

Cardiometabolic Syndrome & Anesthesia for the Vasculopath

Nathaniel J Brown, MD, PhD
Rocky Mountain Regional VAMC
University of Colorado SOM

Outline

- Definitions
- Introduction (AKA: Why care?)
- Preoperative considerations
 - Prehabilitation?
- Intraoperative considerations
 - Implications
 - Management
- Postoperative considerations
 - More on outcomes

Definitions: CardioMetabolic Syndrome (CMS)

- Cardiometabolic Syndrome (CMS)
- Also known as: Metabolic Syndrome, Syndrome X, Dysmetabolic Syndrome Insulin Resistance Syndrome...
 - Having 3 or more of the following:
 1. Large waistline
 2. High blood pressure
 3. High blood glucose
 4. High triglycerides
 5. Low HDL cholesterol
- Having CMS increases the risk of ischemic heart disease, stroke, type 2 diabetes, NAFLD, PCOS, among others, as well as all cause mortality.

CMS criteria with greater specificity

- In more detail:
 1. Large waistline (>35" in F & AFAB; >40" in M & AMAB)
 2. High blood pressure (>130mmHg systolic and/or >80mmHg diastolic)
 3. High blood glucose (FBG >100mg/dL)
 4. High triglycerides (>150mg/dL)
 5. Low HDL cholesterol (< 40mg/dL in M & AMAB; <50mg/dL in F & AFAB)

What causes it?

- Multifactorial, of course, but the primary driver is:
 - Insulin resistance
 - Contributing factors include
 - Visceral adiposity
 - Lack of physical activity
 - Genetics
 - Some medications (corticosteroids, antipsychotics, some HIV meds...)
 - Smoking
 - decreases HDL, increases BP
 - Poor sleep
 - Stress

How were we thinking about this a few years ago?

Review > Br J Anaesth. 2015 Aug;115(2):194-202. doi: 10.1093/bja/aev199. Epub 2015 Jun 23.

Impact of metabolic syndrome in surgical patients: should we bother?

P Tzimas¹, A Petrou², E Laou², H Milionis³, D P Mikhailidis⁴, G Papadopoulos²

Affiliations + expand

PMID: 26109210 DOI: 10.1093/bja/aev199

How about a few years before that?

Review > *Anaesthesia*. 1975 Sep;30(5):633-47. doi: 10.1111/j.1365-2044.1975.tb00924.x.

Obesity: its relation to anaesthesia

A Fisher, T D Waterhouse, A P Adams

PMID: 1103646 DOI: 10.1111/j.1365-2044.1975.tb00924.x



Are Outcomes Different?

Review > *Best Pract Res Clin Anaesthesiol*. 2020 Jun;34(2):131-140. doi: 10.1016/j.bpa.2020.04.002. Epub 2020 Apr 21.

Metabolic syndrome – Evidence-based strategies for patient optimization

Shuhan J Reyes¹, Taylor Pak², Tiffany Sun Moon³

Affiliations + expand

PMID: 32711824 DOI: 10.1016/j.bpa.2020.04.002



What Happens Under Anesthesia?

Review > *Anaesth Crit Care Pain Med*. 2021 Dec;40(6):100947. doi: 10.1016/j.accpm.2021.100947. Epub 2021 Sep 14.

Obesity, metabolic syndrome, and inflammation: An update for anaesthetists caring for patients with obesity

Victoria A Eley¹, Moe Thuzar², Séverine Navarro³, Benjamin R Dodd⁴, André A van Zundert⁵

Affiliations + expand

PMID: 34534700 DOI: 10.1016/j.accpm.2021.100947



Review > *J Clin Med*. 2023 Jun 2;12(11):3818. doi: 10.3390/jcm12113818.

A Comprehensive Summary of the Current Understanding of the Relationship between Severe Obesity, Metabolic Syndrome, and Inflammatory Status

Razvan-Marius Ion¹, Melania Sibianu², Adina Hutanu³, Felicia Gabriela Beresescu⁴, Daniela Tatiana Sala⁵, Mocian Flavius⁵, Ancuta Rosca⁶, Calin Constantin⁷, Alexandra Scurtu⁵, Renata Moriczi⁷, Mircea Gabriel Muresan⁵, Popescu Gabriel⁷, Raluca Niculescu⁵, Radu Mircea Neagoe⁵

Affiliations + expand

PMID: 37298013 PMCID: PMC10253880 DOI: 10.3390/jcm12113818



Review > *Int J Obes (Lond)*. 2015 Jun;39(6):877-83. doi: 10.1038/ijo.2015.21. Epub 2015 Feb 20.

