



Ultrasound of the Fallopian Tube

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Outline

- Introduction
 - Embryology
 - Normal Tubes on Ultrasound
- Pelvic Inflammatory Disease
- Hematosalpinx
 - Endometriosis
 - Ectopic Pregnancy
- Tumors
- Torsion
- Infertility
- Look-a-likes



Embryology

- 5-6 weeks paired paramesonephric ducts form
- Cranial portions → fallopian tubes
 - Caudal portion fuses, forms uterus
 - Cranial end is funnel shaped and open to peritoneum
- Congenital Anomalies
 - Hydatid of Morgagni = Paratubal cyst
 - Part of paramesonephric duct that does not contribute to uterine tube may remain as a vesicular appendage
 - Other congenital anomalies: ectopic tube, tube in inguinal hernia (along with ovary)




Merlini et al. Ped Radiol 2008;38:1330-1337

Normal Fallopian Tubes


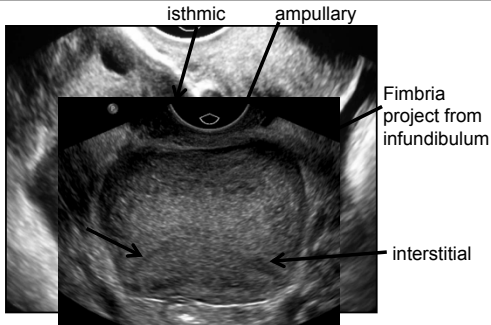
- Extend from ovary to uterus within broad ligament, serve to transport ovum
- 10-12 cm in length, 1-4 mm in diameter
- Open to peritoneal cavity
- Fimbria at open end suspended over ovary and capture released ovum

Kim et al. Radiographics 2009;29:495-507
 Rezvani, Shaaban. Radiographics 2011;31:527-548




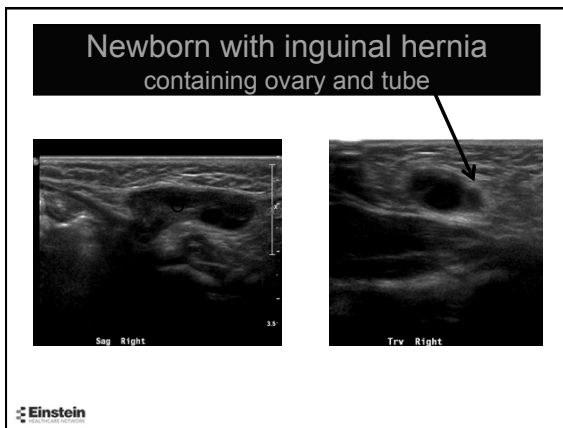
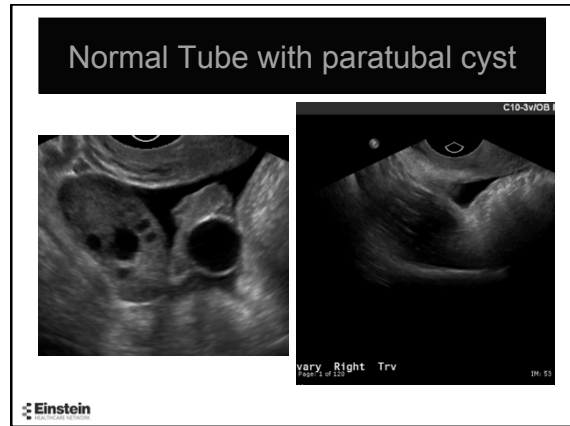
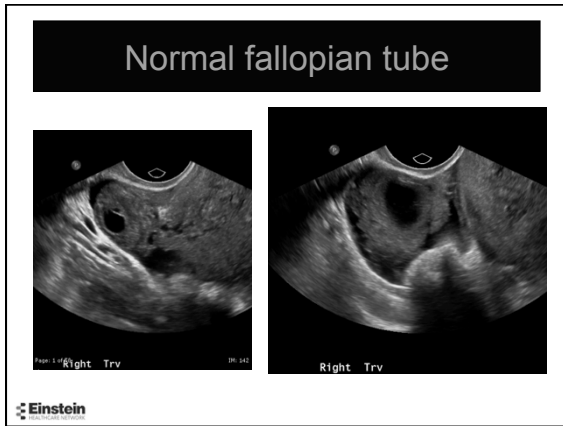
Normal Fallopian Tube

- 4 anatomic segments
 - Interstitial- within myometrial cornua
 - Isthmic- narrowest portion of tube
 - Ampullary- closer to ovary, wider segment, ½ tube
 - Funnel shaped infundibulum
- Composition of wall
 - Mucosa- with fingerlike projections (plicae)
 - Epithelium- ciliated and non-ciliated columnar cells
 - Ciliated epithelium and plicae propel ovum towards uterine cavity, fluid is propelled out of tube into peritoneal cavity

Normal Fallopian tube





PID: Background

- Polymicrobial: Gonorrhoeae cause epithelial damage to tubes allowing super infection with opportunistic organisms
- Initial endometritis, leads to tubal inflammation, adhesions, obstruction, spread to peritoneum and ovary
- In 50% symptoms insufficient for diagnosis

