CEUS FOR INTRACAVITARY USE

ESPR ABDOMINAL TASK FORCE
Damjana Ključevšek

55th Annual meeting of ESPR, Helsinki, May 16-18, 2019

INTRODUCTION

- INTRACAVITARY CEUS − application of UCA into the physiological or non-physiological cavities via catheter or tube (ceVUS is not included)

- DO WE NEED UCA AND WHEN?

WHEN

- more accurate delineation of the „cavity“ anatomy – complex collections
- communications and fistulas
- questions related to the catheter/tube complications − position and patency of the catheter, drainage efficiency, leakage
- patency of ureter and biliary tree, leakage
- bowel evaluation
- CEUS guided intervention

- off-label use

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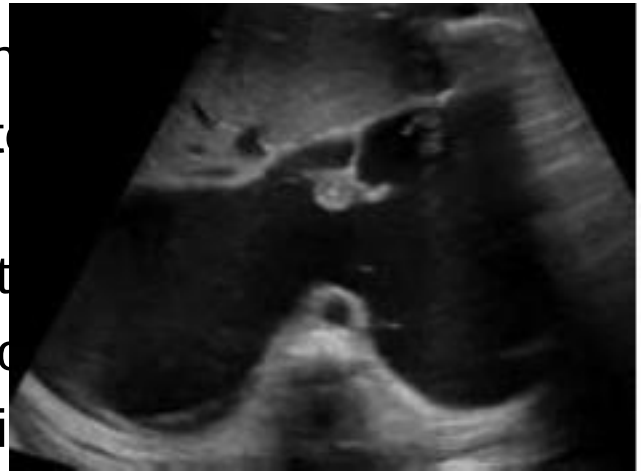

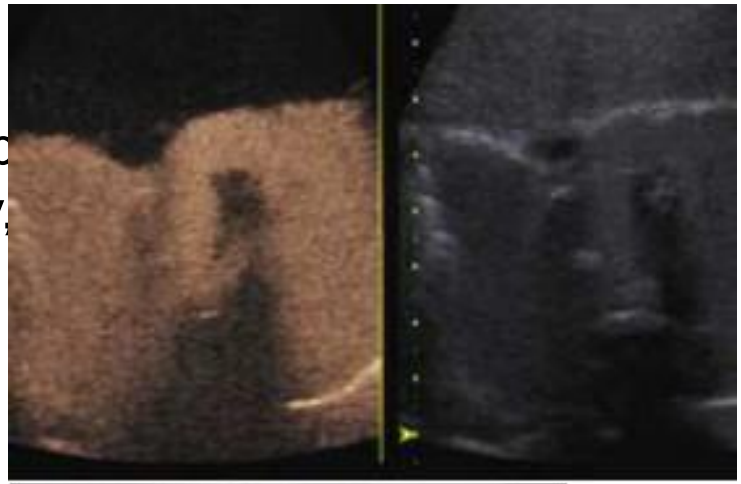

- off-label use

Courtesy M Riccabona, LKH-Universitätsklinikum, Graz

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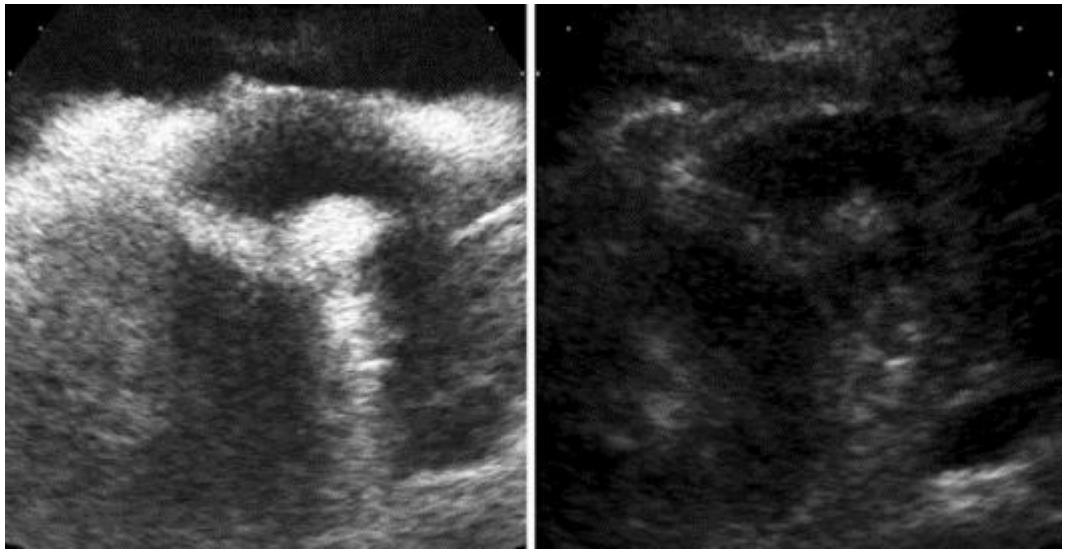

