

NJANA Gastric Ultrasound Lab

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Introduction

Pulmonary aspiration of gastric content is a major anesthetic-related complication which may result in significant morbidity and mortality. This is particularly true in high-risk patients and situations (e.g., parturient, emergency surgery, and diseases associated with slow gastric emptying). The volume, nature (fluid vs. particulate or solid matter), and acidity of the aspirate are thought to be important factors that determine patient outcomes. Current prevention strategies rely mainly on recommended fasting periods for elective surgery (i.e., NPO protocol). However, underlying medical conditions that slow gastric emptying can predispose patients to greater amount of gastric content at the time of anesthetic induction despite appropriate fasting intervals. There is a growing interest in applying bedside ultrasound as a noninvasive portable tool to assess gastric content and volume to clinically evaluate aspiration risk by providing qualitative and quantitative information.

The main objective of point-of-care (POC) gastric ultrasound is to help clinicians assess gastric contents when NPO status is unknown or uncertain in the immediate pre-anesthetic period.

Indications

POC gastric ultrasound is indicated when a clinician is uncertain about the patient's NPO status and /or the level of aspiration risk at the time when sedation, anesthesia or airway management is required.

Some common clinical scenarios are:

- GLP-1 Receptor Agonist Usage
- urgent or emergency surgical procedure without planned fasting
- patients with co-morbidities or medical conditions that may delay gastric emptying despite adherence to appropriate NPO guidelines e.g., diabetes, neuromuscular disorders, severe renal or liver dysfunction, recent trauma, pain and opioids, active labour, and gastric dysmotility of any etiology
- inability to obtain information on prandial status e.g., language barrier, decreased level of consciousness, and cognitive dysfunction
- patients undergoing elective procedures with questionable or borderline adherence to fasting instructions

References

- Block Buddy PWA. (n.d.). <https://app.myblockbuddy.com/truncal>
- Gastric UltraSound • Image Acquisition. (n.d.). <https://www.gastricultrasound.org/en/acquisition>
- USRA - Gastric Ultrasound. (n.d.). Retrieved September 4, 2024, from <https://usra.ca/regional-anesthesia/specific-blocks/pocus/gastric.php>

HOW?

Image Acquisition

Gastric scanning targets the antrum which can be reliably located and identified using standard internal anatomical landmarks.

Patient Positions

- 1.Scan first in the supine position as shown in Figure 6.
- 2.Then scan in the right lateral decubitus position as shown in Figure 7.

3.Occasionally, a semi-sitting position is used should the patient not able to turn to right lateral decubitus

A thorough evaluation of gastric content requires examination in the right lateral decubitus position because gastric content is expected to gravitate to the antrum in this body position. An examination performed solely in the supine position is considered **incomplete** and **inaccurate** because it underestimates the amount of gastric content. Failure to visualize gastric content in the supine position does not guarantee an empty stomach.

Figure 6. Sagittal Scan in the Supine Position



Figure 7. Sagittal Scan in the Right Lateral Decubitus Position



Qualitative Assessment

Figure 10. Sonogram Showing an Empty Antrum in a Sagittal Scan.



Figure 11. Sonogram Showing the Gastric Antrum Distended with Clear Fluid in a Sagittal Scan.