Hillis et al. Am J Obstet Gynec. 1993;168:1503-1509
 Molander et al. Ultras. ObstGyn 2001;17:233-238
 Sweet RL. Infect Dis in Obstet Gynecol 2011: 1-13

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Ultrasound

- Frequently used, no large trials of sensitivity and specificity
- Insensitive for mild abnormalities and non-specific for some findings
- TV imaging most useful; supplement with TA for large abnormalities and extent of fluid
- Useful to exclude other diagnoses
- Sonographic demonstration of abnormal tube is hallmark of PID

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Abnormal Fallopian Tube

★ tubular structure SEPARATE from ovary ★

- Waist sign = diametrically opposed indentations in wall
- Incomplete septum = linear, echogenic protrusion arising from one wall but not reaching the opposite wall
- Thick wall ($\geq 5\text{mm}$) and cogwheel sign are best markers for acute disease
- Thin wall ($< 5\text{mm}$) and beads on string indicates chronic disease
- Other findings: tubular, “solid” structure, fluid/debris level, gas
- Cine clips, 3D inverted imaging

Timor-Tritsch. Ultra. Obstet Gyn. 1998: 12-56
 Benjaminov. AJR 2004;183:737-742
 Patel. AJR. 2006; 186:1033-1038

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Discriminators of Hydrosalpinx

- Incomplete waist sign
- Tubular structure with incomplete waist sign
- Tubular structure with short projections, "beads on a string"

Einstein Patel. AJR. 2006; 186:1033-1038

Normal tube

"Cogwheel sign"

"Waist Sign"

"Beads-on-string sign"

Einstein Timor-Tritsch Ultra Obstet Gyn 1998; 12:56

Inflammatory changes around enlarged ovary and thickened fallopian tube: salpingitis

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Acute Salpingitis

TRV L FT

SAG L FT

LQ

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CT with pre-vesicle inflammation and thickened hyperemic tubes

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Mildly dilated tube

Dist 8.52 cm

Right Adnexa Sag

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Examples of "Cogwheel Sign"

Increasing dilatation →

Do Not Mistake folds for Mural Nodules!

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Cogwheel Sign on CT and histology

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Ylita, et al. Radiographics 2009;29:1987-2003

Progression of Disease

- Salpingitis: swollen, congested tube
- Pyosalpinx: distal tube occludes, lumen fills with pus
- Tubo-Ovarian Complex: tube becomes adherent to ovary, but ovary still distinct
- Tubo-ovarian Abscess
- Other: peritonitis, rupture, Fitz-Hugh-Curtis, ileus, hydronephrosis

