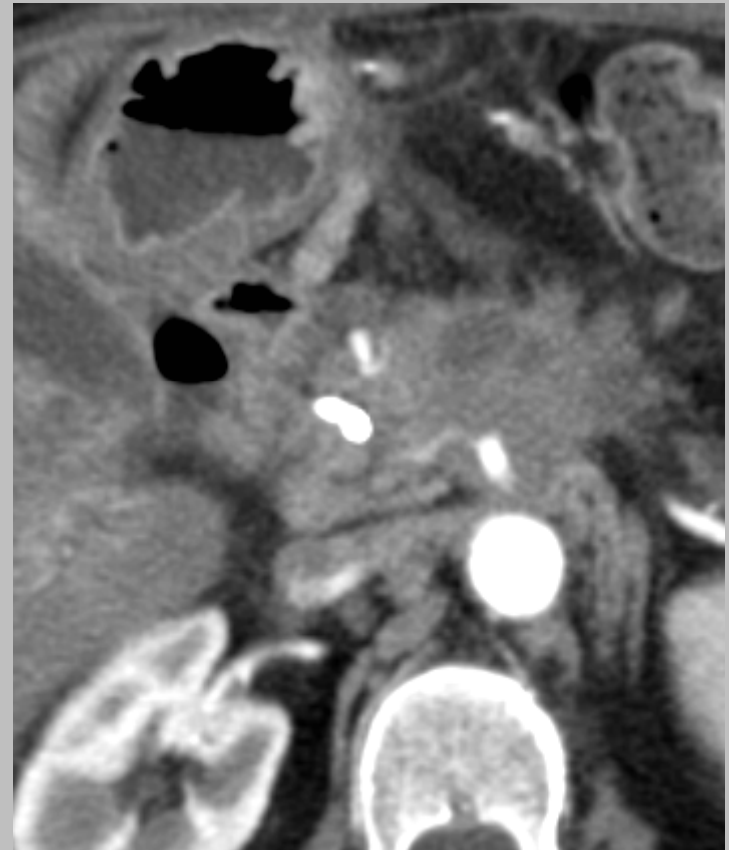
St.p. RFA



Infiltrace AMS



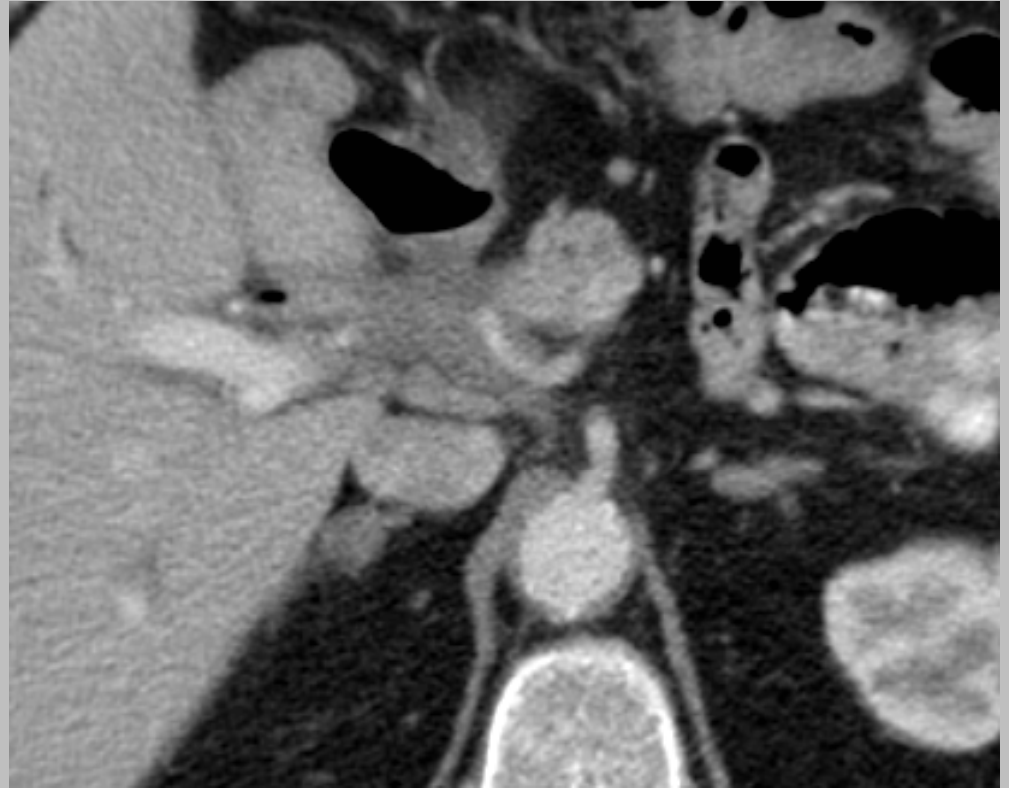
Akcesorní hepatická tepna



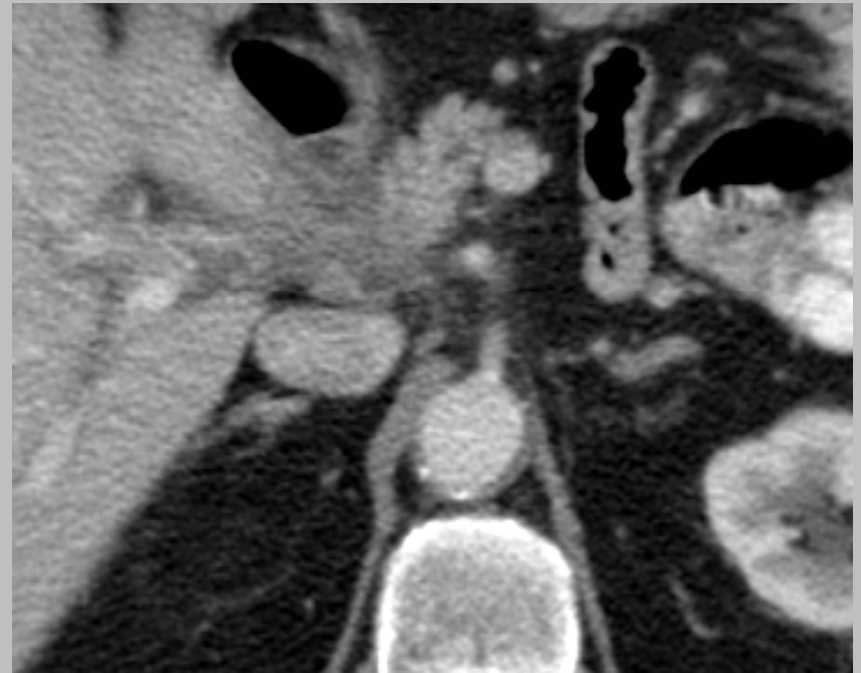
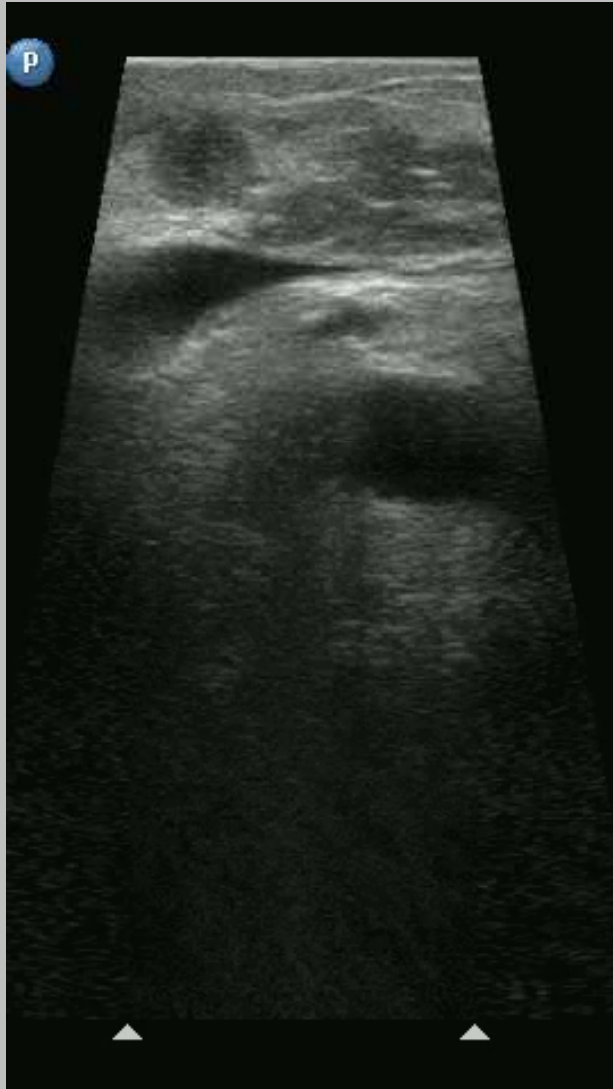
Color Doppler vs. CEUS (4-2MHz)