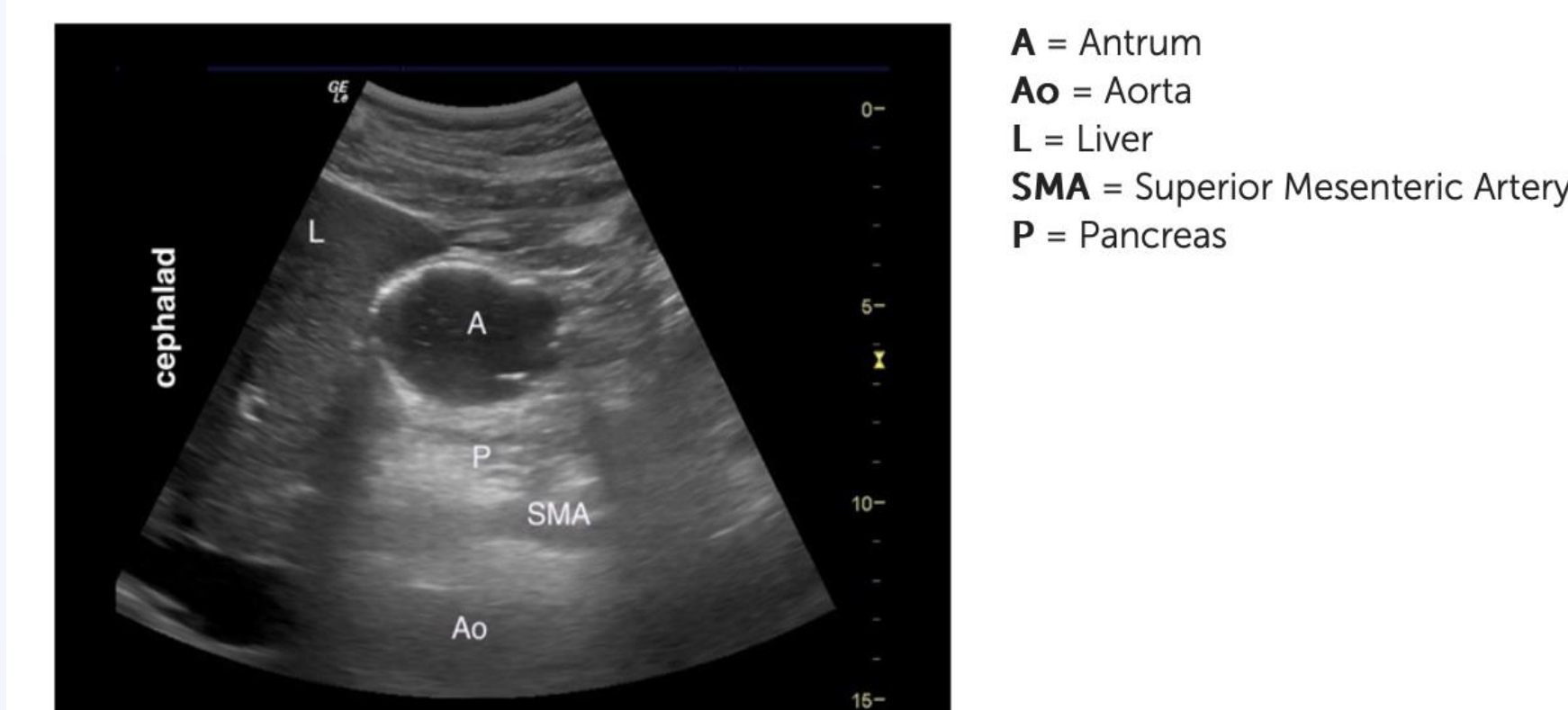


Figure 12. Sonogram Showing Thick Fluid and Solid in the Antrum in a Sagittal Scan.



Figure 13. Sonogram Showing Solid and Air (hyperechoic) in the Antrum in a Sagittal Scan.

