Gastric Ultrasound: Objective data for debatable NPO Guidelines

Andy Baum, CRNA

1

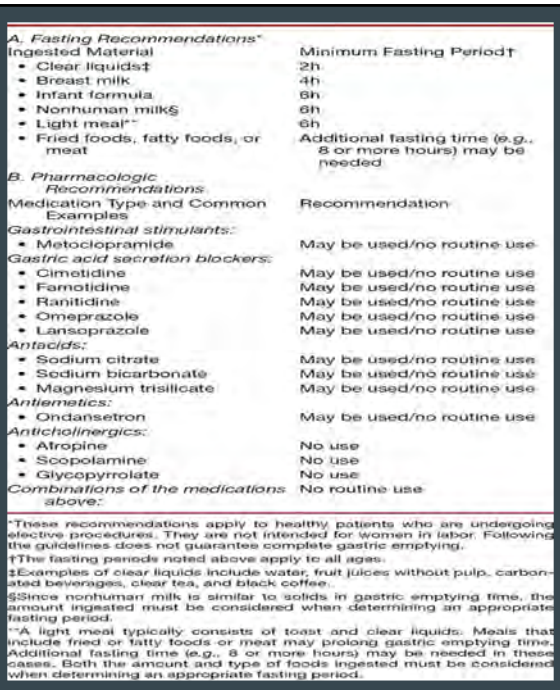
Objectives

- Review peri-operative NPO Guidelines
- Review gastric sonoanatomy
- Understand clinical indications for POCgUS
- Differentiate gastric contents using gastric ultrasound images
- Application of objective data in clinical practice/ decision making

2

Fasting Guidelines

- 2017 published NPO Guidelines
- Goal: prevent pulmonary aspiration
- Evidence:
  - Category A
    - RCTs/ Meta Analysis
  - Category B
    - Observational
  - Category C
    - Opinion Based Evidence
- Routine treatment of GI symptoms with antacids, H2 blockers and anticholinergics is not recommended



*A. Fasting Recommendations**

Ingested Material	Minimum Fasting Period†
• Clear liquids‡	2h
• Breast milk	4h
• Infant formula	6h
• Nonhuman milk§	6h
• Light meal‖	6h
• Fried foods, fatty foods, or meat	Additional fasting time (e.g., 8 or more hours) may be needed

B. Pharmacologic Recommendations:

Medication Type and Common Examples	Recommendation
Gastrointestinal stimulants:	
• Metoclopramide	May be used/no routine use
Gastric acid secretion blockers:	
• Cimetidine	May be used/no routine use
• Famotidine	May be used/no routine use
• Ranitidine	May be used/no routine use
• Omeprazole	May be used/no routine use
• Lansoprazole	May be used/no routine use
Antacids:	
• Sodium citrate	May be used/no routine use
• Sodium bicarbonate	May be used/no routine use
• Magnesium trisilicate	May be used/no routine use
Antiemetics:	
• Ondansetron	May be used/no routine use
Anticholinergics:	
• Atropine	No use
• Scopolamine	No use
• Glycopyrrolate	No use
Combinations of the medications above:	No routine use

*These recommendations apply to healthy patients who are undergoing elective procedures. They are not intended for women in labor. Following the guidelines does not guarantee complete gastric emptying.

†The fasting periods noted above apply to all ages.

‡Examples of clear liquids include water, fruit juices without pulp, carbonated beverages, clear tea, and black coffee.

§Since nonhuman milk is similar to solids in gastric emptying time, the amount ingested must be considered when determining an appropriate fasting period.

‖A light meal typically consists of toast and clear liquids. Meals that include fried or fatty foods or meat may prolong gastric emptying time. Additional fasting time (e.g., 8 or more hours) may be needed in these cases. Both the amount and type of foods ingested must be considered when determining an appropriate fasting period.

Anesthesiology March 2017, Vol. 126, 376–393.