Harrow et al. US Clin 2007;2:297-309
Rezvani . Radiographics 2011;31:527-548

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Pyosalpinx

Normal ovary

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Bilateral pyosalpinx

Thick walls, hyperemia

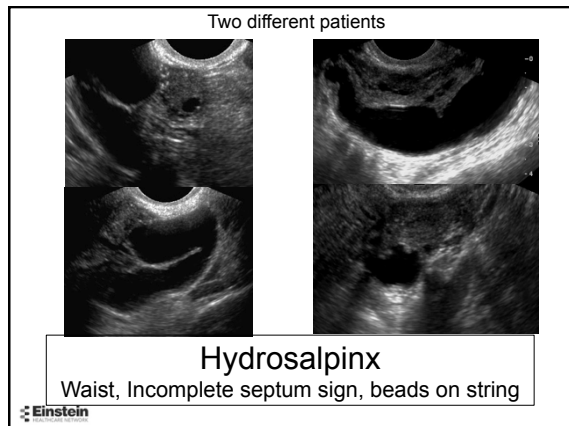
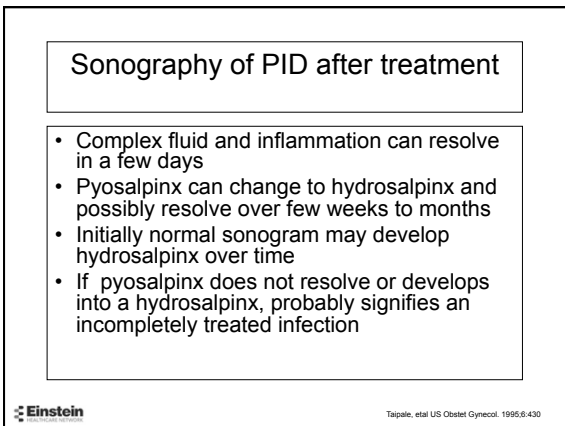
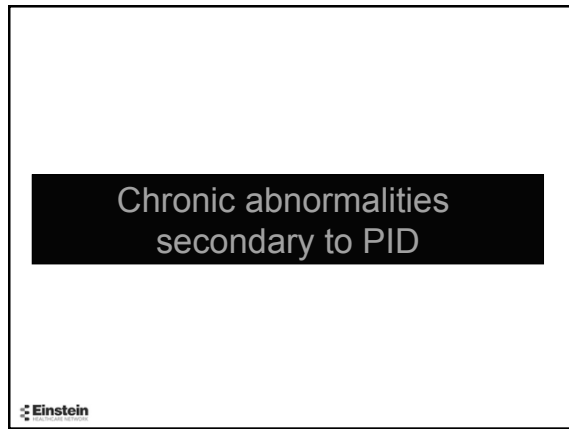
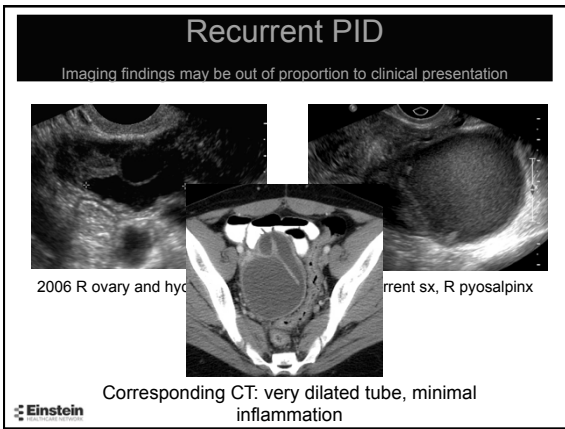
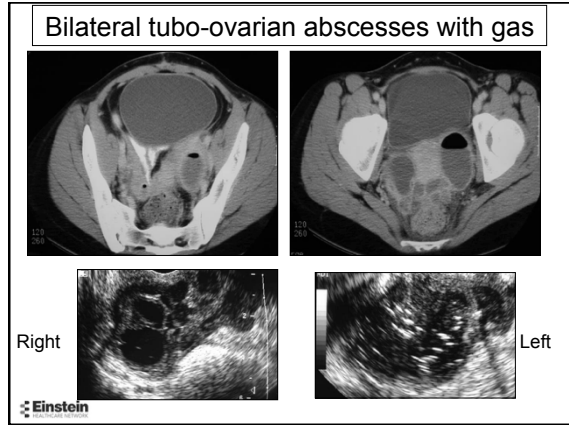
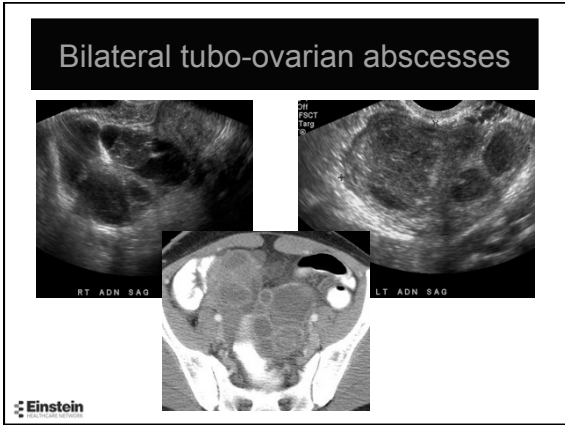
Left Right

Molander, et al. US Obstet Gynecol 2001;17:233-238

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Tubo-ovarian complex

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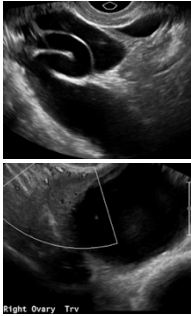


Hydrosalpinx

- obstruction
- Most common after PID, but can be due to tubal ligation, ovulation induction, tumors and occasionally after hysterectomy when tubes are left in place
- Identification of separate ovary crucial to distinguish from cystic ovarian mass

Einstein Benjaminov, et al. AJR 2004;183:737-742

Postmenopausal woman

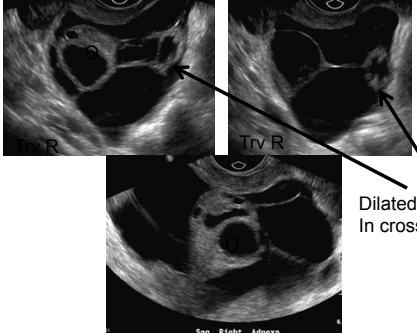



Right Ovary Trv

Hydrosalpinx post hysterectomy

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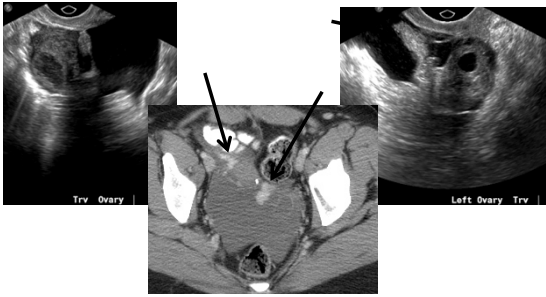
History of PID with significant, chronic pain



Dilated tube
In cross section

Peritoneal Inclusion Cyst with hydrosalpinx

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Peritoneal Inclusion Cyst with
normal tubes

