Introductory statement

- I have given dozens of “Basic 3D US” lectures!
- I may have wasted my and my audiences’ time giving “State of the art 3D US” talks!
- I got frustrated leading “Hands on 3D US” computer tutorials!
- As I see it, the result was disappointing.
- Even though most US machines have 3D on, only a fraction use it.
- I asked myself why?
- The answer: users do not know what it does!!

Example

- I have lots of apps on my IPhone
- I use a only a few
- I have an app called “Waze” 😊
- I don’t own, but sometimes I drive a car
- I did not know what it should do until somebody explained to me how it works
- Oh boy! Do I use it now? You bet I do!!!
- Why?
I shall demonstrate the reasons for my words by way of an example.

Here are the shortcuts to apply 3D US in my daily clinical application!

- Want to rule out uterine anomaly?
- Shorten the time of a SIS?
- Reliably rule out/in cornual gestation?
- Locate an IUD?
- Determine location of Essure?
- Create any needed-plane?

These are My most important & used 3D features

Most will say:
“It is not even reimbursed by payors! Why bother?”
Because it shortens the time to the dx.
It leads to more accurate diagnoses.
Better scanning time utilization

That’s why!
3D in Gyn: its rightful place

- I will not overstate
- I will not understate
- I will try an objective evaluation
  - Based on PUBMED as a mirror
  - Using our experience of 28 years in US
    out of these, over 15 years using 3D

3D US in Gyn: Hard to ignore!

- Gaining increasing acceptance
  - Almost all machines now have 3D
    (if yours does not….it is time to upgrade)
- Versatile & expanding display modes
- Versatile & expanding clinical use
- More literature
- Laptop software: off-line use easier

Just ONE slide about the tools
Not to leave out the consummate users!
Use specific displays generic to 3D:
- Multiplanar navigation
- Thick slice (VCI)
- 3D “Angiography”
- Inversion
- “Sculpting” tools
- Tomography
- SonoAVC
- OmniView

Just TWO slides about 3D display

ORTHOGONAL PLANES
Multiplanar navigation (scrolling)
The “bread-and-butter” of 3D
I use it every day every time it enhanced my scans
TV or TA acquisition in the sagittal plane of an antverted uterus:

- **Sagittal**
  - Ant
  - Post
  - Box A
  - Box B
  - Box C

- **Coronal**
  - Cx

**This is your acquisition plane**

**This is transverse plane**

**Axial or transverse section**

- **Rt**
- **Lt**

**This is your “never-before-seen” coronal plane**

Three more rotation and you have these planes:

- **Coronal**
  - Cx

- **Sagittal**
  - Ant
  - Post
  - Box A
  - Box B
  - Box C

**Axial or transverse section**

- **Rt**
- **Lt**

Different machines: different displays

Differences are insignificant learn what YOUR machine does.
I lied to you!

One – really - last slide about application that my sonographers asked to insert about 3D display

The tomographic (Multi-slice) display
Serially displays several consecutive scanned sections on one image similarly to CT and MRI
(Finally we joined the “league” of displays in MRI & CT!!)

The most used display mode by my sonographers. It replace acquiring & saving a large number of 2D images

3D ultrasound of the endometrial cavity
Easy & daily “brad-and-butter” use,
Very helpful. Saves time. You can continue to proceed to 3D SIS
Let us finally start

My routine in Gyn US

- EVERY uterine scan has to contain a coronal view of the uterus!

1. Shorten your precious time of a Saline Infusion Sonogram

Our 1st and most common use of 3D in our practice: assisting a SIS
I use it for EVERY SIS.
Example to convince about the utility of using 3D US in the workup of the uterine cavity

Gyn scan. Indication: AUB

On the sagittal of the uterus: something suspicious in the cavity. Explain patient the finding

Explain next step: “will perform a SIS”. Switch on 3D

Explain next step.
As for a speculum, expose cervix, wipe w. betadine solution.
Grab pre-prepared syringe with saline.
Insert cannula.
Remove speculum.
Insert vaginal probe.
Inject under 3D
**Display on multiplanar view**