3

Limitation of NPO Guidelines

Intended for healthy ASA 1 and 2 patients undergoing elective surgery

- Common Pathology- Severe Obesity, DM, GERD, hernia, bowel obstruction, ilieus
- Medication Concerns: Incretin-mimetics, Chemotherapy, Opioids
- Surgical Concerns: Urgent/ Emergent Surgery, Questionable NPO status

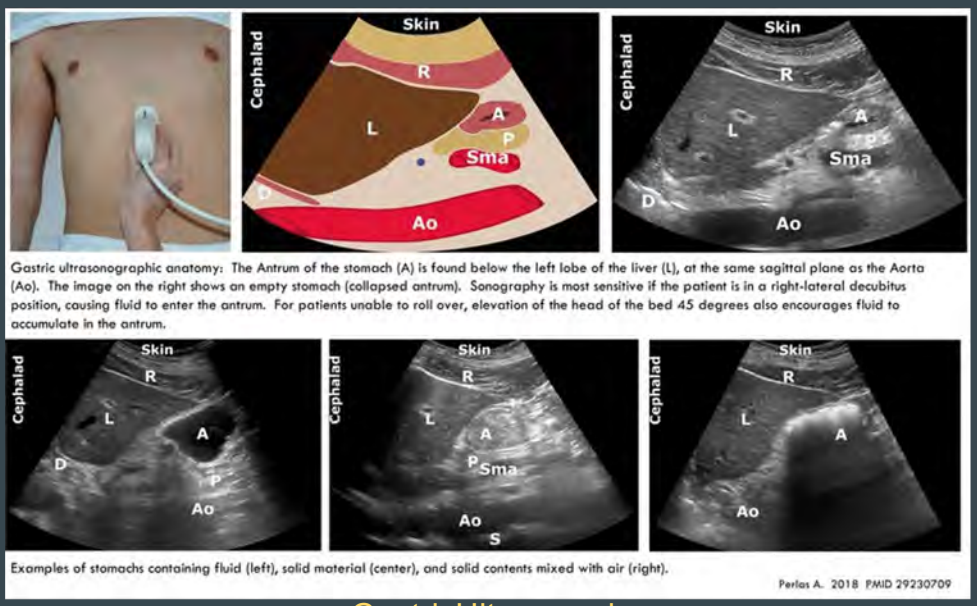
Other:

- Altered Mental State
- Pediatrics
- Language Barrier

Does not consider Airway exam- difficult intubation

4

POCgUS is a Pre- Operative Assessment Tool



GastricUltrasound.org

5

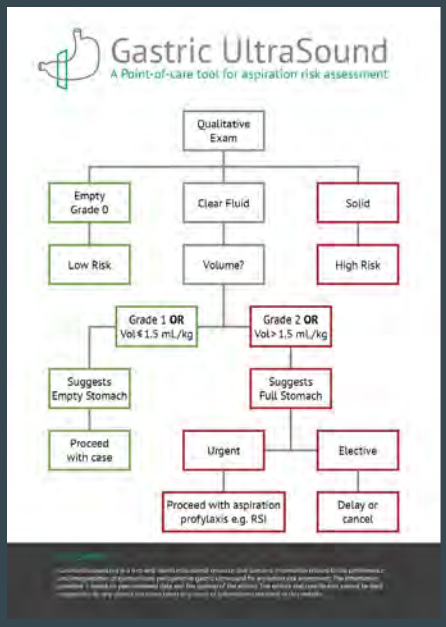
How POCgUS can help decision making

Assess gastric content

apply to accepted gastric volume thresholds (clear liquids)

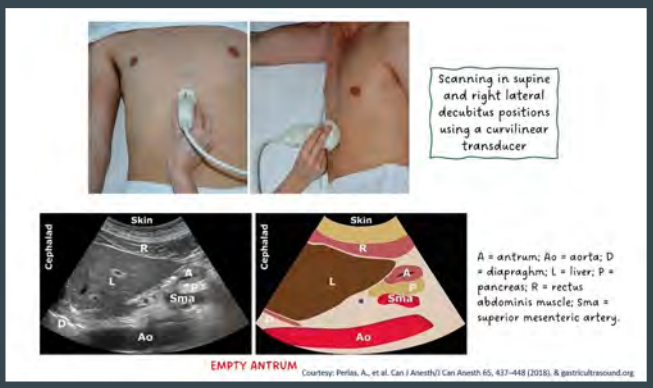
Offers an objective assessment for clinical decision making