Courtesy M. Riccabona, Pediatric Ultrasound: Requisites and applications, p.43

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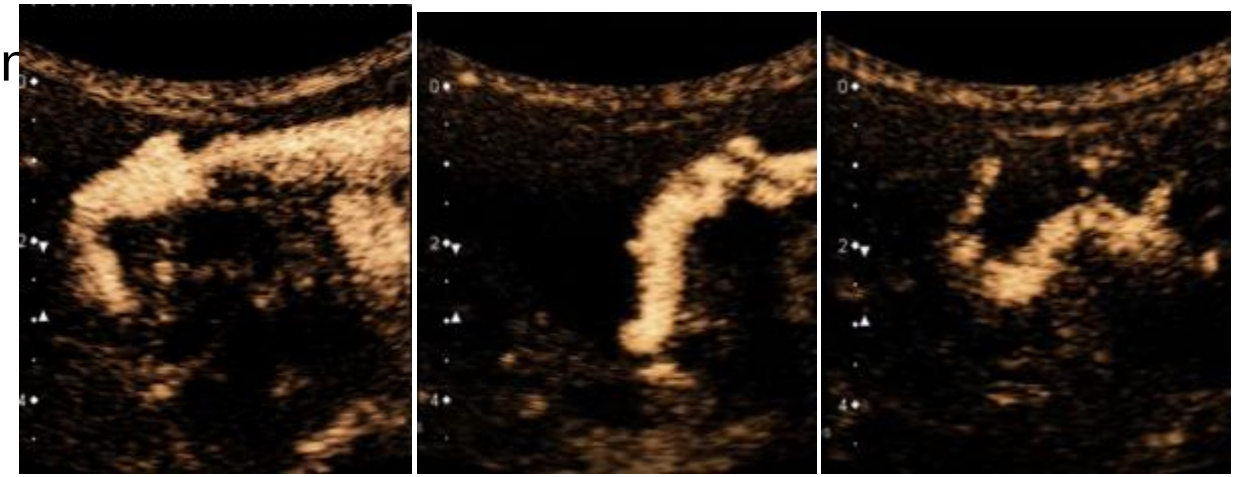

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WHERE

PHYSIOLOGICAL CAVITY	TYPE OF CATHETER/TUBE	INDICATIONS
Urethra	Urine catheter, cystostomy tube	Urethra evaluation
Pelvicalyceal system	Nephrostomy tube	Patency of urinary tract – obstruction versus stenosis of UPJ or VUJ, PNS position, look for urine leaks, fistula?
Pleural cavity	Chest drainage catheter	Tube position & efficiency of drainage (septations of pleural fluid or empyema), communication between several cavities
Peritoneal cavity	Peritoneal catheter	Catheter position, efficiency of drainage
Biliary system	Bile duct/gall bladder drain	Tube position, leak detection, percutaneous US-cholangiography?
Upper GIT	Feeding or PEG tube, Per os	Check the tube position after insertion or change of PEG tube, leak detection Position of duodenal loop, search for duodenal stenosis

NON-PHYSIOLOGICAL CAVITY	INDICATIONS
Cloaca , urogenital sinus	Evaluation of cloaca and urogential malformations
Abscesses, complex collections	Better visualization of the abscess cavity (septations), Control the tube position
Fistulas	Intracavitary CEUS may display the abnormal communication after UCA is injected through drainage tubes or sinus

ADVANTAGES

- problem solving method
- no radiation
- longer observation time
- dynamic character of the examination
- availability
- bedside – avoiding transfer to radiology suit
- presence of parents

LIMITATIONS

- individual case-by-case approach
- off-label, except for ceVUS
- known restrictions for US use (impact of body habitus, bowel gas, access)
- more difficult to obtain the panoramic view of pathology
- costs

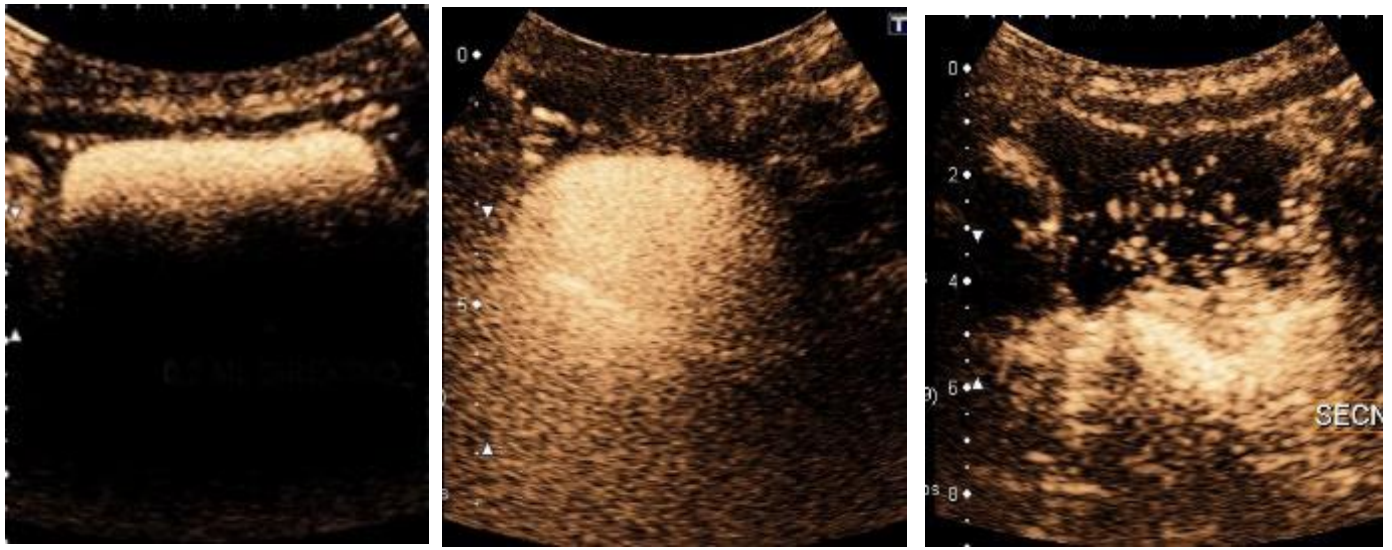
INTRACAVITARY CEUS TECHNIQUE

- Conventional US
  - estimate the ability to access and visualisation of the targeted cavity
  - intracavitary CEUS or fluoroscopy? → perform CEUS first
  - first i.v. CEUS then intracavitary CEUS at the same patient
- Determine the dose, the amount of UCA and the way of application
- Documentation (video recording, key still images)