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Peritoneal Inclusion Cyst

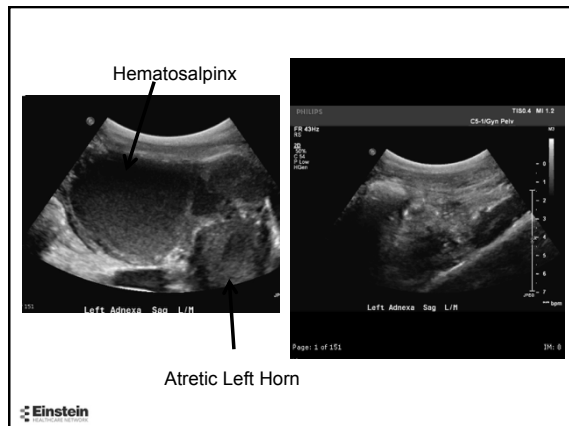
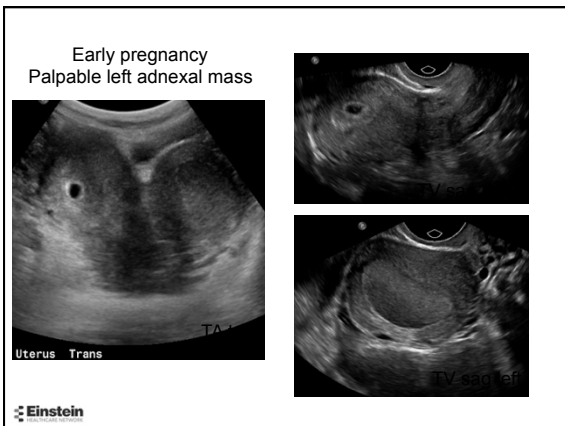
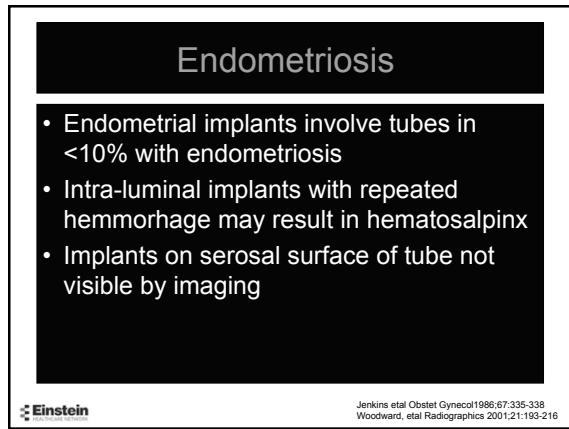
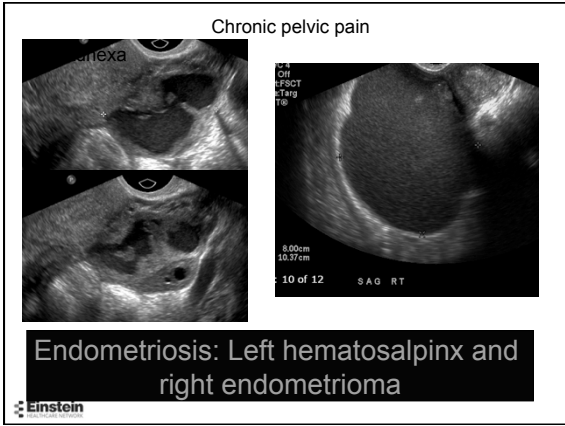
- trapped by peritoneal adhesions
- Causes: prior surgery, trauma, pelvic inflammatory disease, endometriosis
- Need to demonstrate ovary within the cysts or within the wall of the cyst
- Differential diagnosis: hydrosalpinx, para-ovarian cysts
- Treatment: oral contraceptives, lysis of adhesions