- Delay vs Cancel
- Gastric decompression
- LMA vs ETT
- SIVI vs RSI



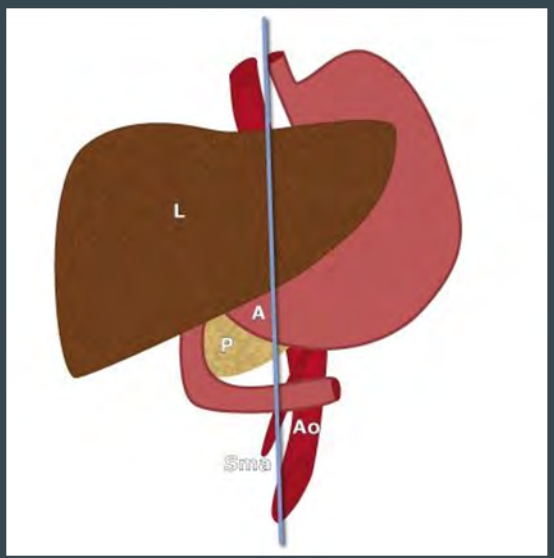
6

POCgUS Qualitative Assessment

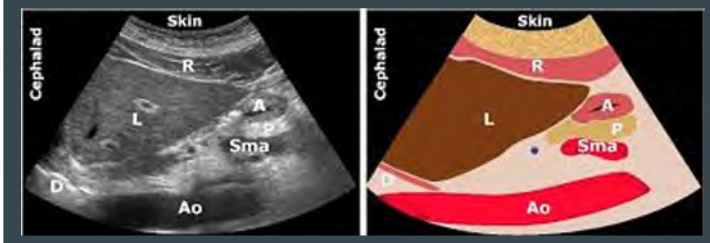


7

POCgUS sonoanatomy



Blue line: scanning plane; A: antrum; Ao: aorta; L: liver; P: pancreas; Sma: superior mesenteric artery



skin/ sub cutaneous tissue

Rectus muscle

Liver

Antrum- “ bullseye” sign or target sign

Pancreas

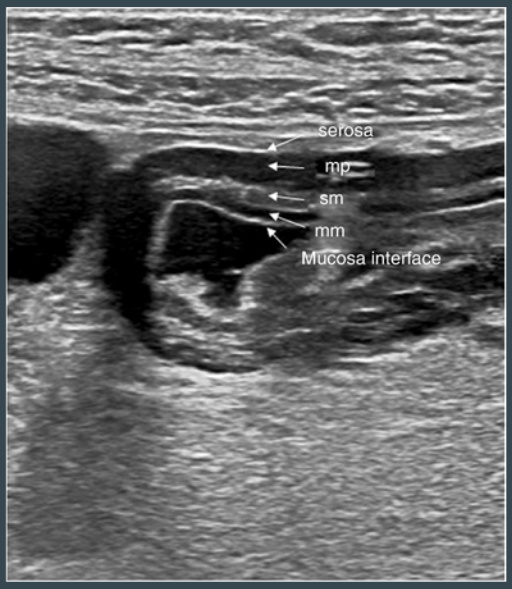
Superior mesenteric artery

Aorta- should be in longitudinal view

8

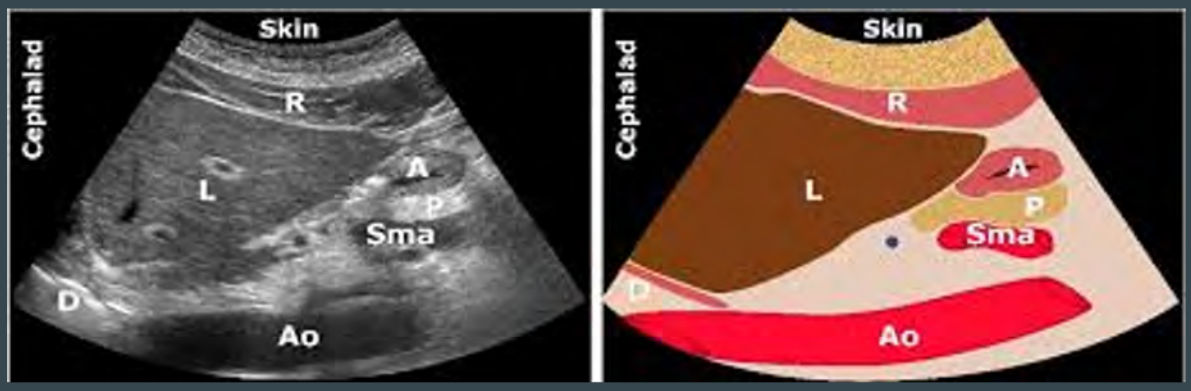
POCgUS Images- Antrum

LAYER	CHARACTERISTICS
Serosa (1)	Thin, hyperechoic
Muscularis propriae (2)	Thick, hypoechoic
Submucosa (3)	Hyperechoic
Muscularis mucosae (4)	Hypoechoic
Mucosal-air interface (5)	Thin, hyperechoic