DOSE

- DOSAGE AND APPLICATION ISSUES
  - pooling of contrast
  - artefact from excessive signal

- IMPACT OF UCA CONCENTRATION
  - too high → attenuation and overflow → disturb visualisation of the cavity
  - too low → decreased sensitivity → decrease diagnostic efficiency



- 0,1% - 5% UCA solution*

- UCA DOSE DEPENDS ON
  - sensitivity of the equipment
  - type of transducer
  - the purpose of the investigation
    - a higher dose of the UCA in cases of communicated or unobstructed cavities
    - a lower dose of the UCA in cases with severely or completely obstructed cavities or to detect drainage tubes

- SAFETY OF INTRACAVITARY CEUS

*dose recommendation based on adult publications / recommendations & personal experience

INTRACAVITARY CEUS LITERATURE

- Deganello A et al. Intravenous and intracavitary use of contrast-enhanced ultrasound in the evaluation and management of complicated pediatric pneumonia. J Ultrasound Med 2017; 36(9): 1943-1954.
- Zhou L et al. Percutaneous US-guided Cholecystocholangiography with Microbubbles for Assessment of Infants with US Findings Equivocal for Biliary Atresia and Gallbladder Longer than 1.5 cm. Radiology 2018; 286(3): 1033-9.
- Chow JS et al. Contrast-Enhanced Colosonography for the Evaluation of Children With an Imperforate Anus. J Ultrasound Med 2019; 00:1–7.
- Serrano N et al. Contrast enhanced genitosonography (CEGS) of urogenital sinus: A case of improved conspicuity with image inversion. Radiology Case Reports 2018; 13: 652-4.

- Sidhue P et al. Role of Contrast-Enhanced Ultrasound (CEUS) in Paediatric Practice: An EFSUMB Position Statement. Ultraschall in Med 2017; 38: 33–43.
- M Riccabona et al. ESPR abdominal imaging task force recommendations in paediatric uroradiology, part IX: Imaging in anorectal and cloacal malformation, imaging in childhood ovarian torsion, and efforts in standardising paediatric uroradiology terminology. Pediatr Radiol 2017; 47:1369–1380.

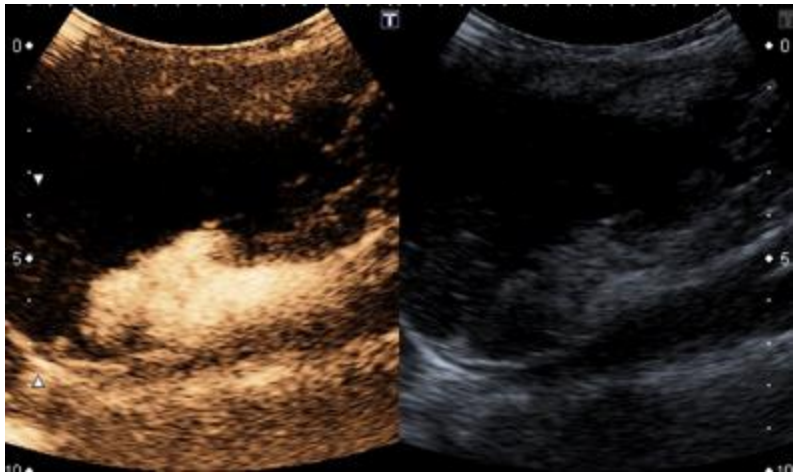
CLINICAL APPLICATIONS OF INTRACAVITARY CEUS

