

**GLP-1 RECEPTOR AGONISTS
&
THE UTILITY OF GASTRIC
ULTRASOUND**


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Conflict of Interest Disclosure Statement

- I have no financial relationships with any commercial interest related to the content of this activity.
- I will not discuss off-label use during my presentation.

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LEARNER OBJECTIVES

- Identify current recommendations and anesthetic considerations regarding GLP-1RAs.
- Describe the basic techniques of POCgUS.

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AGENDA

<p>GLP-1RAs</p> <ul style="list-style-type: none"> ▪ The IMPACT of GLP-RA-1s ▪ Pharmacology ▪ Anesthetic Considerations & Recommendations 	<p>POCgUS</p> <ul style="list-style-type: none"> ▪ Why POCgUS? ▪ Basic Techniques & Prandial States ▪ FAQs
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IMPACT of GLP-1RAs

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IMPACT of GLP-1RAs

BRAND	GENERIC	FDA Approval	Notes
Bydureon	Exenatide	2005 (AI), 2017 (DM2)	AstraZeneca
Byetta	Exenatide	2005 (AI), 2009 (DM2)	Amylin Pharmaceuticals & Eli Lilly
Mounjaro	Tirzepatide	2022 (DM2)	Eli Lilly
Ozempic	Semaglutide	2017 (DM2)	Novo Nordisk
Rybelsus	Semaglutide	2019 (DM2)	1 st PO drug; Novo Nordisk
Saxenda	Liraglutide	2014 (CWL)	Approved for chronic weight loss; Novo Nordisk
Trulicity	Dulaglutide	2014 (AI), 2020 (DM2)	Eli Lilly
Victoza	Liraglutide	2010 (DM2), 2019 (Peds)	Peds: 10 years +; Novo Nordisk
Wegovy	Semaglutide	2017 (AI), 2021 (WL), 2024 (CV)*	* Approved to reduce risk of CV death, MI, & Stroke in Overweight & Obese patients with CV disease; Novo Nordisk
Zepbound	Tirzepatide	2022 (AI), 2023 (WL)	Eli Lilly

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IMPACT of GLP-1RAs

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IMPACT of GLP-1RAs

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IMPACT of GLP-1RAs

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PHARM & PHYS

Pathogenesis of Diabetes Mellitus (DM), Type II

Unhealthy Lifestyle: i.e. over-eating, obesity, inactivity
 Intra-abdominal cavity accumulates "visceral fat" (aka, "abdominal fat"), which is an endocrine organ that secretes:
 Inflammatory mediators, Adipokines, Free Fatty acids (FFAs)

Genetic Susceptibility: Polygenic or monogenic factors (i.e. maturity-onset diabetes of the young (MODY) can predispose insulin resistance)

Aging: Beta cell mass declines with aging, so those predisposed to insulin resistance may develop Type II DM as they age

Medications: i.e. corticosteroids, anti-psychotics, highly active anti-retrovirals, estrogen-only oral contraceptives

Complex, unclear actions on body tissue: **Insulin resistance** (beta cells produce more insulin but are less responsive to glucose and thus less able to use glucose as a fuel source)

Lipotoxicity: If an optimal function of GLP1R on beta cells, a glucose signal? Beta cells do not recognize high blood glucose → a insulin secretion

Blood [glucose] is kept normal → Initially, beta-cells of the pancreas work overtime to ↑ insulin secretion

Over many years, as insulin resistance worsens, beta cells "wear out" → insulin secretion (relative insulin deficiency)

Over many more years, beta-cells deteriorate until they finally stop producing insulin (absolute insulin deficit)

Glucotoxicity: hyperglycemia is directly toxic to beta-cells

Since cells can't use glucose, body perceives a state of "starvation", thus involving triglycerides (not FFAs, to be used as fuel by cells)

Hyperglycemia

Note: There is a HUGO genetic basis for Type II DM: high concordance rate between family members, (90% for monozygotic twins), and if a first-degree relative is affected, the risk for other family members is 5-10x above baseline.