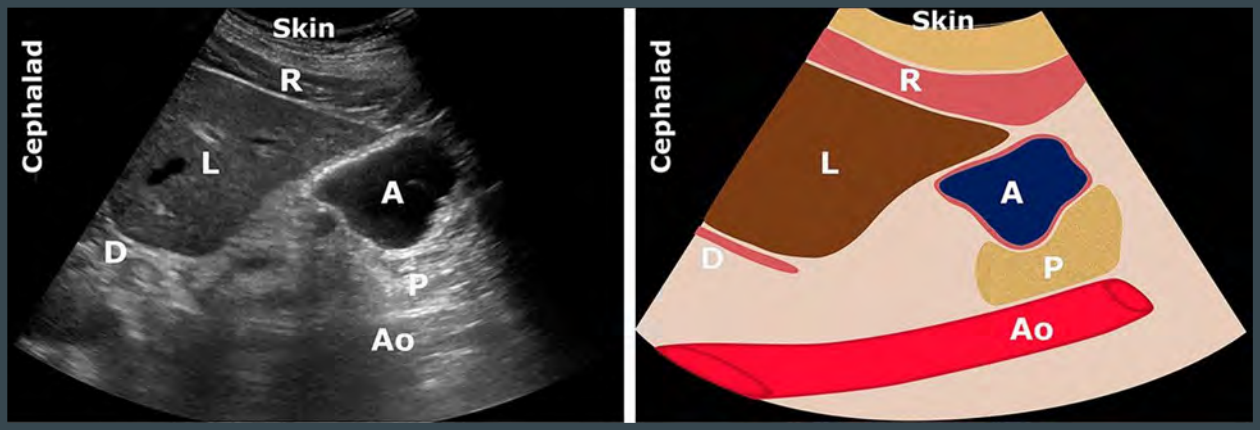
9

POCgUS Images- empty stomach



10

POCgUS Images- Clear Fluid



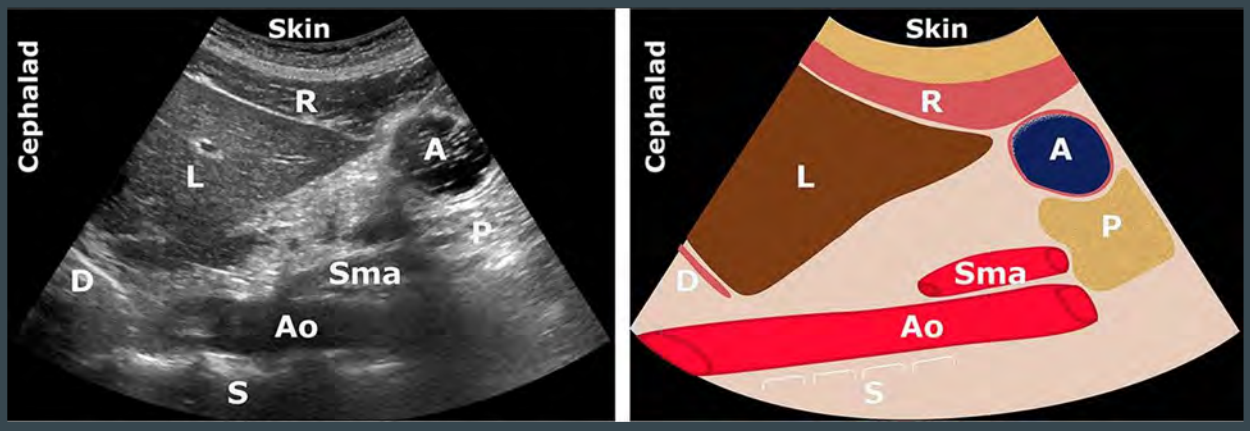
Anechoic (or hypoechoic) antrum

Distended antrum

Size of the antrum is proportional to the gastric volume

11

POCgUS Images- Clear Fluid + Carbonation/ Ingested Air



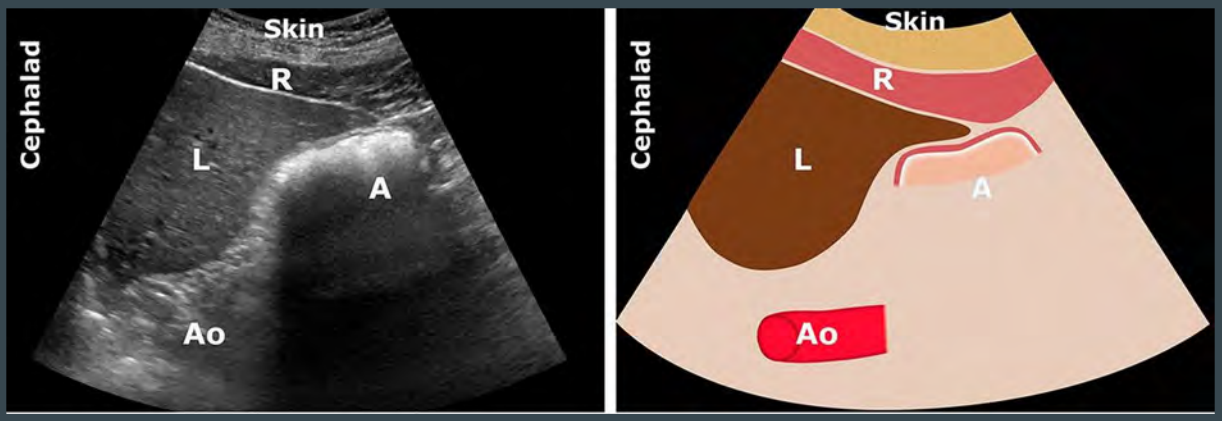
AKA- "Starry Night"

multiple air bubbles (on a hypoechoic background)

usually seen shortly after ingestion of clear fluids or carbonated beverages

12