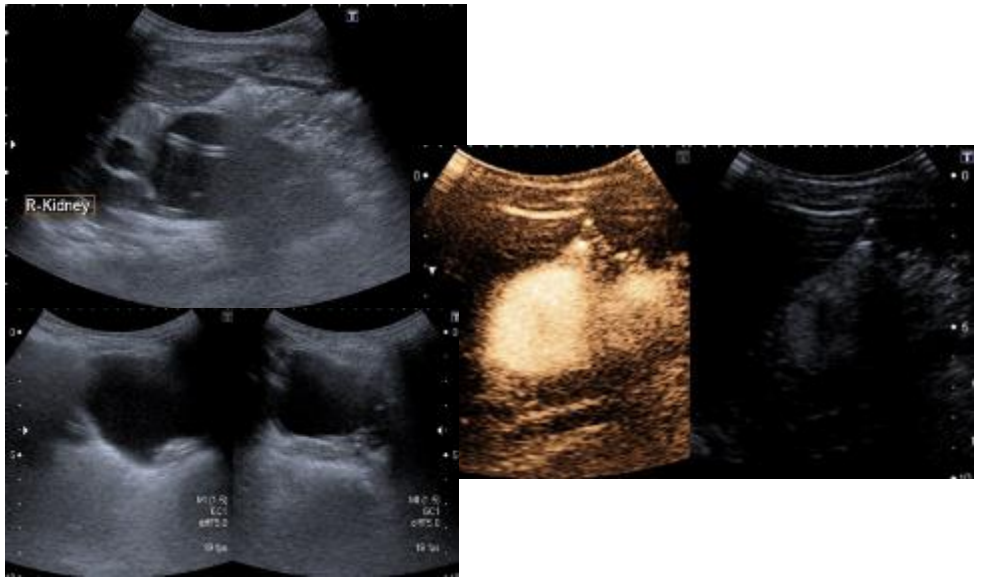
CEUS NEPHROSTOMY

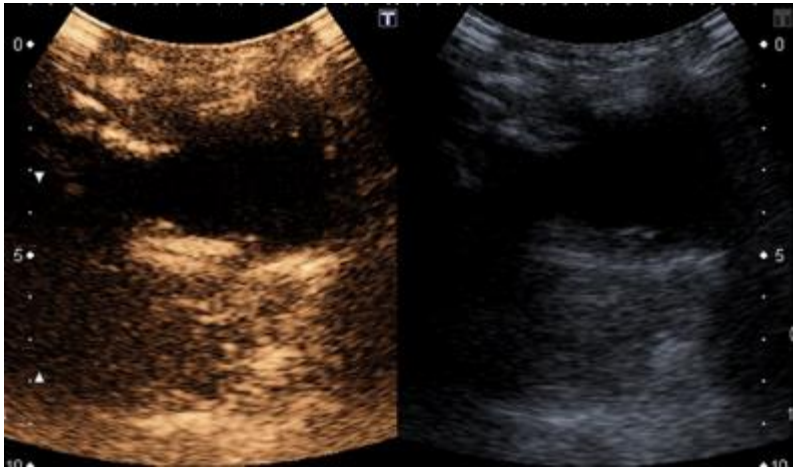
- TECHNIQUE
  - Choose the best child‘s position to follow the course of the ureter
  - Dose: up to 0,1 ml of UCA in 10 ml of saline solution via PNS catheter

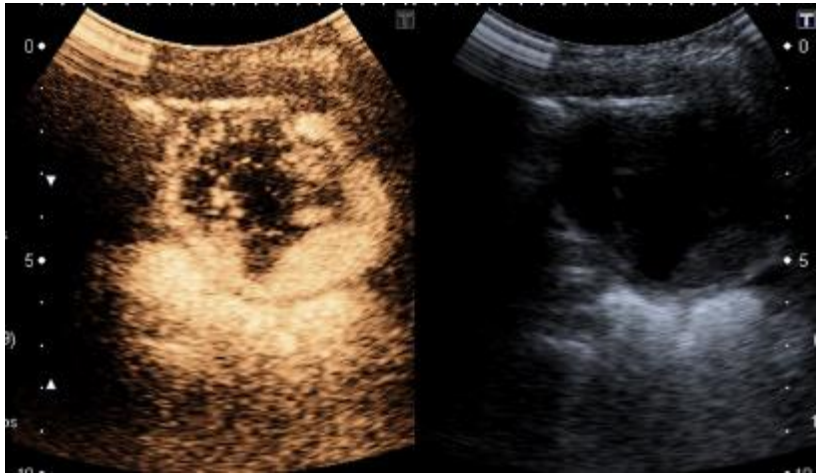
- INDICATIONS:
  - PNS related complications
  - evaluation of ureteral patency
  - urine leakage

- air in the bowel can obscure the visualisation of the whole ureter
- limited to provide panoramic views









a 3-year-old boy with juxtavesical obstruction after VUR surgery and PNS, no MB in bladder

DJ insertion, post insertion dilation of collecting system, ? of DJ function → MB in bladder, patent ureter

CE-GENITOUROSONOGRAPHY

- TECHNIQUES
  - ceVUS to delineate urethra and possible urethro-vaginal fistula
  - ceGUS with UCA application in abnormal perineal opening − urogenital sinus, cloaca, fistula in anal atresia
  - Dose: as for other intraluminal applications, avoid too high concentration

- INDICATIONS: anatomy of urogenital and rectal anomalies and connections between structures in this region

good sonographic visualisation of structures in proximity to the genital tract, ability of 3D/4D reconstructions

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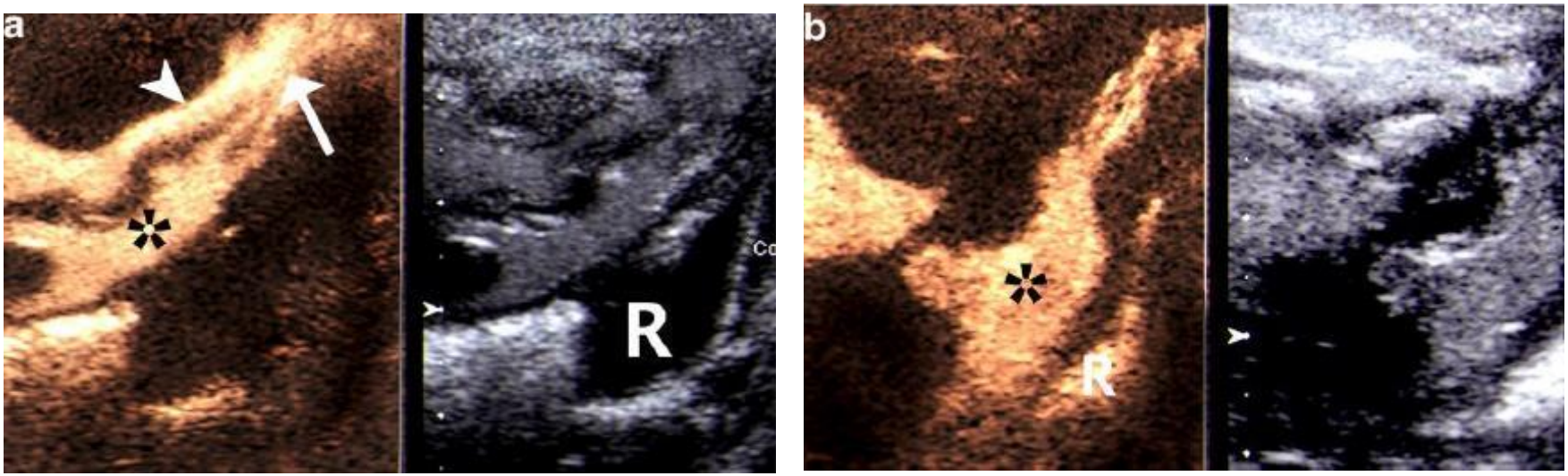
Chow JS, J Ultrasound Med 2019; 00:1–7
Serrano N, Radiology Case Reports 2018; 13: 652-4.