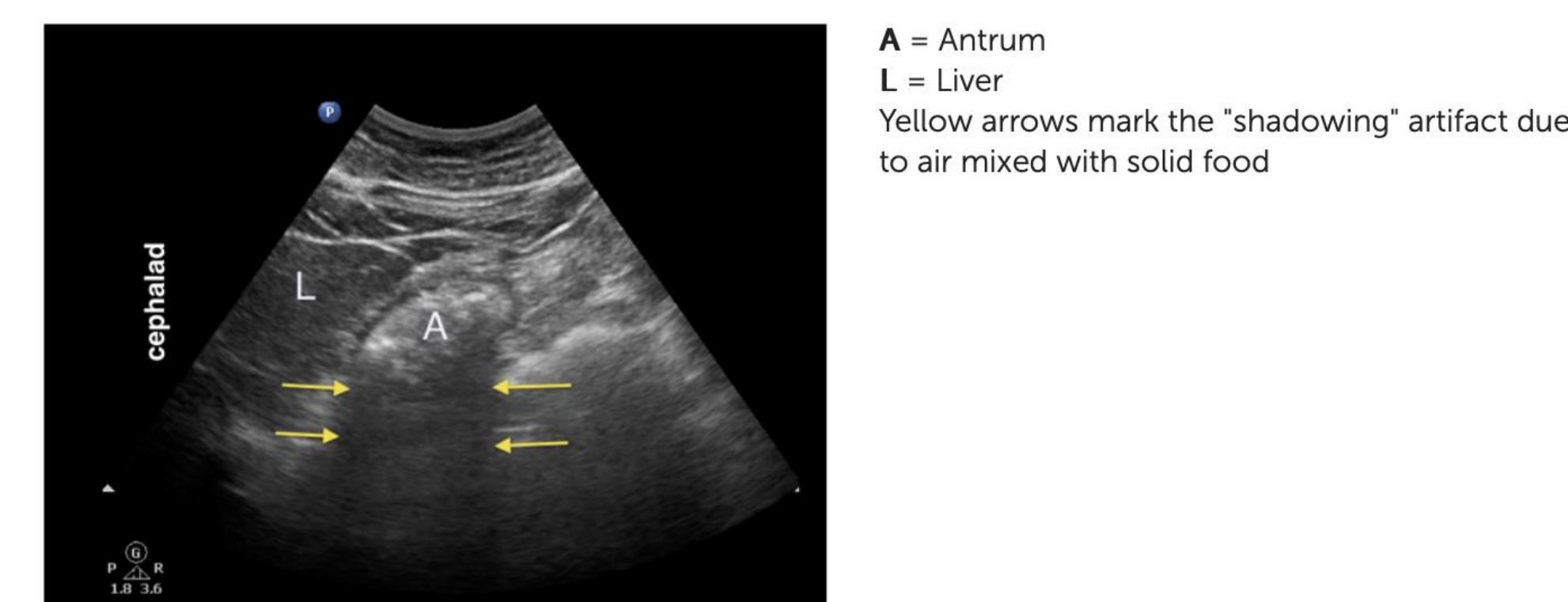
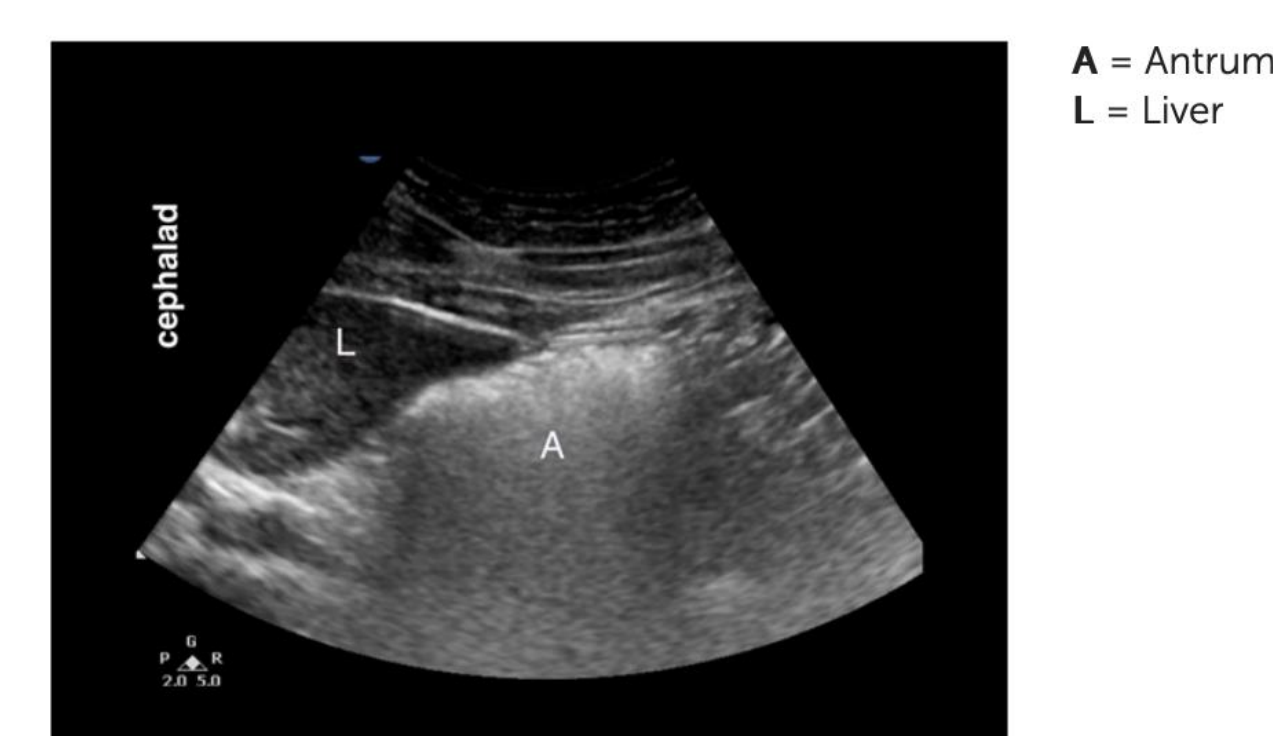