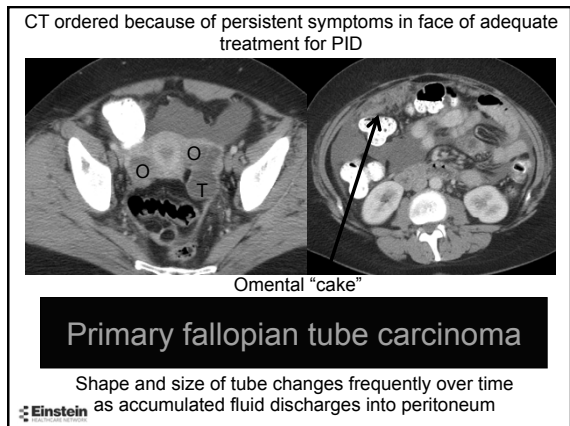
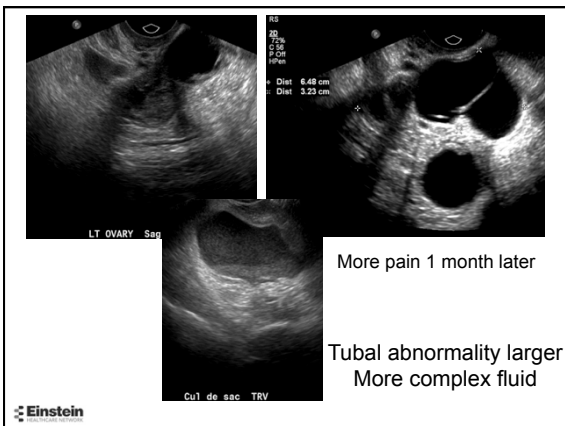
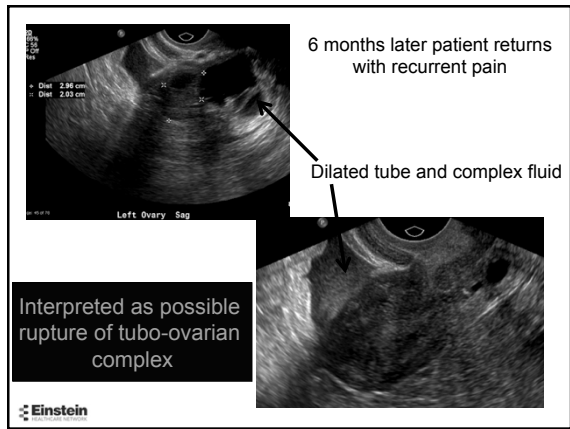
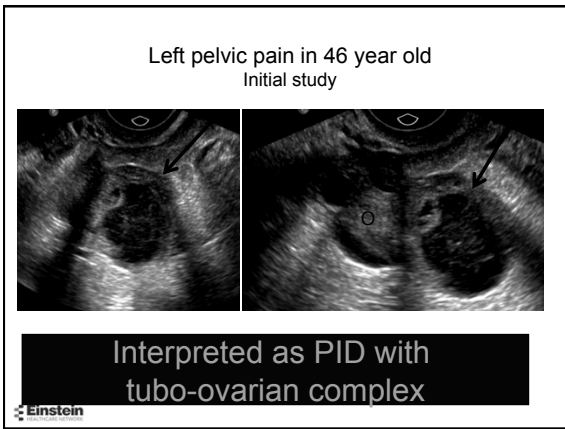
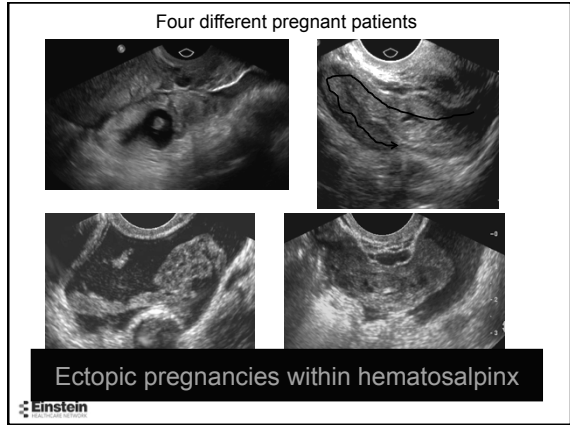
Einstein Kim, et al. Radiology 1997;204:481-484
Horrow, Brown. JIVO 2002;4:99-90

Hematosalpinx

- Endometriosis
- Uterine anomalies
- Tubal ectopic pregnancy

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Primary Fallopian Tube Carcinoma

Clinical

- copious fluid leading to tubal distention and hydrosalpinx
- Pain occurs as tube dilates and abates with discharge into vagina/peritoneum
 - Latzko triad: intermittent vaginal discharge, colicky pain, adnexal mass
- Appearance and symptoms overlap with PID, rarely diagnosed preoperatively
- CA-125 antigen often positive with PFTC




Primary Fallopian Tube Carcinoma


Pathophysiology


- EOC (epithelial ovarian carcinoma)- no underlying cell of origin, no precursor lesions
- Recent theory: vast majority of serous EOC actually arises from fimbrial end of FT which implants in ovary
 - salpingo-oophorectomy in high risk women rather than in situ EOC
 - Recommend also removing uterus with entire FT
- Further studies found > 70% non-hereditary EOC and peritoneal serous carcinomas have tubal mucosal involvement

Pedraza et al. The Oncologist 2006;11:902-912
 Pick et al. J Pathol 2001;195:451-456
 Przybycin et al. Am J Surg Pathol 2010;34:1407-1416
 Shaaban, Rezvani. Abdom Imaging 2012. DOI:10.1007/s00261-012-9920-4

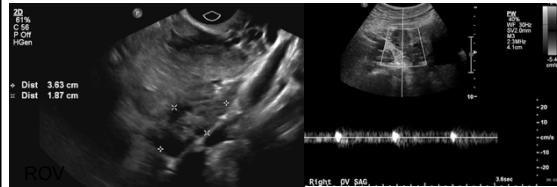


PFTC with thick, "solid" tubes






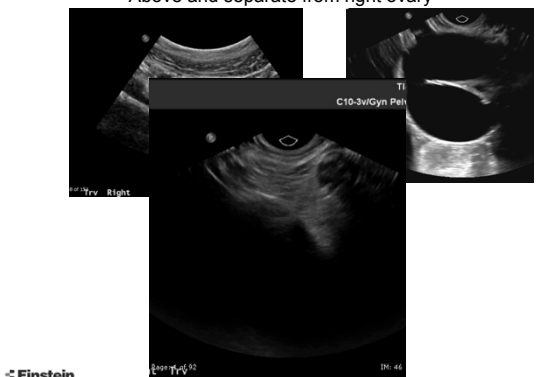
Acute right pelvic pain, US to evaluate for ovarian torsion