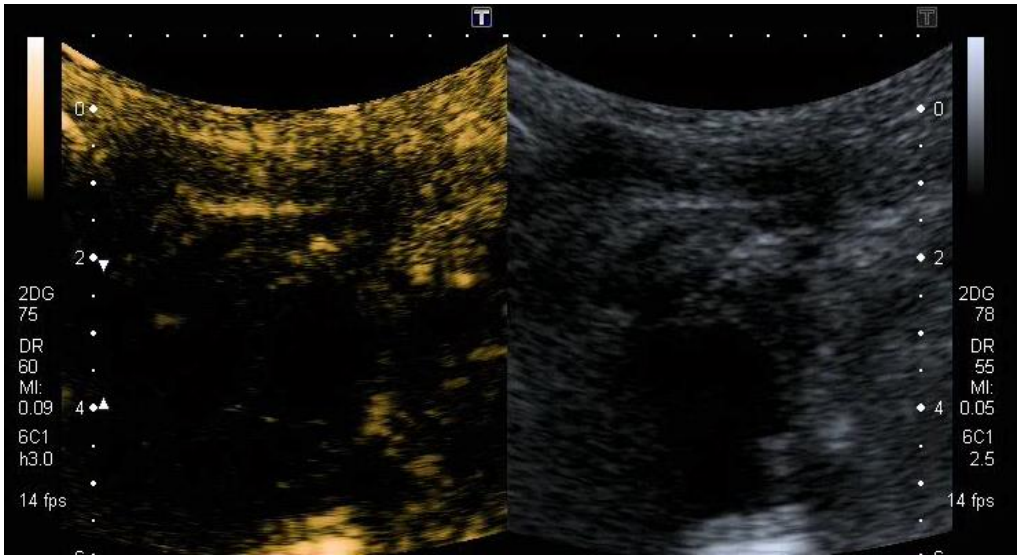


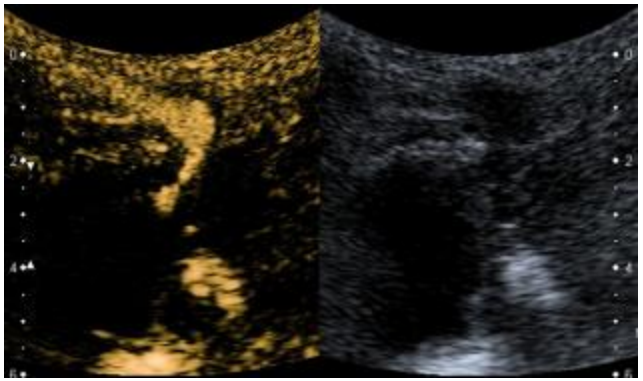
a newborn girl with cloacal malformation

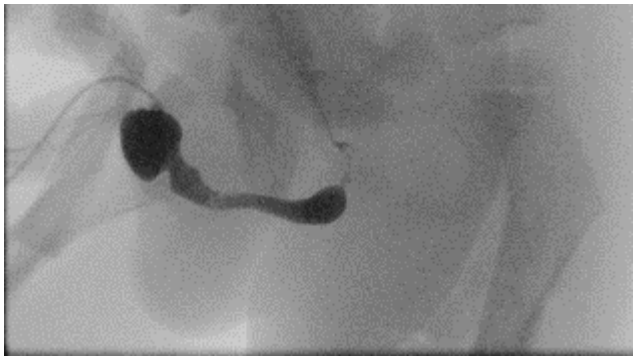
Courtesy M Riccabona. Pediatr Radiol (2017) 47:1369–1380. p1373 Fig.5

CE-RETROGRADE URETHROSONOGRAPHY

- TECHNIQUES
  - „Standard retrograde urethrography“ approach
  - „Pull-back urethrography“