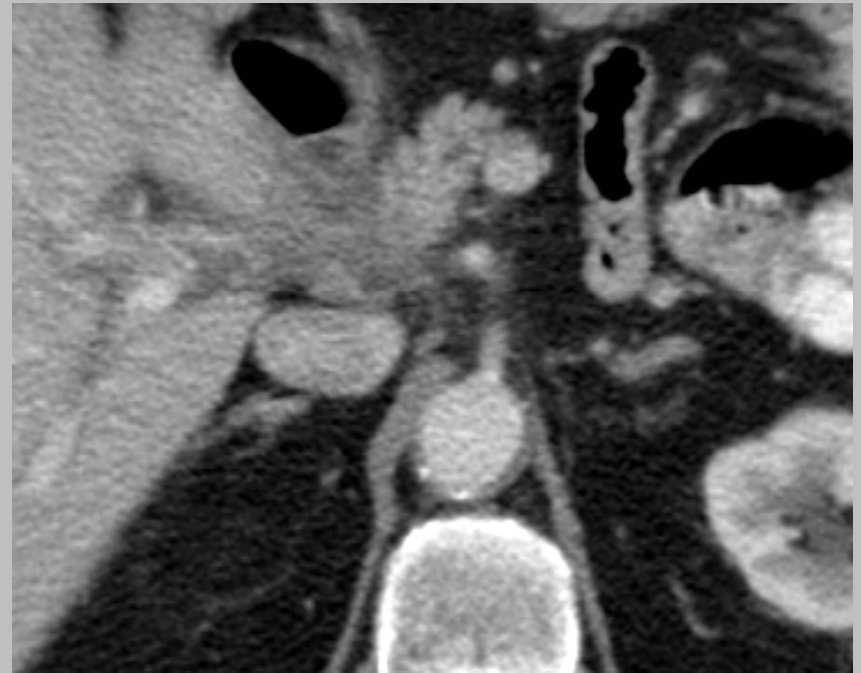
Adenoca pankreatu



Adenoca pankreatu



Adenoca pankreatu

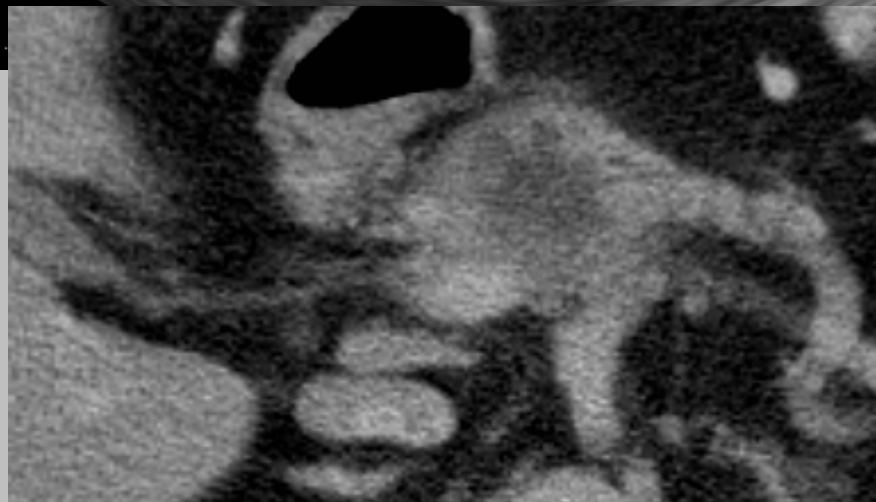
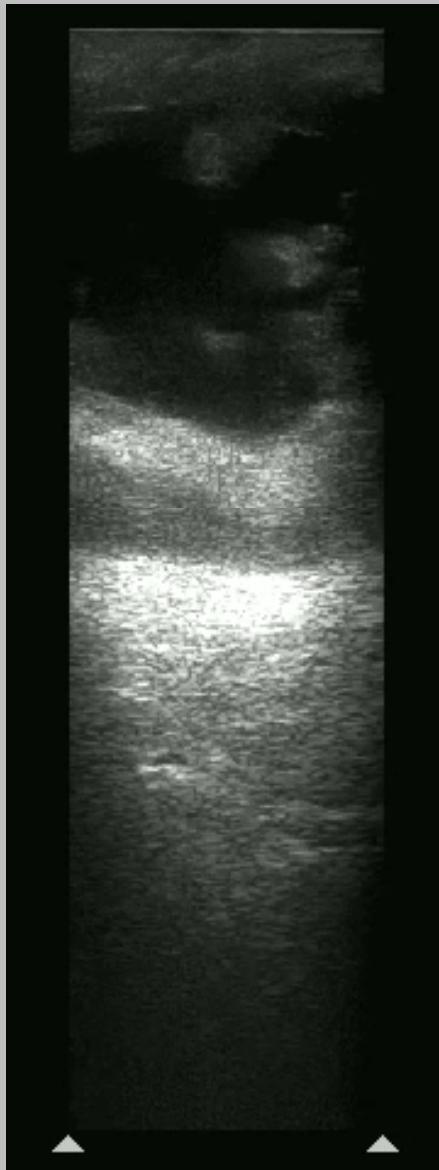