Normal ovary

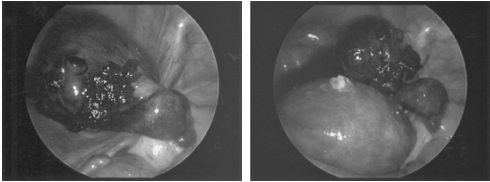



Above and separate from right ovary

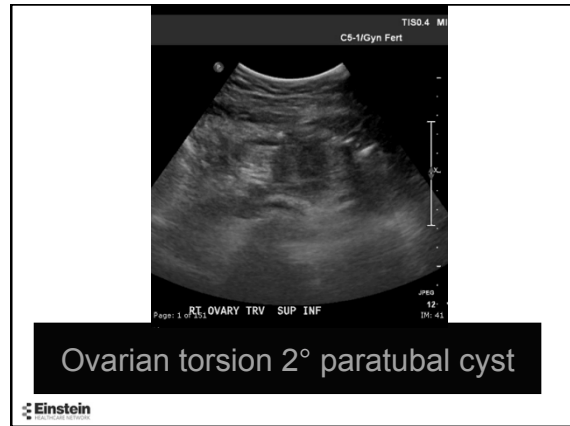
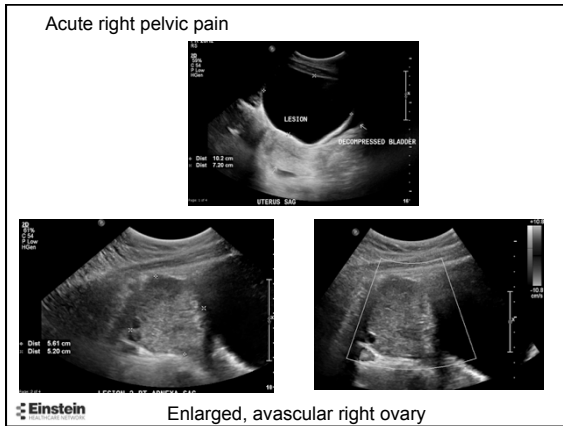




Fallopian Tube Torsion







Fallopian Tube Torsion

- Isolated FT torsion extremely rare, usually pre-menopausal, occasionally post-menopausal
- Predisposing factors
 - Intrinsic to tube: tortuosity, dilatation, tubal ligation, tumor
 - Extrinsic: paratubal mass, adhesions, uterine enlargement
- Presentation: sudden lower quadrant pain, nausea and vomiting, peritoneal signs, discrete adnexal mass
- Complications include tubal and secondary ovarian necrosis, superinfection, peritonitis
- More common on the right

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Gross, et al. AJR 2005;185:1590-1592

Fallopian Tube Torsion

- Complications include tubal and secondary ovarian necrosis, super infection, peritonitis
- More common on the right
- Imaging findings: normal uterus and ovary with ipsilateral dilated fallopian tube often displaced out of pelvis Doppler may not be intrinsically helpful, however visualization of twisted vascular pedicle (whirlpool sign) may help in diagnosis
- Ovarian torsion with tubal torsion much more common

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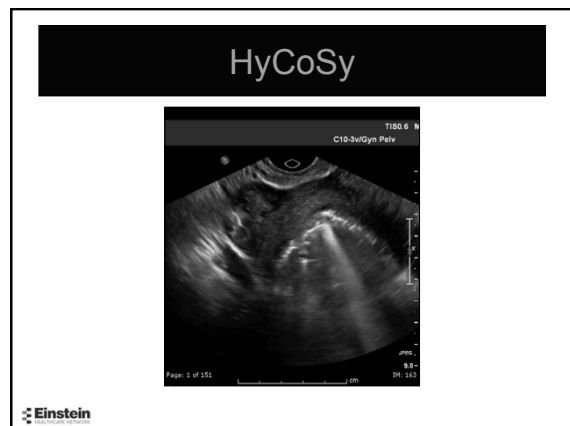
Vijayaraghavan, JUM 2009;28:657-662