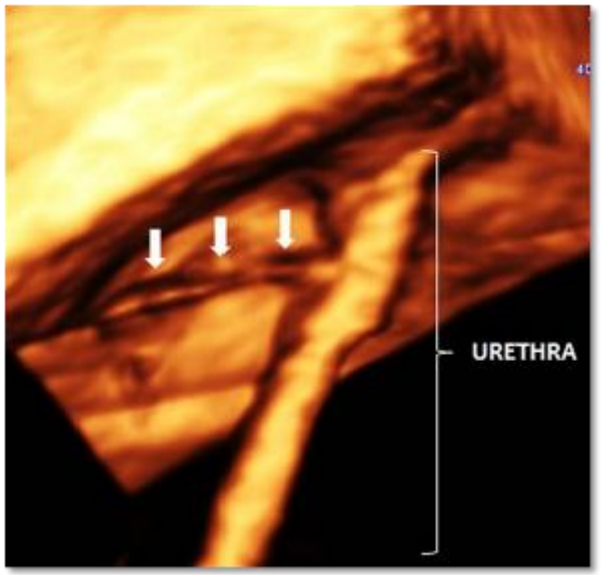




CE-RETROGRADE URETHROSONOGRAPHY

- TECHNIQUES
  - „Standard retrograde urethrography“ approach
  - „Pull-back urethrography“

  - 3D/4D CEUS reconstructions increase the depiction of urethra morphology
  - Dose: 0,2-0,5 ml SonoVue in 20 ml of saline solution



Courtesy of M. Wozniak
Department of Pediatric Radiology,
Medical University of Lublin, Poland

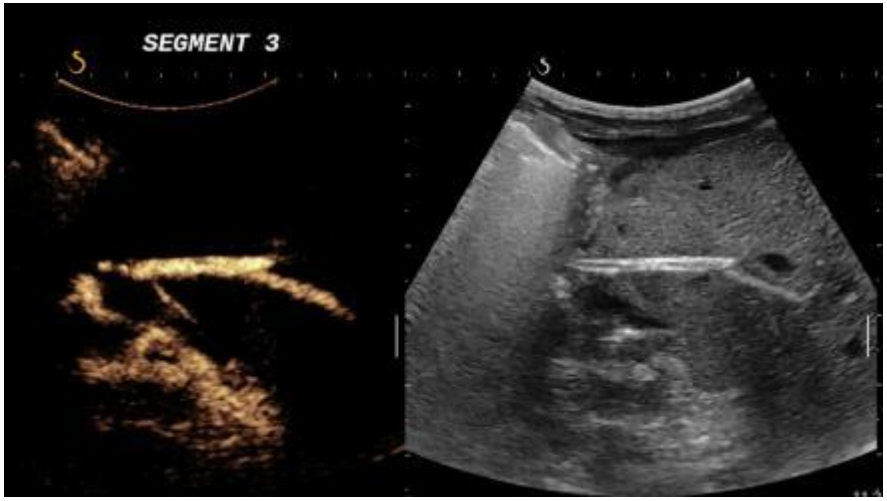
CEUS CHOLANGIOGRAPHY

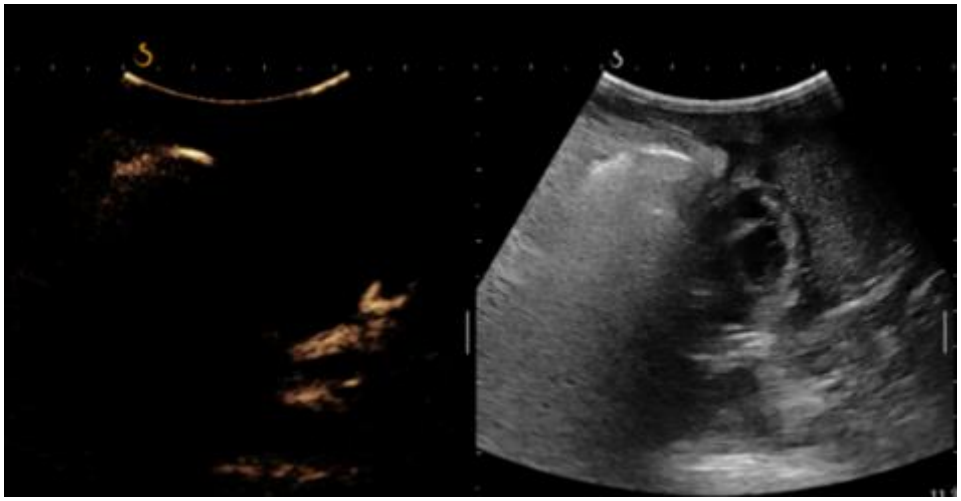
- TECHNIQUE
  - administration of UCA into the biliary system
    - through percutaneous inserted drainage catheter
    - by direct injection of UCA into the gallbladder
  - dose: higher dose, but be careful

- INDICATIONS
  - detection of the level of the bile drainage impedance, bile leakage, communications,
  - bile drainage catheter related complications
  - suspected biliary atresia

- presence of bowel gas, pooling of MB within cystic duct remnant after surgery
- inadequate for visualisation of the biliary tree abnormalities