Mucinózní tumor pankreatu

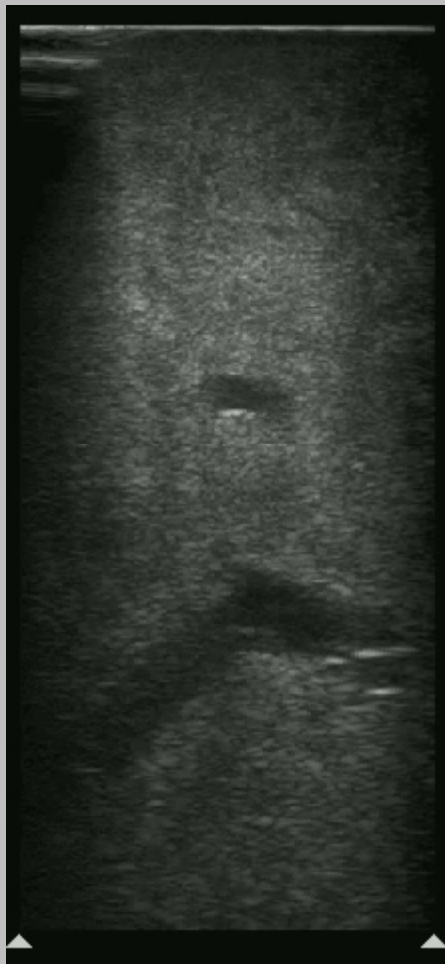
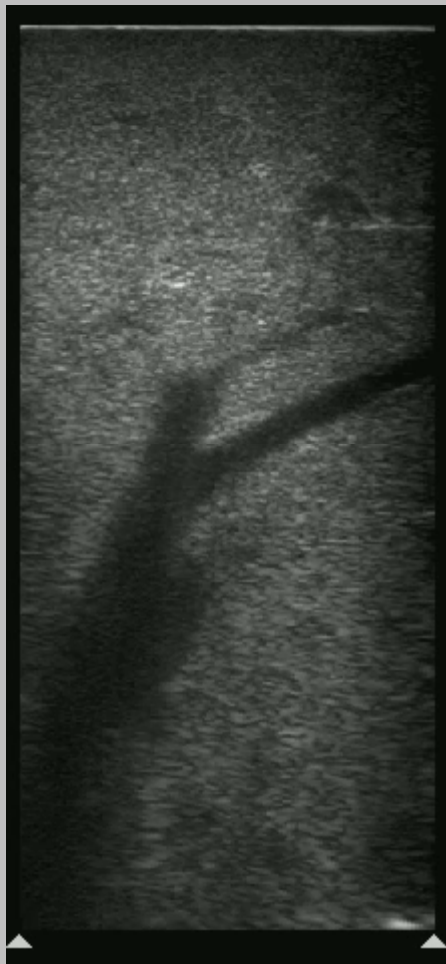
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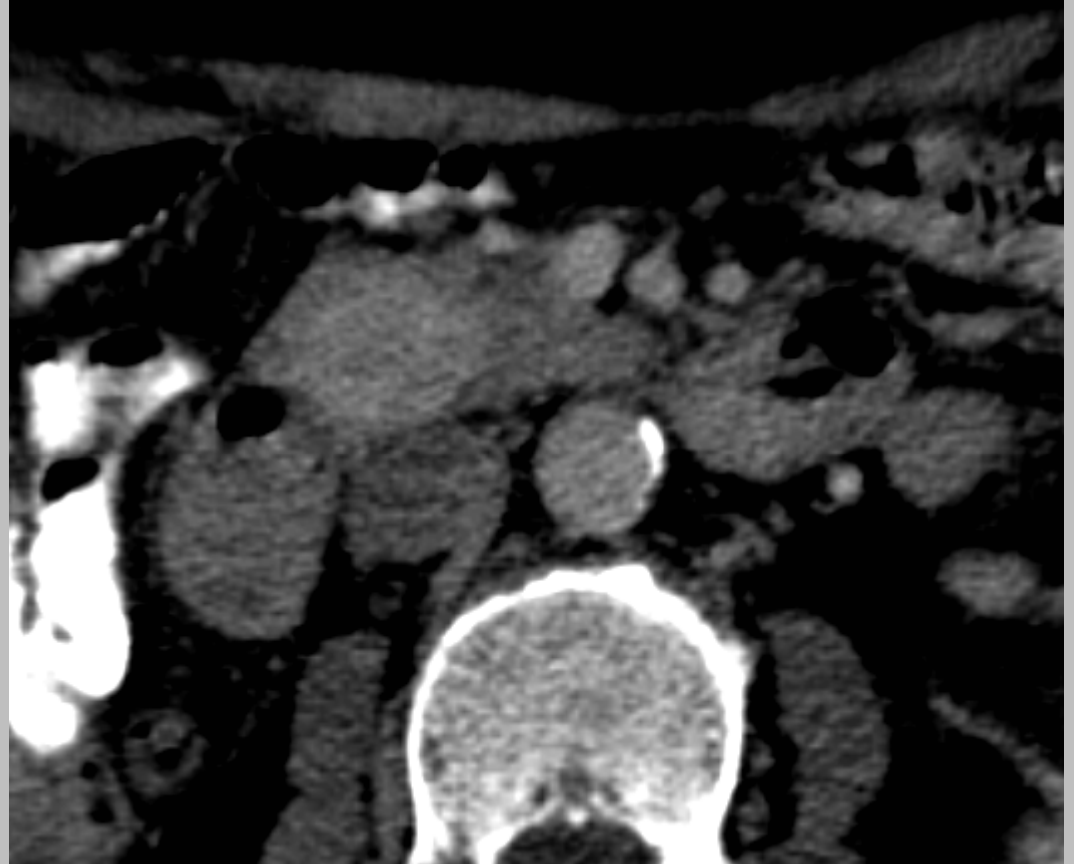