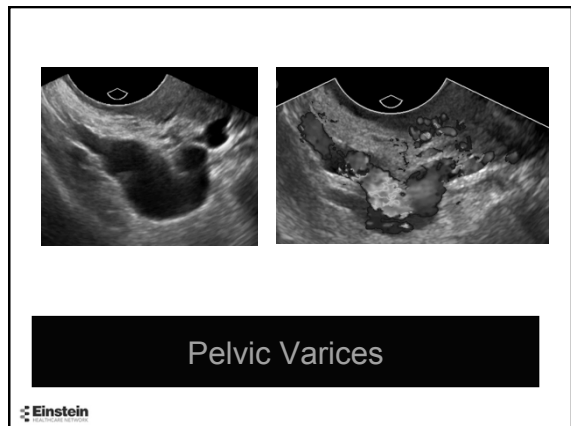
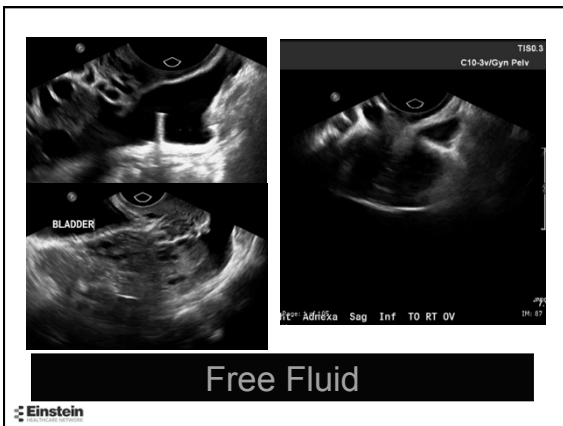
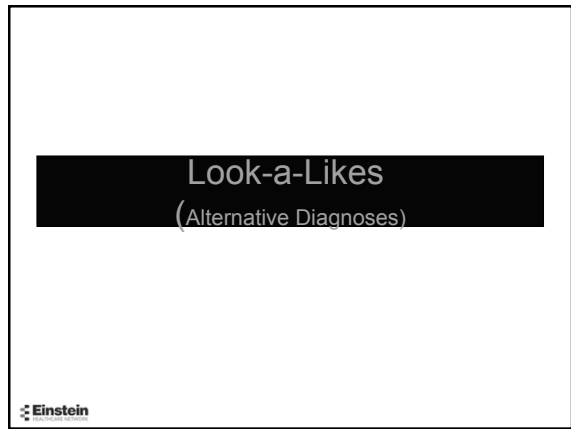
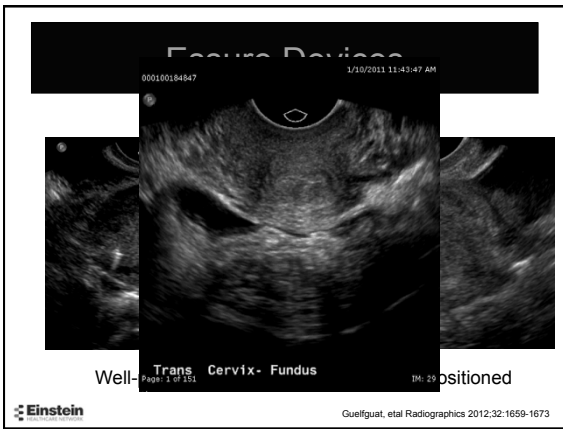
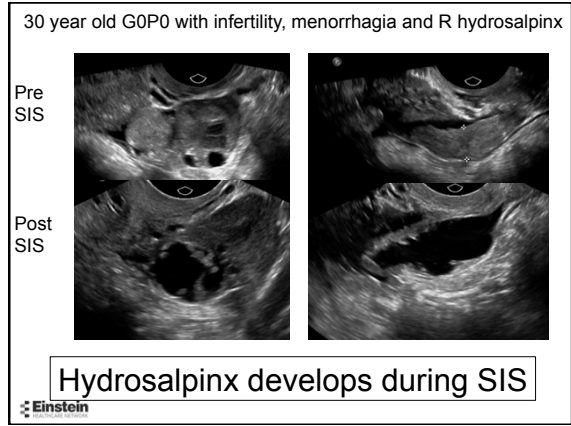
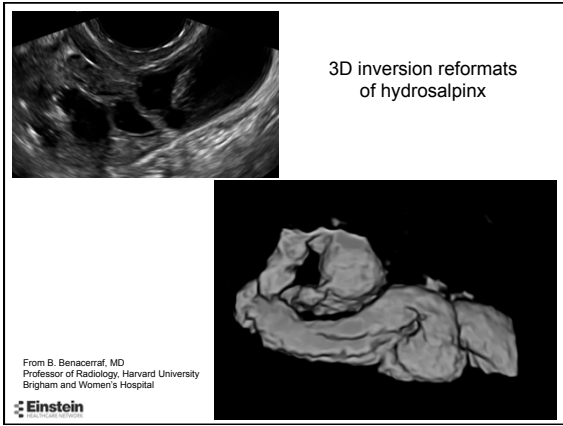
Newer Techniques: issues of tubal patency