Zhou L .Radiology 2018; 286(3): 1033-9



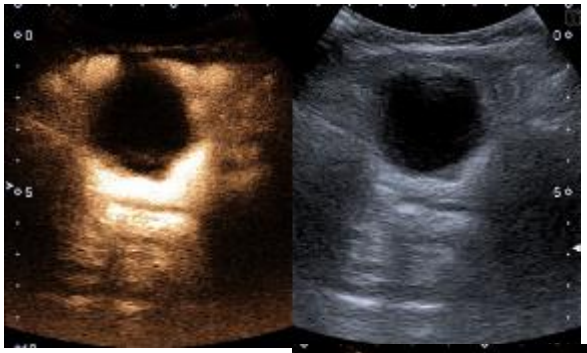


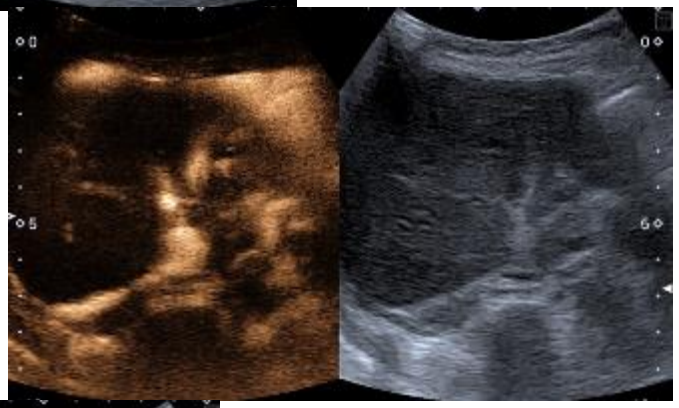
a 4-year-boy after liver tx and biliary complications with biliary stenosis and leaks

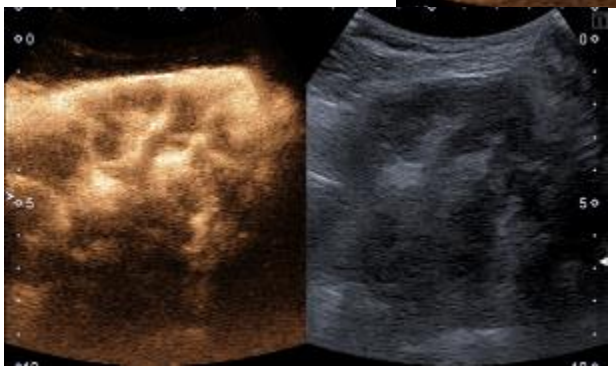
Courtesy of Franchi-Abella S
Service Radiopédiatrie - Hopital Bicêtre, Paris, France

CEUS PERITONEOGRAPHY

- TECHNIQUE
  - UCA application via peritoneal catheter
  - Dose: as for ceVUS
- INDICATIONS
  - help to identify the position of peritoneal catheter
  - confirm patency
  - show a fluid distribution







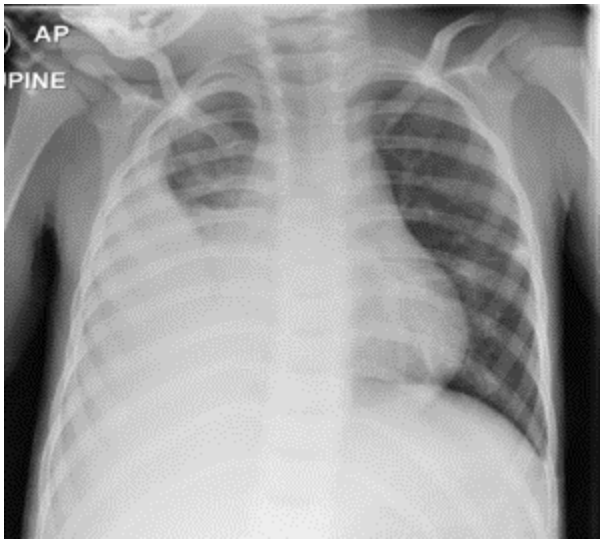
CEUS OF PLEURAL CAVITY

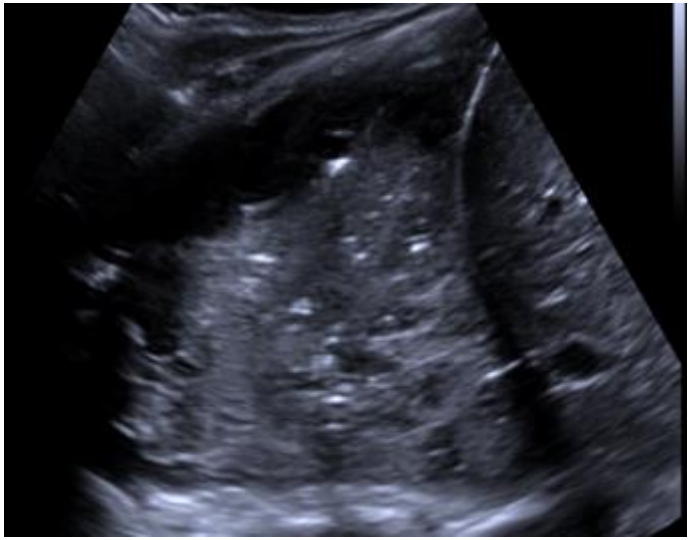
- TECHNIQUE
  - UCA application via inserted chest drain
  - Dose: a few drops of of SonoVue in 20mL of saline solution