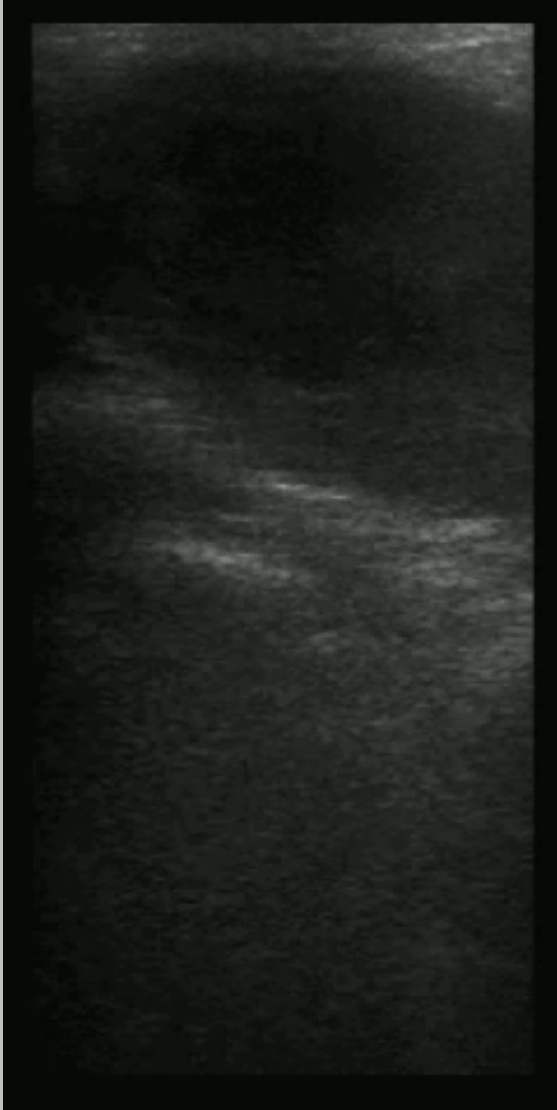
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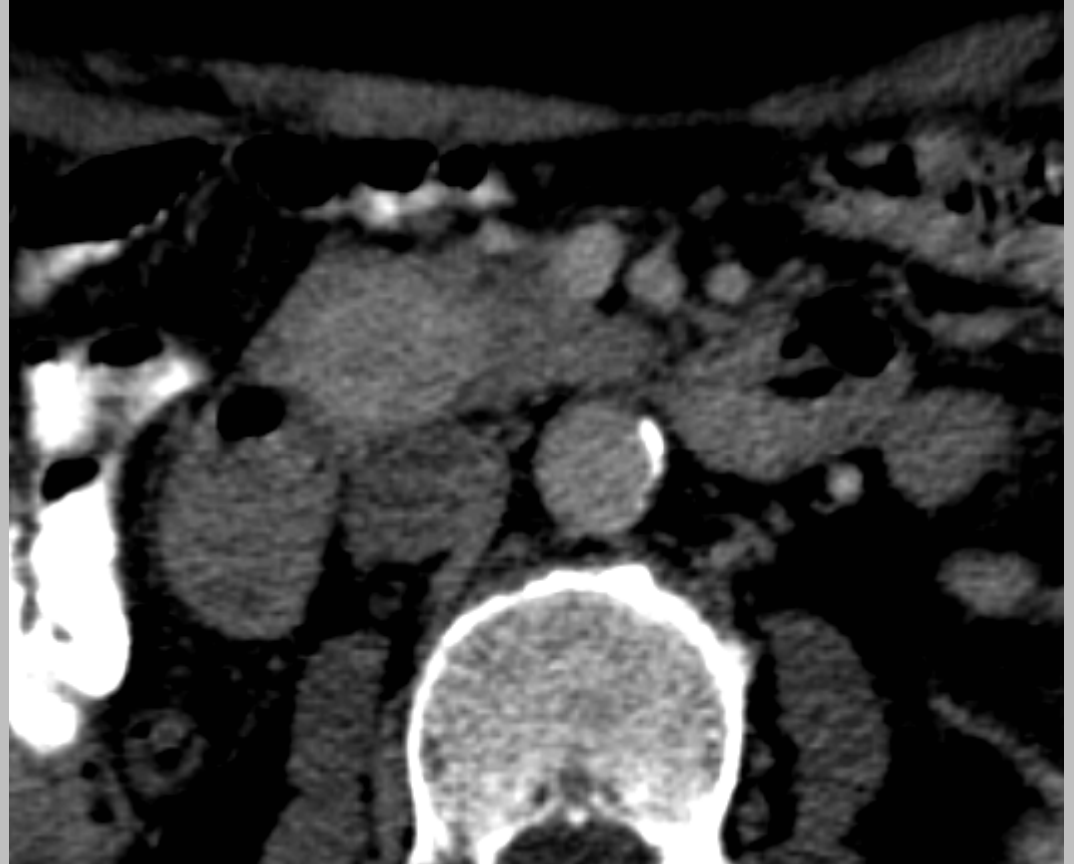
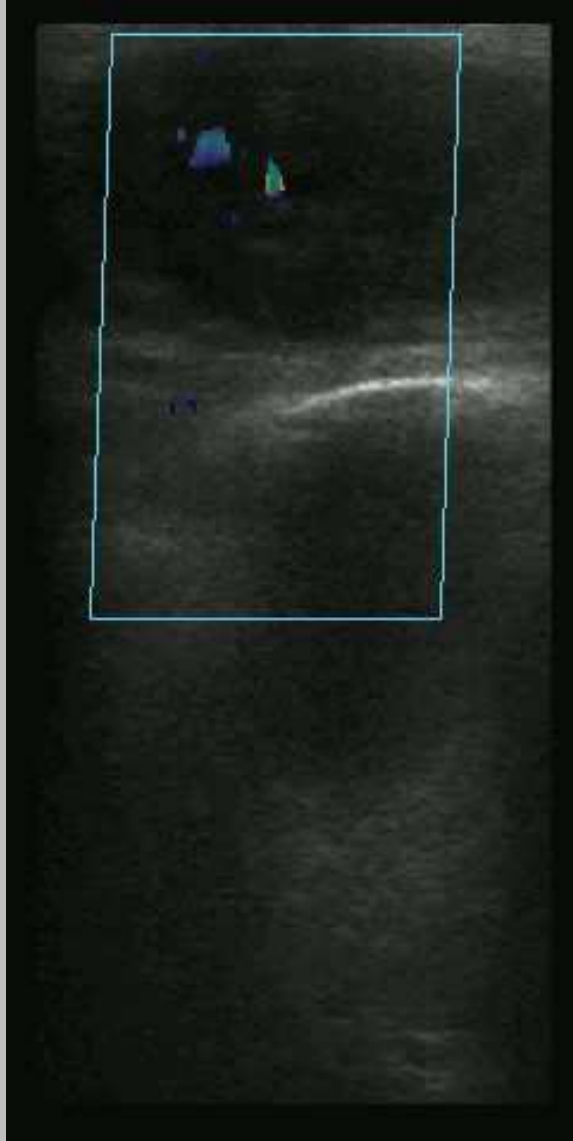
Jaterní postižení