Type II Diabetes Mellitus

Author: Yan Yu, Rosemary, Peter Vetter, Glenn Glesne, Darren Kelly → MD on time of publication

Legend: Pathophysiology, Mechanism, Sign/Symptom/Lab Finding, Complications | Published July 11, 2018 on www.thecalgaryquill.com

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PHARM & PHYS

B Incretin Mimetic

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PHARM & PHYS

GLP-1 actions and target organs
 GLP-1, through its receptor GLP-1R

www.researchgate.net / 46561

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GLP-1 RAs Considerations

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GLP-1 RAs Considerations

Generations	Examples
1 st Generation	GLP-1 Receptor Agonists
2 nd Generation	GLP-GIP Receptor Agonists
3 rd Generation	GLP-GIP-GCGR Receptor Agonists

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Anesthetic Considerations & Recommendations

Severe Delayed Gastric Emptying; “Gut Paralysis”
Increased Risk of Hypoglycemia (if used with oral hypoglycemics or insulin)
Acute Pancreatitis
Dehydration
Cholelithiasis & Cholecystitis
Renal Function Impairment (eGFR < 30ml/min/1.73m2): Discontinue Medication
Sever Hepatic Impairment: Discontinue Medication
Long Term Effects: Unknown

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Anesthetic Considerations & Recommendations

June 29, 2023

American Society of Anesthesiologists Consensus-Based Guidance on Preoperative Management of Patients (Adults and Children) on Glucagon-Like Peptide-1 (GLP-1) Receptor Agonists

Girish P. Joshi, M.B.B.S., M.D., Basem B. Abdelmalak, M.D., Wade A. Weigel, M.D., Sulpicio G. Soriano, M.D., Monica W. Harbell, M.D., Catherine J. Kuo, M.D., Paul A. Stricker, M.D., Karen B. Domino, M.D., M.P.H., American Society of Anesthesiologists (ASA) Task Force on Preoperative Fasting

Correspondence | February 2024

ASA Consensus-based Guidance on Preoperative Management of Patients on Glucagon-like Peptide-1 Receptor Agonists

Credentialed: M.B.B.S., M.D., C.C.E., D.F.P.H., F.A.S.A., Robert W. Sabin, M.D., M.C.H.E., F.R.C.R.(P), F.R.C.P.C., F.C.C.M.

Author and Article Information

Anesthesiology 2024; Vol. 140, 344-348

<https://doi.org/10.1097/ALD.00000000000004716>

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Anesthetic Considerations & Recommendations

Editorial > Can J Anaesth. 2023 Aug;70(8):1281-1286. doi: 10.1007/s12630-023-02550-y. Epub 2023 Jul 19.

Anesthesia and glucagon-like peptide-1 receptor agonists: proceed with caution!

Philip M Jones¹, Ion A Hobai², Patricia M Murphy³

Affiliations + expand
PMID: 37466910 DOI: 10.1007/s12630-023-02550-y

PHARMACOKINETICS



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Anesthetic Considerations & Recommendations

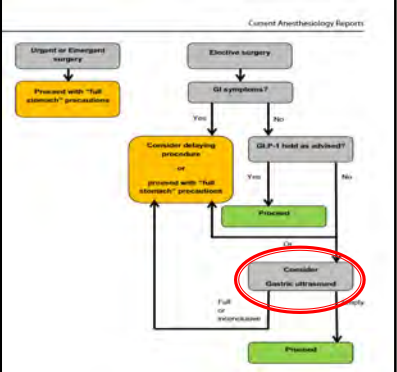
Current Anesthesiology Reports
https://doi.org/10.1007/s40142-024-00114-6

PATIENT SAFETY IN ANESTHESIA (S) BRILL AND JR RENEW, SECTION EDITORS!

Perioperative Considerations for Patients on Semaglutide

Shen-Lu Pal¹, Michael A. Smith², W. Brian Beam², Monica W. Harbell³

Accepted: 16 January 2024
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POCgUS


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What does our National Organizations say?