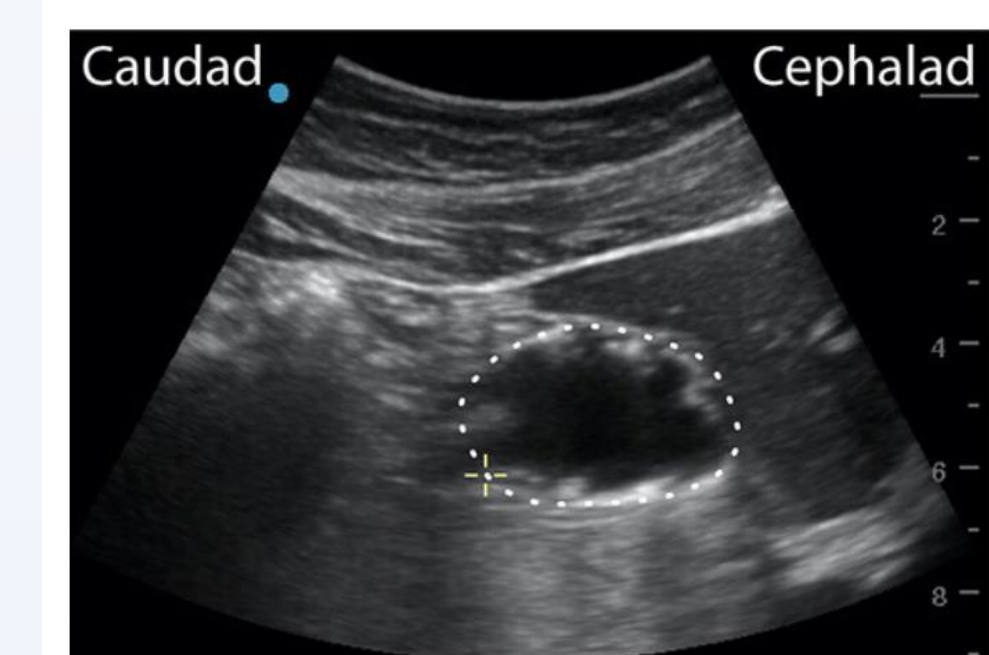
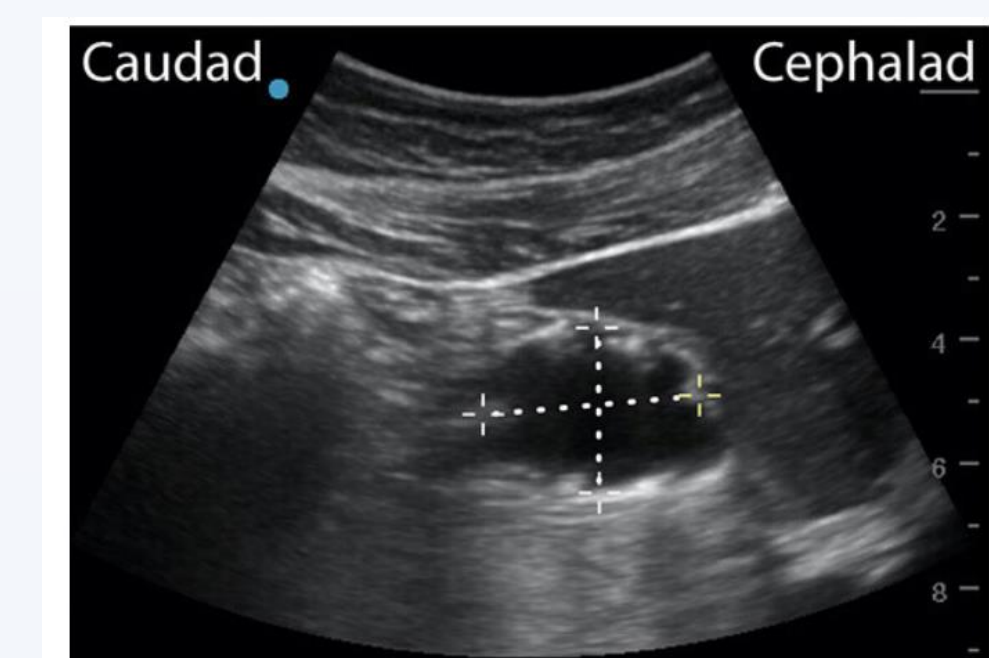