POCgUS Images- Solid Foods (Early)
AKA- "Frosted Glass"

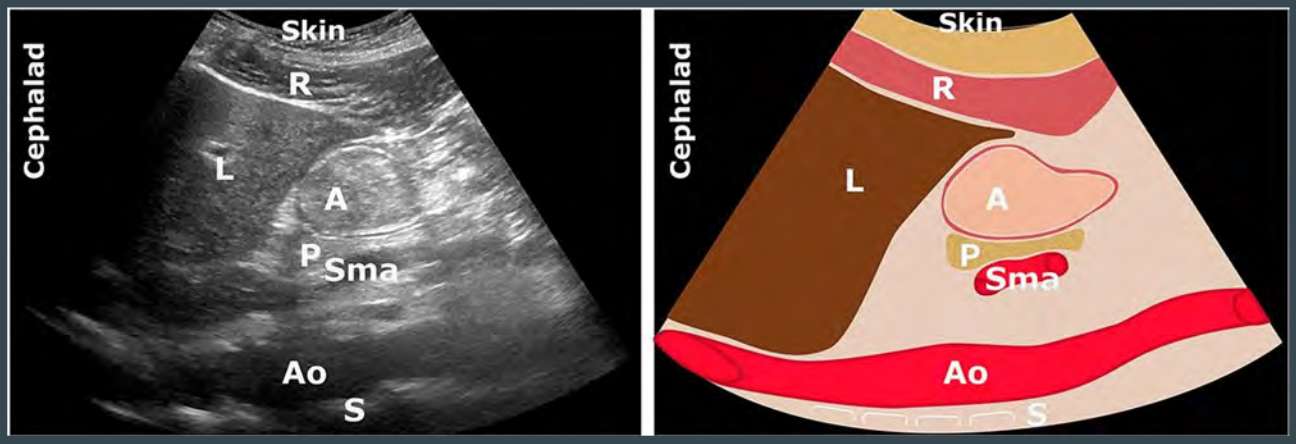


The antrum appears distended with thin walls

The content is of high or mixed echogenicity

13

POCgUS Images- Solid Foods (Late)



14

Grading System- Qualitative Assessment

Grade	Assessment	Volume	Aspiration Risk
0	Empty- Supine/ RLD	Empty- Supine/ RLD	LOW
1	Empty- Supine RLD- clears	< 1.5 mL/kg Predictive of baseline gastric secretions	LOW
2	Fluid in both Supine and RLD	> 1.5 mL/kg Likely excess of baseline gastric secretions	HIGH