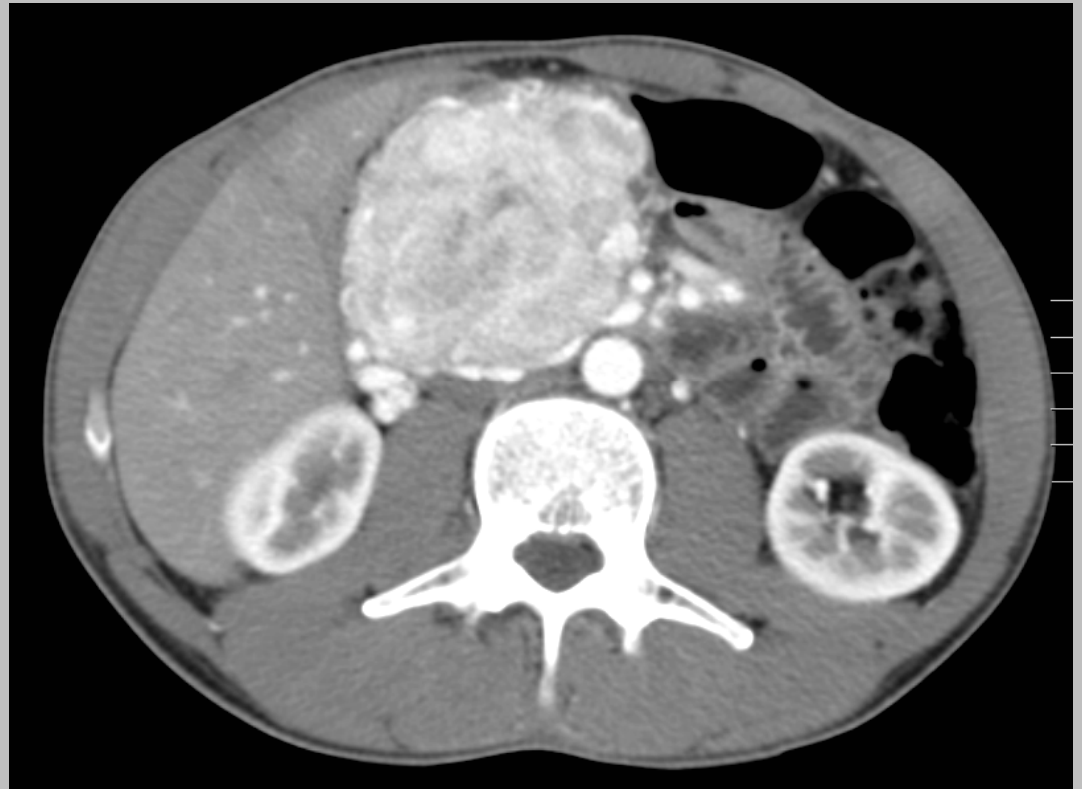
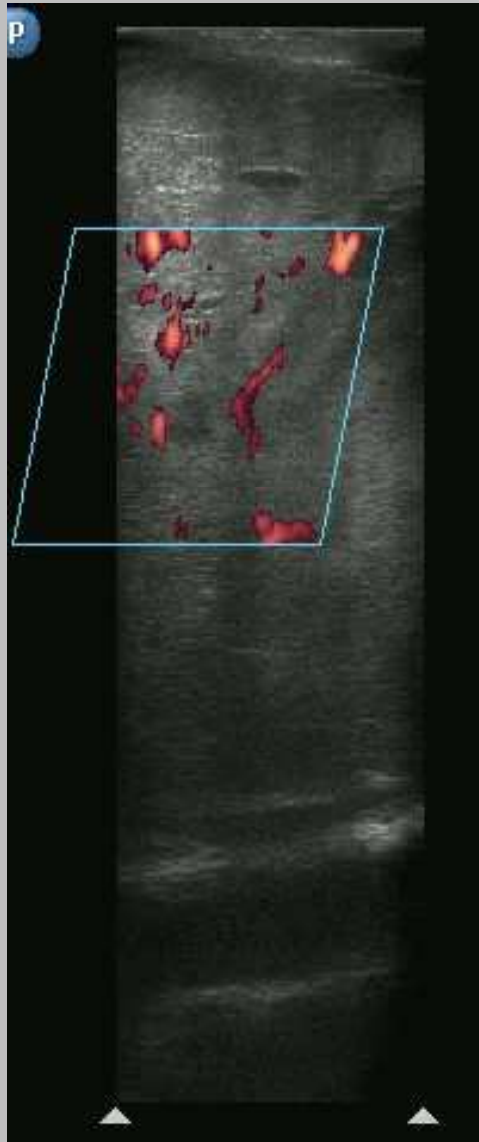
Neuroendokrinní tumor pankreatu