- Coronal view
- Sagittal view
- Horizontal view

**Measure 3 dimensions of polyp on one single picture**

**Enlarge the sagittal plane picture to measure endometrial thickness**

**Report:** Endometrial polyp arising from the posterior/fundal aspect of the cavity measuring 9 x 12 x 6 mm with feeding vessel. NL EM: 4.3mm

**Total time: 6-8 minutes**
Other examples

Polyps

- [Image of Polyps]

- [Image of Polyps]
Endometrial polyps or fibroids

Multiplanar imaging –ADVANTAGE: navigating, scrolling in the volume

“Marker dot” indicates the same anatomic spot simultaneously in all 3 planes. Help locate a structure in all three planes at the same time

Endometrial cancer color Doppler.
Is this a polyp??

SIS: Endometrial “moguls” = hyperplasia

2. Rule out or diagnose uterine anomalies
If someone asked me to name **only one** area that 3D US is the **most** helpful in Gyn, my answer: It is in scanning the uterus and its anomalies.

We can now see the **REAL** coronal section of it.

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The normal uterus

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**Coronal:** Shape of fundus

**Axial of the Body**

**Coronal:** Shape of the cervix

**Axial of the cervix**
The Uterus

Where does 3D US really help?

• To define a normal uterus
• Find & define uterine malformations
• Look at the uterine cavity (polyps, fibroids etc.)
• Image the cervix

What determines the type of uterine malformation?

• The fundal contours
• The shape the uterine cavity
• The cervix

Make sure that edges are sharp & well defined!
Possible and promising use: Diagnosis of adenomyosis

Three-Dimensional Ultrasound in Diagnosis of Adenomyosis: Histologic Correlation With Ultrasound Targeted Biopsies of the Uterus

Dustelle E. Luciano, MD*, Katrina Exacoustos, MD, Lauren Albrecht, MD, Rachel Lamonica, DO, Abigail Proffie, MD, Enrico Zapi, MD, and Anthony A. Luciano, MD

Conclusions: Our results indicate that adenomyosis is a clinical condition with a high prevalence that may affect the reproductive results. The described severity criteria may help future validating studies for better counseling of infertile couples.
46 yo. Dysmenorrhea: Rt abd discomfort

Diagnosis based upon only the gray scale?
How about after looking at the 3D of the EM?

**Diagnosis: adenomyosis**

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**Uterine malformations**

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**Three dimensional ultrasound**

- Uterine malformations are a significant problem in reproductive performance
- The Dx depended upon HSG, MRI & laparoscopy
- Lately 2D & 3D US became relatively simple, effective and inexpensive diagnostic modalities to allow appropriate clinical management
If you do not specifically need info on tubal patency, 3D US is more informative than HSG.

Hysterosalpingogram  3 D ultrasound

Uterine anomalies: 3D Ultrasound
The different ways imaging the uterus

- Un-enhanced exam in the follicular phase
- Un-enhanced exam in the secretory phase (best using the “thick slice” technique)
- Saline infusion sonohysterography with, or w/o inversion
- Tomographic display

Arcuate Uterus
3-D SIS detects the arcuate uterus

2-D scan can NOT supply the coronal plane of the uterus!! 3D can!!!
Septate Uterus

Complete septate uterus
Thick slice

Incomplete septate uterus
Thick slice
Incomplete septate uterus SIS

Septate uterus SIS

Didelphic Uterus
SIS Uterus didelphis

Unicornuate uterus

Can 3D US outperform MRI?
US vs. MRI

• “Currently available 3D/4-D volume ultrasound imaging can produce images of the female pelvis of comparable quality and orientation to those of MRI and CT but without radiation and at relatively lower cost”.


3D US vs MRI

• 3D UD has proved just as effective as MRI for the demonstration of Müllerian duct anomalies
• Like MRI, it can produce simultaneously an image of the uterine contour & the entire endometrial cavity.
• 3D US enables to manipulate uterine volumes in any orientation regardless of its orientation or rotation.