Figure 14. Sonogram Showing Solid in the Antrum with Frosted Glass Appearance in a Sagittal Scan.



Quantitative Assessment

- Assessment of the total volume of clear fluid in the stomach is determined by measuring the cross-sectional area (CSA) of the antrum.
- The measurement should occur in the RLD position at the level of the aorta.
- The antrum is measured between peristaltic contractions using either the free tracing tool or two perpendicular diameters (AP: antero-posterior diameter and CC: craniocaudal diameter)
- $CSA = (AP \times CC \times 3.14) / 4$
- The entire thickness of the gastric wall (including the serosa) should be used when measuring the CSA/



Age (years)	Predicted Gastric Volume (ml)							
	20	30	40	50	60	70	80	90
3	45	32	20	7	0	0	0	0
4	60	47	34	21	9	0	0	0
5	74	62	49	36	23	10	0	0
6	89	76	63	51	38	25	12	0
7	103	91	78	65	52	40	27	0
8	118	105	93	80	67	54	41	0
9	133	120	107	94	82	69	56	0
10	147	135	122	109	96	83	71	0
11	162	149	136	123	111	98	85	0
12	177	164	151	138	125	113	100	0
13	191	178	165	153	140	127	114	0
14	206	193	180	167	155	142	129	0
15	220	207	194	182	169	156	143	0
16	235	222	209	200	184	171	158	0
17	249	236	224	211	198	185	173	0
18	264	251	239	226	213	200	187	0
19	278	266	253	240	227	214	202	0
20	293	281	268	255	242	229	217	0
21	307	295	282	269	258	244	231	0
22	325	310	297	284	271	259	246	0
23	337	324	311	298	285	273	260	0
24	352	339	326	313	301	288	275	0
25	366	353	340	327	315	302	289	0
26	381	368	355	343	330	317	304	0
27	395	382	369	357	344	331	318	0
28	410	397	385	372	359	346	333	0
29	424	411	398	386	373	360	347	0
30	439	427	414	401	388	375	363	0

- Formula to predict gastric volume of clear fluid:
 - Volume (ml)=27.0+14.6 x CSA (cm²) – 1.28 x age (years)
 - Use in non-pregnant adults up to a BMI of 40.
 - Predicts volumes up to 500ml

Gastric Scan Interpretation				
Grade	Supine	RLD	Gastric Volume	Aspiration Risk
0	Empty	Empty	Minimal	Low
1	Empty	Fluid visible	<1.5ml/kg	Low
2	Fluid visible	Fluid visible	>1.5ml/kg	High
	Solid Food	Solid Food		High

- Empty stomach (Grade 0): low aspiration risk
- Clear fluid visible
 - Volume <1.5 ml/kg
 - (Grade 1): low aspiration risk
 - Volume > 1.5 ml/kg (Grade 2): high aspiration risk
- Solid food: high aspiration risk
- Limitations: Gastric ultrasonography may be unreliable in patients with previous gastric surgery:
 - Gastric bypass
 - Lap-Band
 - Gastric resection
 - Nissen fundoplication
- No formula is available to calculate gastric volume of clear liquid in patients with a BMI >40.