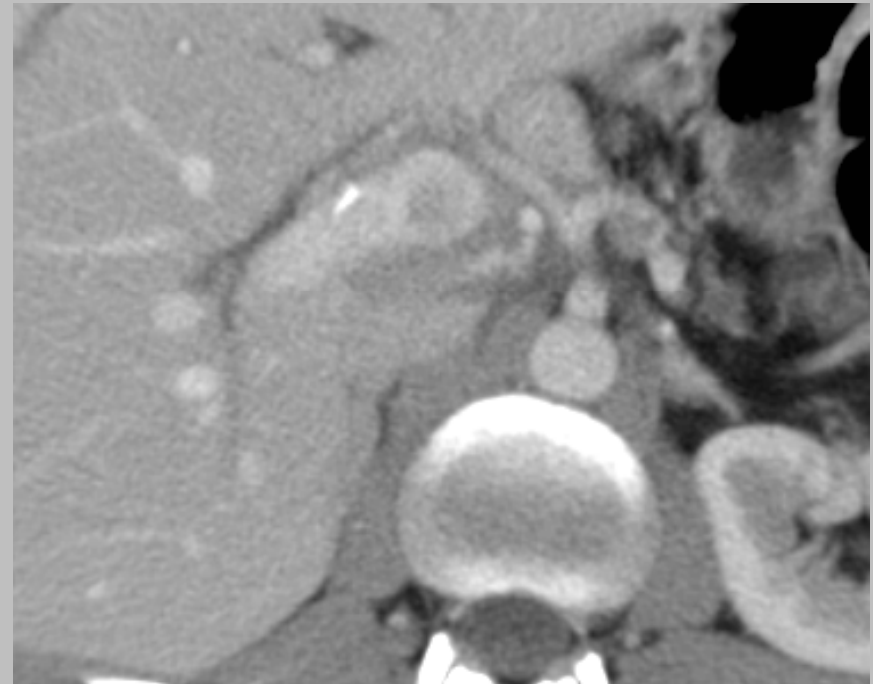
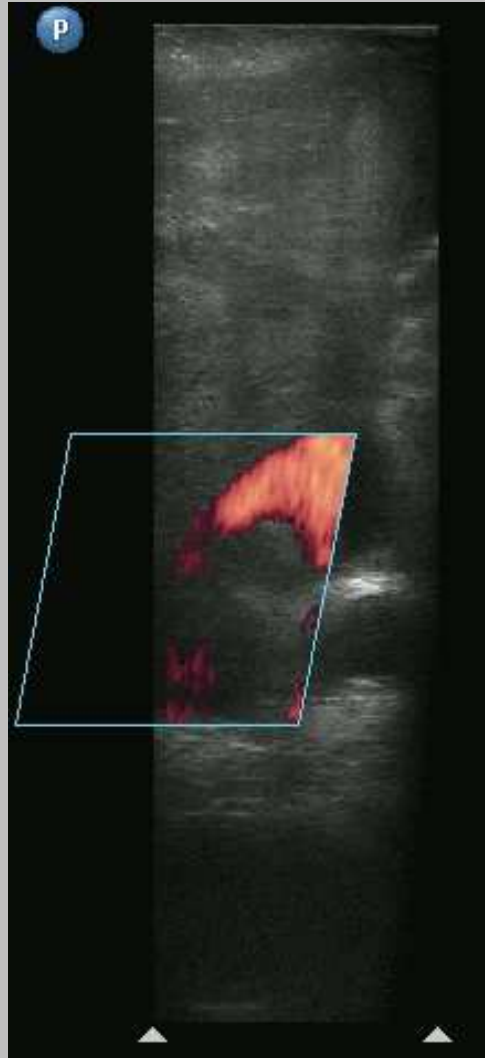
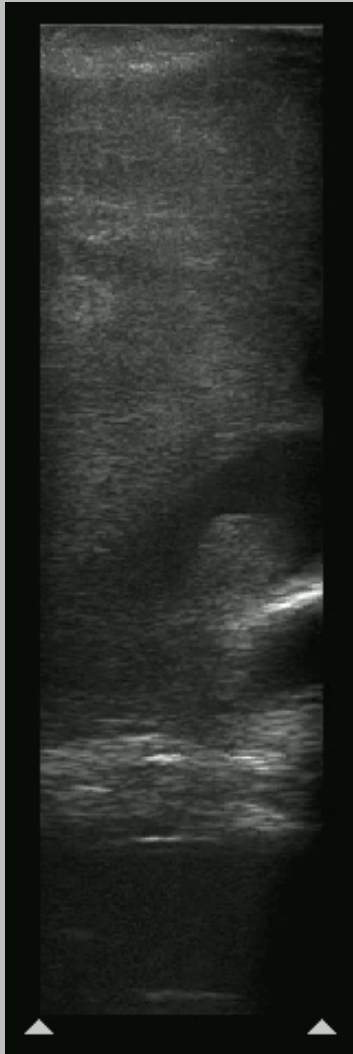
Neuroendokrinní tumor pankreatu