Supine position alone cannot rule out a full stomach

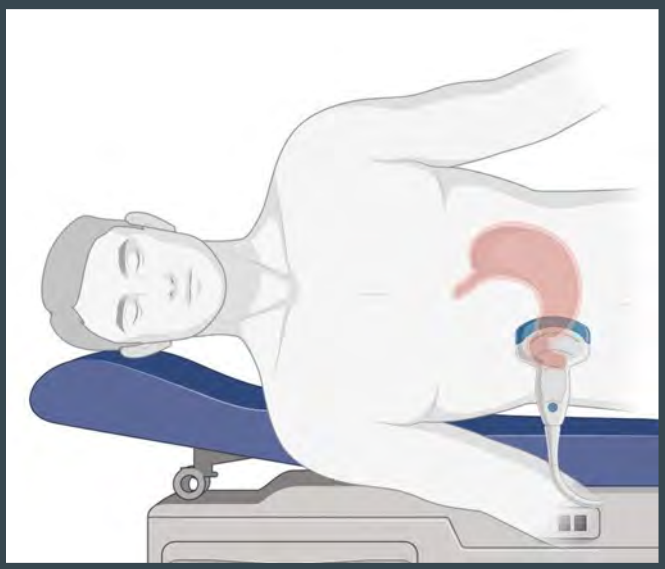
In the RLD gravity allows stomach content to mobilize into the antrum

15

Grading System- Qualitative Assessment with Urinal

Supine position alone cannot rule out a full stomach

In the RLD gravity allows stomach content to mobilize into the antrum



16

Grading System- Qualitative Assessment

Grade	Assessment	Volume	Aspiration Risk
0	Empty- Supine/ RLD	Empty- Supine/ RLD	LOW
1	Empty- Supine RLD- clears	< 1.5 mL/kg Predictive of baseline gastric secretions	LOW
2	Fluid in both Supine and RLD	> 1.5 mL/kg Likely excess of baseline gastric secretions	HIGH

17

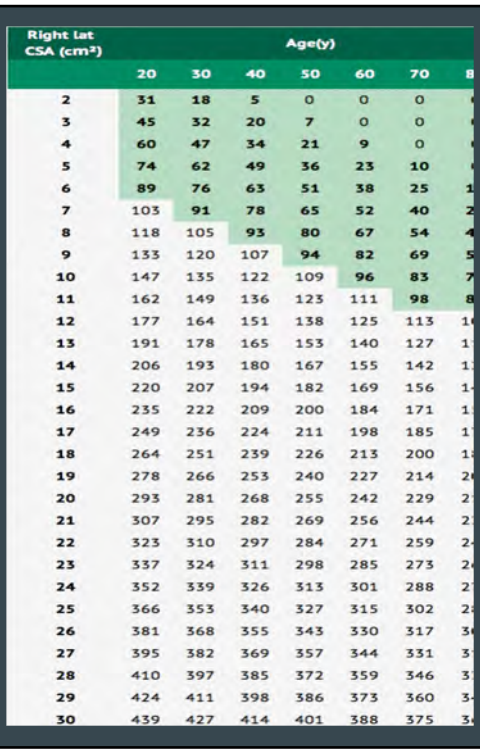
Quantitative Assessment

The cross-sectional area of the antrum (CSA) has a linear correlation with the gastric volume

How measure the CSA:

- Identify the antrum at the level of the aorta in the RLD
- Obtain a still image of the antrum at rest (between peristaltic contractions)
- Use the free-tracing tool of the ultrasound machine to measure the CSA including the full thickness of the gastric wall (from serosa to serosa)
- Use a predictive model to assess the gastric volume

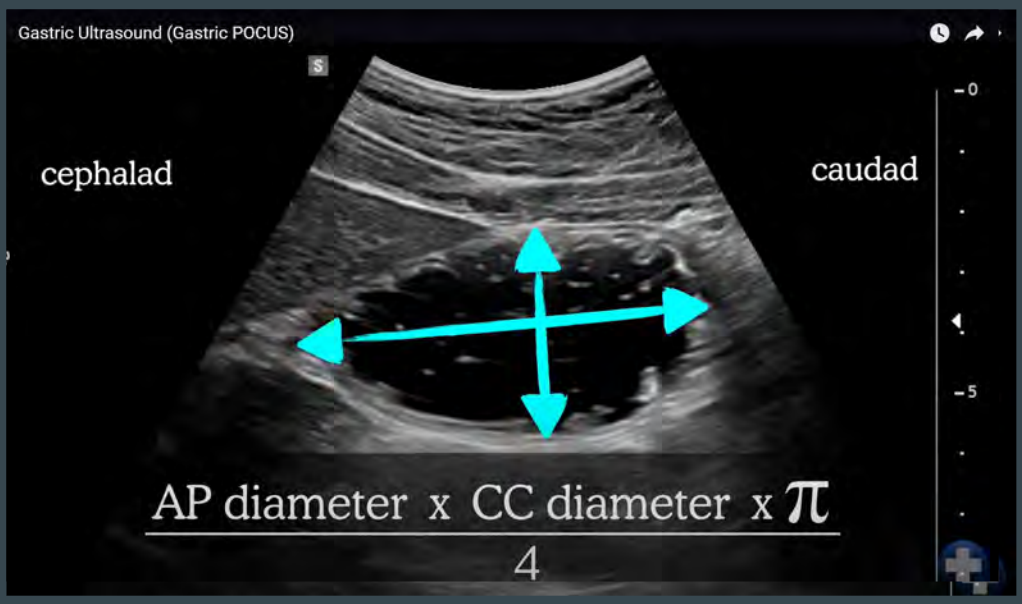
- CSA of 10 cm2 is generally considered low risk for aspiration