Changes related to point of care ultrasound

Approved Change	Key Points
<ul style="list-style-type: none"> Add the following glossary definition to Doctoral Standards: Point of Care Ultrasound (POCUS): Refers to the use of portable ultrasonography as a patient's bedside for diagnostic (e.g., symptom or sign-based examination) purposes. This is exclusive of using ultrasound for image-guidance purposes such as for regional anesthesia or vascular access. Add the following in the Appendix (Clinical Experience) of the Doctoral Standards: Add POCUS with no case number requirements but require students to track. Implementation date: All students matriculating into an accredited program on or after January 1, 2023. 	<ul style="list-style-type: none"> There has been a rapid escalation in the use of POCUS for assessment and diagnosis as well as vascular and regional access. Currently POCUS does not appear in the Standards for certification. This proposed Standard change addresses the use of ultrasound for more than vascular access and regional guidance.



Approved Revisions to the Accreditation Standards



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Dr. Ana Perlas



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Pulmonary Aspiration

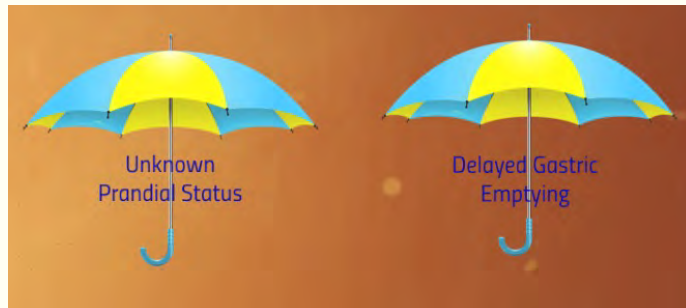


Liquid and Food Intake	Minimum Fasting Period (hours)
Clear liquids (for example, water, clear tea, black coffee, carbonated beverages, and fruit juice without pulp)	2
Breast milk	4
Nonhuman milk, including infant formula	6
Light meal (for example, toast and clear liquids)	6
Regular or heavy meal (may include fried or fatty food, meat)	8

Preoperative Fasting Recommendations* of the American Society of Anesthesiologists

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Basics of POCgUS Who should we scan?



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Qualitative vs. Quantitative



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Basics of POCgUS: Position, Probe, Anatomy

The diagram shows the stomach's anatomy with labels: Cardia, Fundus, Body, Pyloric sphincter, Pylorus, and Antrum. A URL is provided: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7808010>. The ultrasound images show the probe being held against the patient's abdomen. A detailed anatomical diagram labels the Rectus, Liver, Antrum, Propria, Mucosa, Pancreas, SMA, Aorta, and Vertebrae.

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Prandial State: Empty Stomach

Empty Stomach
"Fasted" State
"Bull's Eye"
Baseline Secretions < 1.5ml/kg

The images show a cross-section of the stomach with labels L, A, P, and Ao. A URL is provided: https://www.researchgate.net/publication/315591229/figure/fig/1/figure/fig1/315591229/Qualitative_and_quantitative_ultrasound_assessment_of_gastric_content

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Prandial State: Fluid-Filled Stomach

Fluid
Anechoic
Distention
"Starry Night" (Hyperechoic Dots)
CSA Measurement

The images show a cross-section of the stomach with labels L, A, P, and Ao. A URL is provided: https://www.researchgate.net/publication/315591229/figure/fig/1/figure/fig1/315591229/Qualitative_and_quantitative_ultrasound_assessment_of_gastric_content

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Prandial State: Thick Fluid/Late Digestion

Thick Fluid/Late Stage Digestion
Mixed Hyper/Hypoechoic Appearance
Margins can be identified
(Bill's Triangle)

The images show a cross-section of the stomach with labels L, A, P, Sma, Ao, and S. A URL is provided: https://www.researchgate.net/publication/315591229/figure/fig/1/figure/fig1/315591229/Qualitative_and_quantitative_ultrasound_assessment_of_gastric_content

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Prandial State: Solid-Filled/Early Digestion

Early Stage Digestion
 "Immediate" Consumption
 "Frosted Glass" Appearance
 Difficulty identifying Posterior Wall
 Difficult to identify structures normally seen in Empty State
Full Stomach

<http://www.gastrosonline.org>

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POCgUS Basics

How much fluid is too much fluid?