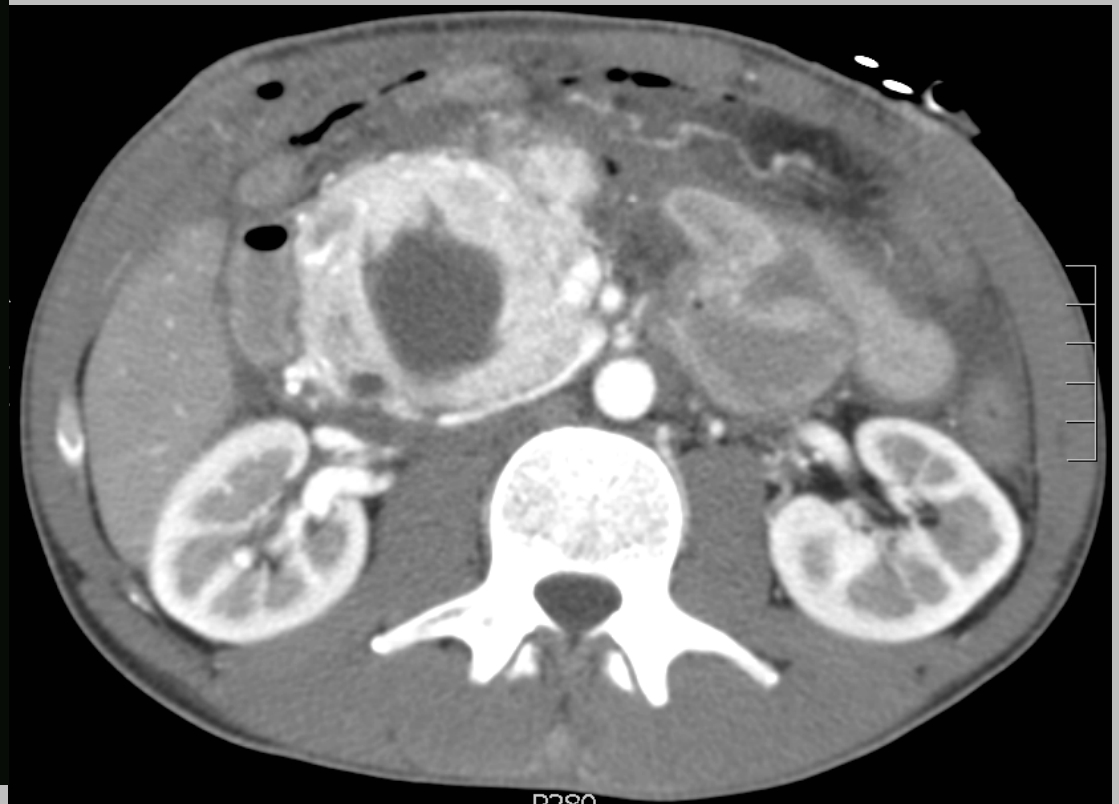
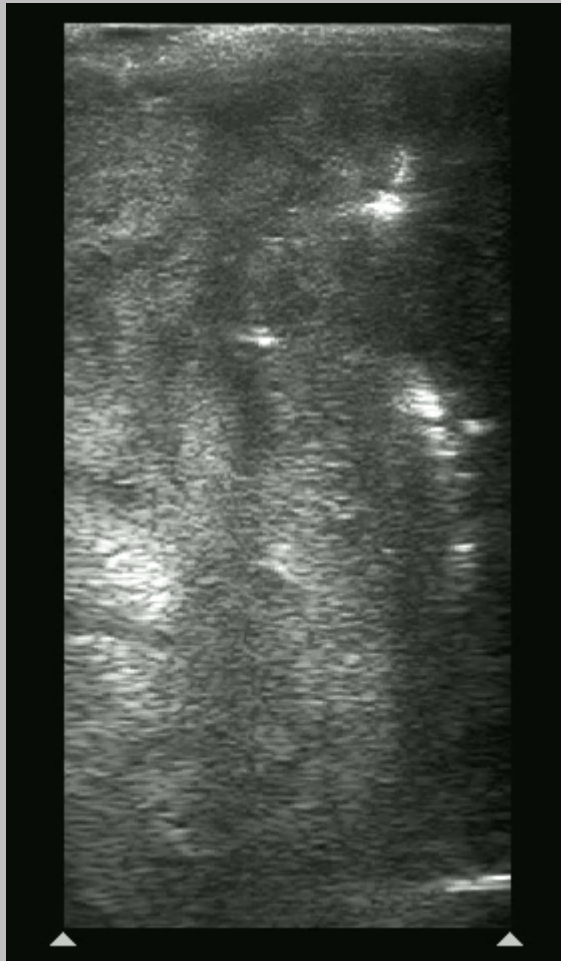
Neuroendokrinní tumor pankreatu II