Right Lat CSA (cm²)	Age(y)						
	20	30	40	50	60	70	8
2	31	18	5	0	0	0	
3	45	32	20	7	0	0	
4	60	47	34	21	9	0	
5	74	62	49	36	23	10	
6	89	76	63	51	38	25	1
7	103	91	78	65	52	40	2
8	118	105	93	80	67	54	4
9	133	120	107	94	82	69	5
10	147	135	122	109	96	83	7
11	162	149	136	123	111	98	8
12	177	164	151	138	125	113	1
13	191	178	165	153	140	127	1
14	206	193	180	167	155	142	1
15	220	207	194	182	169	156	1
16	235	222	209	200	184	171	1
17	249	236	224	211	198	185	1
18	264	251	239	226	213	200	1
19	278	266	253	240	227	214	2
20	293	281	268	255	242	229	2
21	307	295	282	269	256	244	2
22	323	310	297	284	271	259	2
23	337	324	311	298	285	273	2
24	352	339	326	313	301	288	2
25	366	353	340	327	315	302	2
26	381	368	355	343	330	317	3
27	395	382	369	357	344	331	3
28	410	397	385	372	359	346	3
29	424	411	398	386	373	360	3
30	439	427	414	401	388	375	3

18

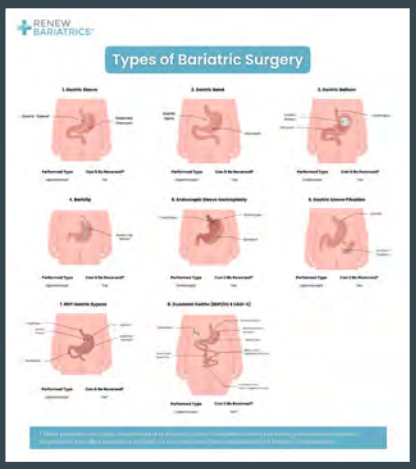
Quantitative Assessment- Grade 1 scan



19

Limitations

- Previous gastric surgery
- Large hiatal hernia
- Pediatrics
  - Cooperation
- Obesity
  - Challenging anatomy
- Pregnancy
  - Displaced anatomy



Contraindications

Absolute
- Patient refusal

Relative
- abdominal wounds
- epigastric bandages
- cannot be safely positioned RLD

- Can use semi fowler position if RLD is not attainable

20

Scanning Technique- Preparation

Ultrasound Machine

- if available one capable of measuring CSA
- Position to optimize ergodynamics
- Curved Linear Probe