VOLUME (ML) = 27.0 + 14.6 X RIGHT-LAT CSA - 1.28 X AGE
 For Non-Pregnant Adults; Up to 500mL; Up to 100kg

Right Lat. CSA (cm ²)	20	30	40	50	60	70	80
2	31	18	5	0	0	0	0
3	45	32	20	7	0	0	0
4	60	47	34	21	9	0	0
5	74	62	49	36	23	10	0
6	89	76	65	51	38	25	12
7	103	91	78	65	52	40	27
8	118	105	95	80	67	54	41
9	133	120	107	94	82	69	56
10	147	135	122	109	96	83	71
11	162	149	136	125	111	98	85
12	177	164	151	138	125	113	100
13	191	178	165	153	140	127	114
14	206	193	180	167	155	142	129
15	220	207	194	182	169	156	143
16	235	222	209	200	184	171	158
17	249	236	224	212	198	185	173
18	264	251	239	226	213	200	187
19	278	266	253	240	227	214	202
20	293	281	268	255	242	229	217
21	307	295	282	269	256	244	231
22	323	310	297	284	271	259	246
23	337	324	311	298	285	273	260
24	352	339	326	313	301	288	275
25	366	353	340	327	315	302	289
26	381	368	355	343	330	317	304
27	395	382	369	357	344	331	318
28	410	397	383	372	359	346	333
29	424	411	398	386	373	360	347
30	439	427	414	401	388	375	363

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POCgUS Basics

ANTRAL GRADING SYSTEM (GRADES 0 - 2)

GRADE	ANTRAL PRESENTATION	VOLUME IMPLICATIONS	ASPIRATION RISK
0	Empty in both supine and RLD position	Minimal	Low risk
1	Empty in supine, clear fluid visible in the RLD	≤ 1.5 mL/kg, compatible with baseline gastric secretions	Low risk
2	Clear fluid visible in both positions	> 1.5 mL/kg, likely in excess of baseline gastric secretions	High risk

<http://www.gastrosonline.org>


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FAQs

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FAQ: When should you NOT use POCgUS?



- Hx of Gastric Surgery
- Large Hiatal Hernias
- Abdominal Bandages
- Abdominal Wounds
- Patients who cannot tolerate the RLD position



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FAQ: How long does it take to ultrasound?


The real question is.... Does this slow up the schedule?
Provider Experience

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FAQ: What is the learning curve?

33 supervised scans to achieve 95% accuracy in qualitative assessment of gastric contents



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FAQ: Can we charge for this assessment?



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My facility doesn't have an ultrasound. FAQs: What should we do and/or how can I convince leadership to invest?

- Follow recommended guidelines or take an even more conservative approach.
- Incidence and cost of Pulmonary Aspiration vs Cost of an US and/or probe
 - PA: \$10,000-\$45000
 - US &/OR Probe: \$3000-\$5000




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FAQ: What are the legal issues surrounding POCgUS?



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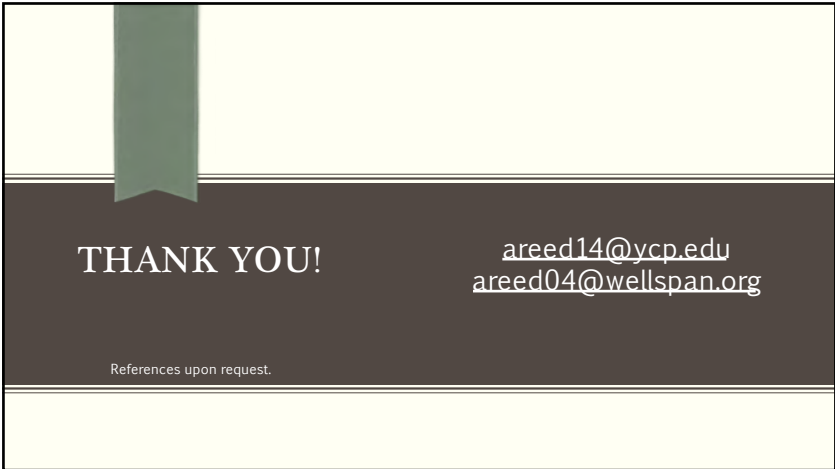
FAQs: What about specialty patient populations and POCgUS?



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THANK YOU!

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References upon request.