Neuroendokrinní tumor pankreatu II



Ireverzibilní elektroporace



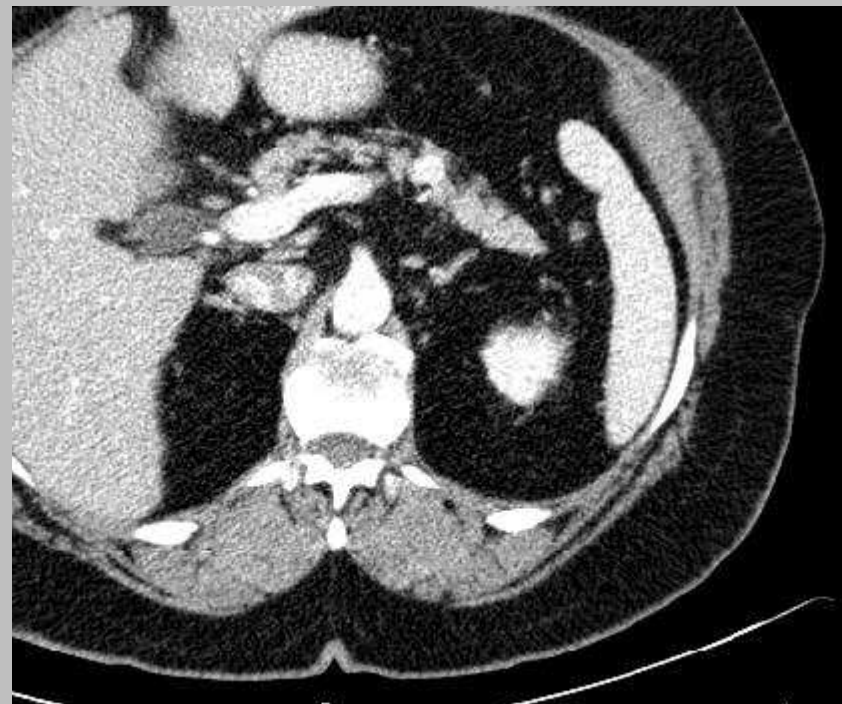
Závěr - játra

- IOUS může změnit management u 15-1% pacientů s mCRC
- Až u 50% pacientů mohou 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
- morfologie tumoru (cystické léze)
- plánování resekčního výkonu a cílení intervence

Odlišení zánět-tumor ?



Děkuji za pozornost

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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 specifitu a senzitivitu z diagnostických metod**
- b) vysokou senzitivitu ale specifitu srovnatelnou s transabdominální sonografií**
- c) senzitivitu závislou na typu operačního výkonu (liberalizace jater)**
- d) vyšší specifitu 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 má malou přídatnou hodnotu u metastáz CRC do jater**
- c) sterilní sonografický gel je nutné z operačního pole v co největší míře odstranit**
- d) sledování léze v průběhu radiofrekvenční ablace není zatíženo artefakty jako při transabdominální sonografii**