Clean Towels

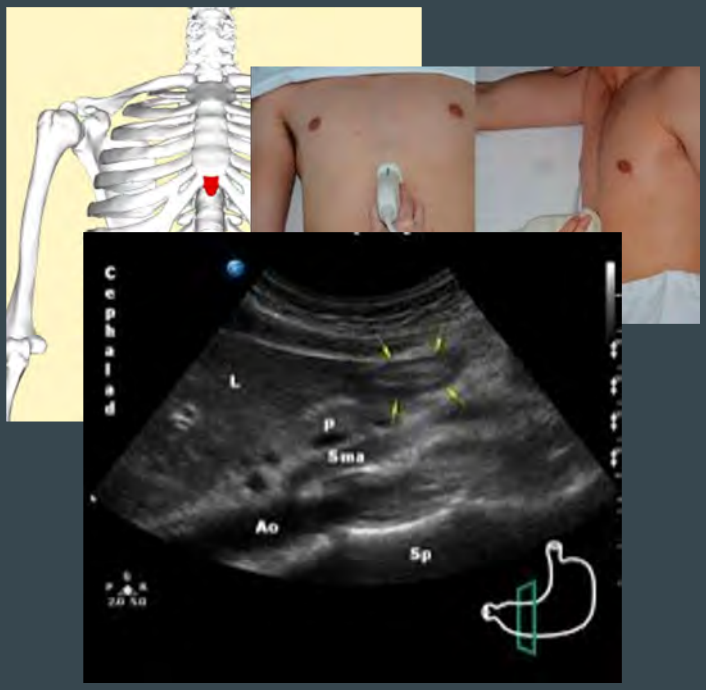
Position patient

Expose epigastrium

21

Scanning Technique

1) Place probe midline/ inferior to xyphoid
2) Confirm probe orientation (cephalad)
3) Locate the liver
4) Locate Adb Ao and SMA (?)
- Optimize depth
1) Scan left to right
2) Identify
   a) skin/ sub cutaneous tissue
   b) Rectus muscle
   c) Liver
   d) Antrum
   e) Pancreas
   f) Superior mesenteric artery
   g) Aorta- should be in longitudinal view
   h) spine



22

Clinical Pearls

- Antrum is located next to the inferior edge of the liver
- Sonoanatomy Priorities:
  - Liver
  - Antrum
  - Aorta
  - Spine
- Scan!!!!
  - There is a direct correlation with number of scans and competence

23

Routine Use

- Routine use of POCgUS is debatable; but not an established standard of care
- All anesthesia providers should be formally trained on POCgUS
  - Including live scans
- Highly recommended POCgUS scan in any delayed gastric emptying:
  - Unknown/uncertain NPO status
  - Type I and II diabetics
  - End-stage renal disease
  - Liver disease
  - Critical illness
  - Neuromuscular disorders
  - Acute pain, opioid use
  - Incretin mimetic medication

24

References

American Society of Anesthesiologists. (2017). Practice guidelines for preoperative fasting and the use of pharmacologic agents to reduce the risk of pulmonary aspiration: An updated report. Anesthesiology, 113(3), 376-393.

Clinical Skills Academy (2024, March 4), Gastric Ultrasound (Gastric POCUS) [Video]. YouTube. https://www.youtube.com/watch?v=4Kc5qVMGGPU&t=339s

Kruisselbrink, R., Gharapetian, A., Chaparro, L. E., Ami, N., Richler, D., Chan, V. W. S., & Perlas A. (2019). Diagnostic accuracy of point-of-care gastric ultrasound. Anesthesia & Analgesia, 128(1), 89-95.

Perlas, A. (n.d.). Gastric Ultrasound. USRA. http://www.usra.ca/regional-anesthesia/specificblocks/pocus/gastric.php

Perlas, A., Arzola, C., & Van de Putte, P. (2018). Point-of-care gastric ultrasound and aspiration risk assessment: A narrative review. Canadian Journal of Anesthesia, 65(4), 437-448. doi: 10.1007/s12630-017-1031-9.

Perlas, A., Chan, V. W., Lupu, C. M., Mitsakakis, N., & Hanbidge, A. (2009). Ultrasound assessment of gastric content and volume. Anesthesiology, 111(1), 82-89. doi: 10.1097/ALN.0b013e3181a97250.

Perlas, A., Davis, L., Khan, M., Mitsakakis, N., & Chan, V. W. (2011). Gastric sonography in the fasted surgical patient: A prospective descriptive study. Anesthesia & Analgesia, 113(1), 93-97. doi: 10.1213/ANE.0b013e31821b98c0.

Van de Putte, P., Van Hoonacker, J., & Perlas A. (2018). Gastric ultrasound to guide anesthetic management in elective surgical patients non-compliant with fasting instructions: A retrospective cohort study. Minerva Anestesiologica, 84(7), 787-795. doi: 10.23736/S0375-9393.17.12305-9.

Van de Putte, P., Bouvet, L., Arzola, C., Gadsden, J., Kruisselbrink, R., & Spencer, A. (n.d.). *Gastric Ultrasound • Image Acquisition*. Gastric UltraSound A Point-Of-Care Tool for Aspiration Risk Assessment. https://www.gastricultrasound.org/en/acquisition/

25