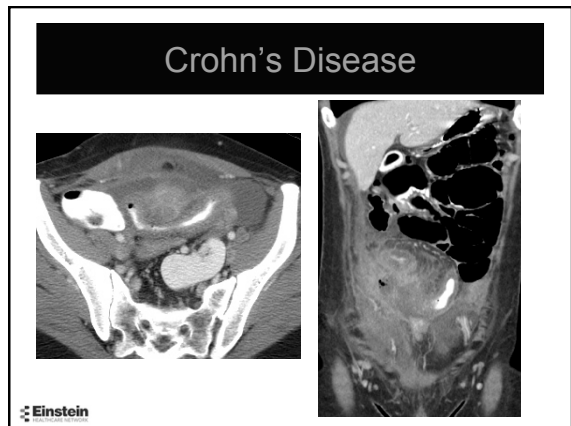
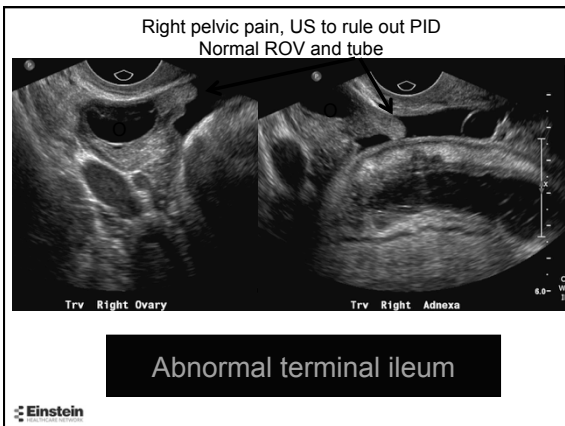
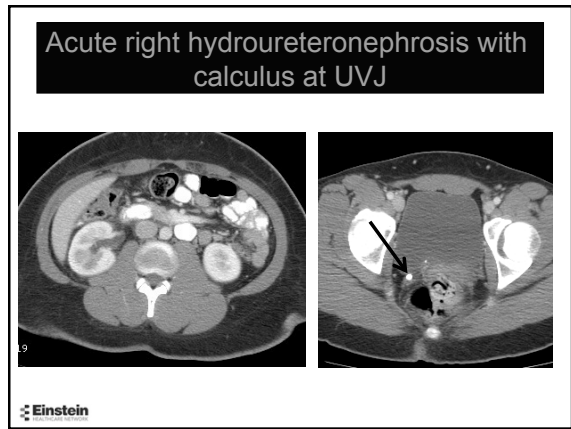
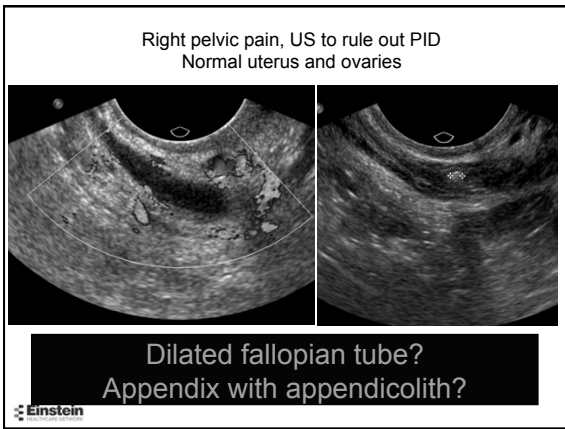
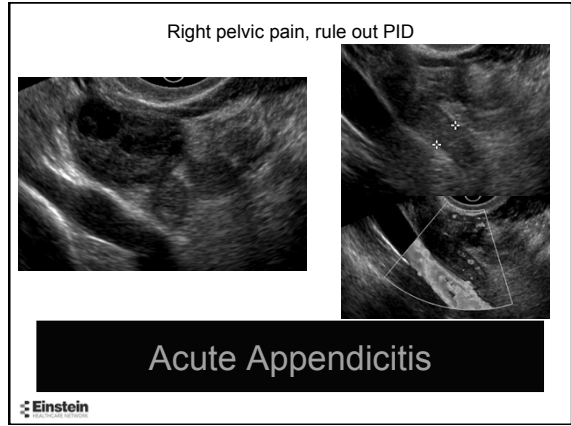
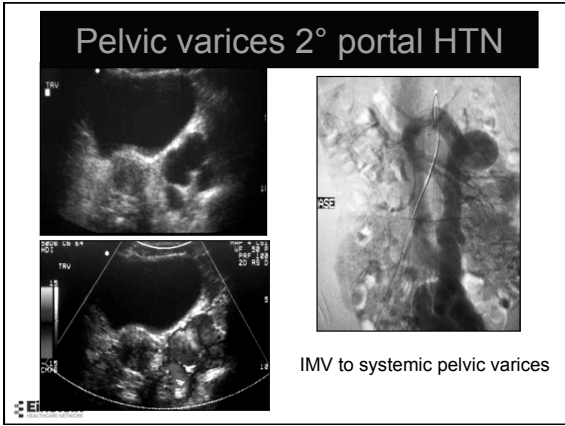
- 3D US inversion rendering to more easily appreciate hydrosalpinx
- HyCoSy: hysterosalpingo-contrast sonography using saline agitated with air as contrast to evaluate tubal patency
- Sonohysterography using US contrast agents and 3D reformatting
- Contraceptive devices

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Strandell et al. US Obstet Gynecol 1999;14:200-204
Timor-Tritsch et al. J Clin US 2010;38:372-376
Zhou, et al. US Obstet Gynecol 2012;40:93-98

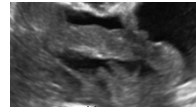






Summary

- Become familiar with appearance of normal fallopian tubes so that you can appreciate subtle abnormalities
- Remember signs of tubal origin of an adnexal "mass"
 - Waist, incomplete septum, cogwheel
- Distinguish between acute and chronic disease
- Distinguish tubal disease secondary to PID from other causes, including endometriosis, ectopic pregnancy and malignancy
- Beware of "look-a-likes"



The End

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