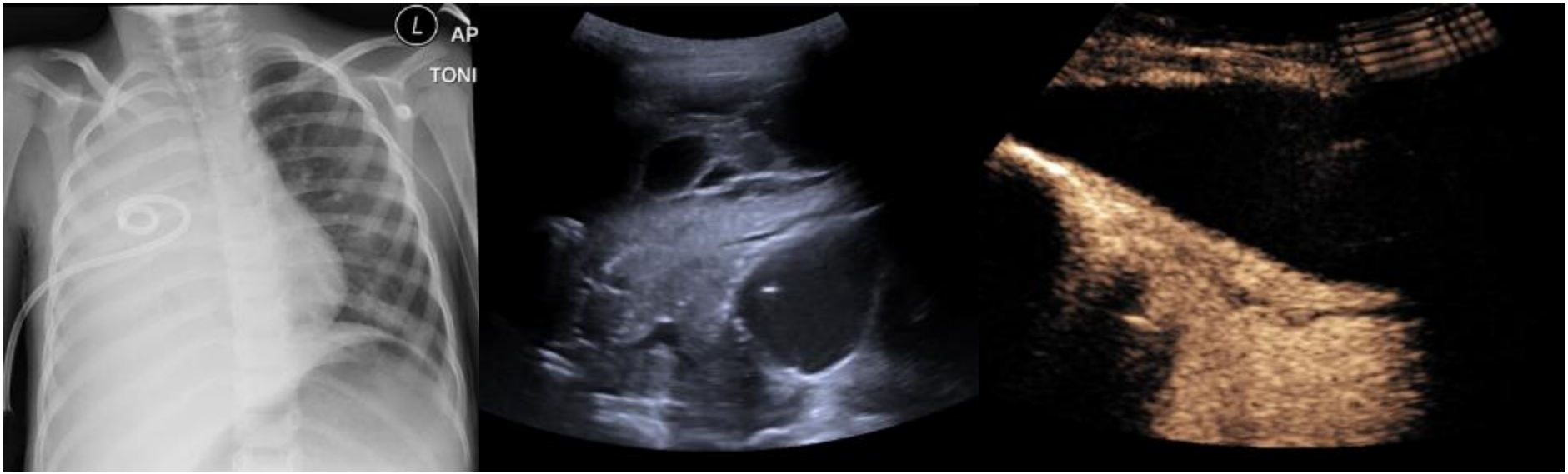
- INDICATIONS
  - chest drainage catheter position, patency
  - drainage efficency
  - guide and evaluate fibrinolytic therapy
  - confirm the adequacy of effective drainage after dissolution of the loculations

avoiding chest CT

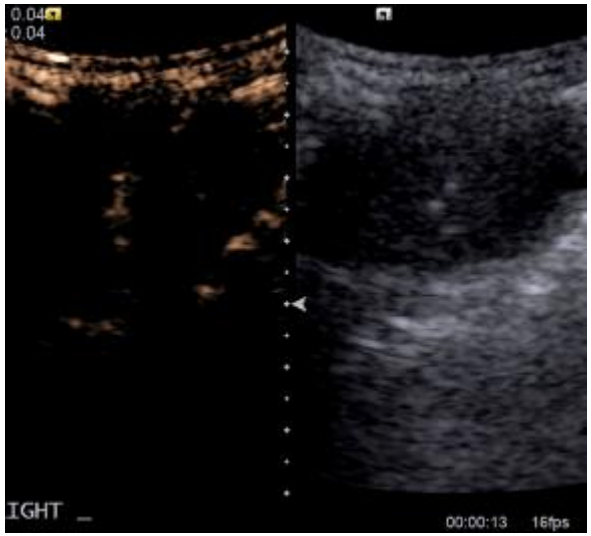
Daganello A et al. J Ultrasound Med 2017

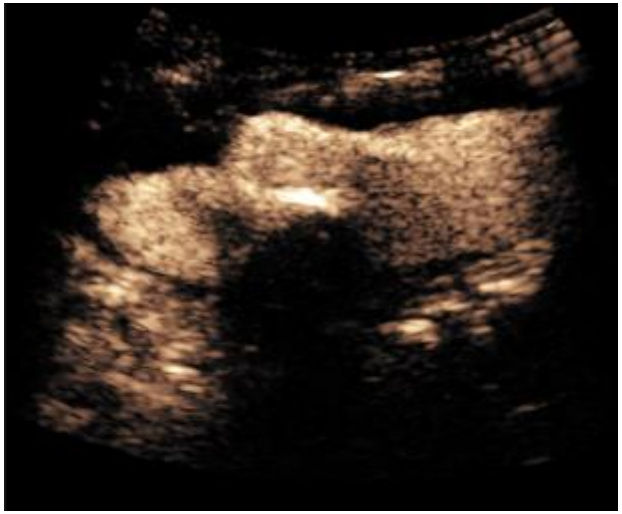






Courtesy of Annamaria Deganello
King‘s College , London, GB





Courtesy of Annamaria Deganello
King‘s College, London, GB

INTRACAVITARY CEUS POSITION STATEMENT

EFSUMB

- „The potential use of trans-catheter injection of UCA has been demonstrated in adults with possible uses in the child needing exploration, with the most likely use in the assessment of the pleural space in the presence of an empyema.“

Role of Contrast-Enhanced Ultrasound (CEUS) in Paediatric Practice: An EFSUMB Position Statement. Ultraschall in Med 2017; 38: 33–43

ESPR TASK FORCE

- no published statement yet
- problem solving, bedside, and radiation-free examination
- great potential in
  - genito-uroradiology
  - tube/catheter related issues
  - guided intervention

WHERE AND HOW TO GO?

- image gently principle
- active role of paediatric radiologists in selection of the children suitable for intracavitary CEUS – education
- off-label is not the same as forbidden
- reimbursement - since November 2017 in Slovenia

5th International Paediatric CEUS Course

EUROSON SCHOOL

London, UK 24 - 25 June 2019

BMUS

THE BRITISH MEDICAL ULTRASOUND SOCIETY

EUROSON SCHOOL

Course Accreditation
The Royal College of Radiologists (UK)
12 CPD Credits

EFSUMB CME Credits