3D US vs MRI

• Multiple studies established the equivalency of 3D US to MRI in diagnostic accuracy of Müllerian anomalies.
• Indeed, accuracy of both 3D US and MRI for the diagnosis of the specific type and extent of Müllerian anomalies typically exceeds 90-95%


3. Reliably rule out/in cornual/isthmic gestation

The Diagnostic Gap of cornual / isthmic pregnancy
There are two kinds of pregnancies that have far reaching clinical consequences:
– Cesarean scar pregnancy
– Cornual/isthmic pregnancy
The reason: missing the correct diagnosis may
– terminate a normal intra-cavitary pregnancy
– delay treatment, resulting in rupture/bleeding
3D is the BEST problem solving imaging!!
Whenever possible use 3D ultrasound
Is it really interstitial/cornual or an angular pregnancy?

2D gray scale

Any doubt now?

3D thick slice !!

Is it really interstitial/cornual or an angular pregnancy?

2D gray scale

Any doubt now?

3D thick slice !!

Dichorionic/intrauterine twin pregnancy. The right one ceased developing, the central one is now passed 30 weeks and alive

Any doubt now?

Dx?

Cornual pregnancy on the right

Any doubt now?

Dx?

Your opinion now?
Dx?

What do U think now?

- Live intrauterine pregnancy in the right upper lateral corner of the uterus

Dx?

Any doubt now?

- Cornual pregnancy on the right

Dx?

Your Dx now?

- Live intrauterine pregnancy in the right upper lateral corner of an arcuate uterus
Your Dx now?

Live intrauterine pregnancy in the right upper lateral corner the uterus

In the last moment...

Dx?

Live intrauterine pregnancy in the left upper lateral corner of the uterus

Your Dx now?

One week later

Two weeks later

Courtesy Drs Monteagudo & Rebarber
Intrauterine pregnancy in the left horn of a septate uterus

Your Dx now?

This is what many refer to as “angular pregnancy”

Tips to make the dx: Use 3D tomography
4. Locate IUDs, mostly that of a Mirena

The second most common use of 3D in our practice

Localizing and defining IUDs

Take-home message

1. If you are a sonographer scanning lots of patients with IUDs or you are an MD placing IUDs, this may be one of the most compelling reasons to learn the use of 3D US
2. If you see an IUD and the indication for the scan is “pelvic pain”: evaluate IUD location by 3D
Saves time. Secures correct diagnosis

What kind of IUD?

Where does the IUD hide?
Imaging a Paragard by 2D?

Easy!

Imaging a Mirena by 2D?

Not so easy!
The fastest way to document malpositioned IUDs. Send image to referring site for better understanding of position.
5. Determine location of Essure

Rare use, but probably the only way to its imaging short of a CT or MRI

“Omni view”
Conclusions: On the basis of a limited number of patients, 2DUS is more time-efficient and equivalent to 3DUS in locating Essure contraceptive microinserts. These results should be considered when planning sonographic follow-up of patients with Essure devices.

6. Create “anyplane” with 3D “Omniview”

Once mastered, it will be used everyday for expanding indications and viewing hard to obtain planes.
New application: OMNI VIEW

Apply to transverse planes

Apply to sagittal/longitudinal planes

Omni view
Curve accommodates shape of cavities

The next slide contains the second most important message of this talk!
Proprietary laptop version of 3D software

- QLab ® (Phillips)
- 4DView ® (GE)
- Sonoviewpro (Medison)
- 3D Volume Viewer (Siemens)

Best way to gain experience in 3D techniques

How easy is it to handle volumes off-line on a laptop?

Summary & Conclusion
3D in Gyn US; The learning curve flattened

- I presented the most used and most practical applications of 3D in my office
- Establish more accurate diagnoses
- One day it may be reimbursed by insurance
- Until then, save 5-10 minutes per scan and see one (or maybe two) extra patient/s per day
- 1/day; 5/wk; 20/mo; 200/year (= U r 4w payed vacation)
- You make the $$ math for yourself & your office
Luxury or Necessity?

- Luxury? – Definitely NOT!!
- Necessity? – Very much SO!
  - Learning curve flattened: You ARE professionals!
  - Yes, it needs time. Yes, it needs $$ investment
  - Yes, it needs constant “maintenance” and update of new applications
- But it is worth it: time saver, problem solver
- Important adjuvant to 2D & Doppler US
- 3D volume ‘manipulation’ on laptop makes training easier and faster!!!