Obesity-related immune responses and their impact on surgical outcomes

M Quante¹, A Dietrich², A ElKhal³, S G Tullius³



Review > *Int J Obes (Lond)*. 2015 Nov;39(11):1575-88. doi: 10.1038/ijo.2015.100. Epub 2015 Jun 1.

Obesity-related insulin resistance: implications for the surgical patient

N Tewari¹, S Awad², I A Macdonald⁴, D N Lobo¹



Not all obesity is unhealthy: Medically Healthy Obesity (MHO)



> *Hepatol Int.* 2022 Dec;16(6):1412-1423. doi: 10.1007/s12072-022-10395-8. Epub 2022 Aug 20.

Association between metabolically healthy obesity and non-alcoholic fatty liver disease

Sallimai Man ^{1 2 3}, Jun Lv ^{1 3 4}, Canqing Yu ^{1 3 4}, Yuhan Deng ^{2 5}, Jianchun Yin ⁶, Bo Wang ^{7 8}, Liming Li ^{9 10 11}, Hui Liu ¹²



Review > *Ann Hepatol.* 2020 Jul-Aug;19(4):359-366. doi: 10.1016/j.ahep.2020.03.001. Epub 2020 Mar 21.

Epidemiology and pathophysiology of the association between NAFLD and metabolically healthy or metabolically unhealthy obesity

Amedeo Lonardo ¹, Alessandro Mantovani ², Simonetta Lugari ³, Giovanni Targher ²



Review > *Syst Rev.* 2018 Mar 27;7(1):50. doi: 10.1186/s13643-018-0713-x.

Life course factors associated with metabolically healthy obesity: a protocol for the systematic review of longitudinal studies

E M Robson ¹, S Costa ², M Hamer ³, W Johnson ³



Review > *Curr Pharm Des.* 2013;19(27):4799-805. doi: 10.2174/1381612811319270002.

Pathophysiology and therapeutics of cardiovascular disease in metabolic syndrome

Yabin Wang ¹, Qiujun Yu, Yundai Chen, Feng Cao



Preoperative Considerations

- Good news: prehabilitation is possible! CMS is reversible.
 - Pharmacological and non-pharmacological
 - Changes in diet / microbiome
 - Regular exercise with focus on strength (muscle is the largest sink for blood glucose) *
 - Drugs for lipid, BP, and DM control
 - Can reduce dose or even eliminate as CMS improves



Prehab

Review > Curr Opin Clin Nutr Metab Care. 2020 Jul;23(4):271-276.
doi: 10.1097/MCO.0000000000000663.

Prehabilitation: metabolic considerations

Katherine Chabot ¹, Chelsia Gillis ², Franco Carli ¹

Affiliations + expand

PMID: 32398440 DOI: 10.1097/MCO.0000000000000663



Review > J Diabetes Metab Disord. 2023 Mar 31;22(1):155-174.
doi: 10.1007/s40200-023-01219-z. eCollection 2023 Jun.

Impact of exercise training duration on obesity and cardiometabolic biomarkers: a systematic review

Richa Hirendra Rai ¹, Ram B Singh ², Vishal Mehta ³, Sakshi ¹, Mohd Asif ⁴, Kajal Goyal ⁴, Apoorva Balodhi ⁴, Palak Manglik ⁴, Abhishek Sharma ⁵, Aksh Chahal ⁶



> J Clin Med. 2021 Sep 18;10(18):4243. doi: 10.3390/jcm10184243.

The Effect of Lifestyle Intervention on Systemic Oxidative Stress in Women with Obesity and Infertility: A Post-Hoc Analysis of a Randomized Controlled Trial

Zheng Wang ¹, Arno R Bourgonje ², Henk Groen ³, Amaal E Abdulle ⁴, Astrid E P Cantineau ¹, Anne M van Oers ¹, Lotte van Dammen ^{1,3,5}, Marian L C Bulthuis ⁶, Vincent Wekker ⁷, Ben W J Mol ⁸, Tessa J Roseboom ^{7,9}, Harry van Goor ⁶, Annemieke Hoek ¹



Intraoperative Considerations

- The prehabilitation ship has sailed; you're in the OR.
- Hemodynamic instability is more prevalent in vasculopath (whether diagnosed as such or not)

Review > Anesthesiol Clin. 2016 Dec;34(4):775-795. doi: 10.1016/j.anclin.2016.06.011.

Anesthesia for Patients with Peripheral Vascular Disease and Cardiac Dysfunction

Sara E Neves ¹

Affiliations + expand

PMID: 27816134 DOI: 10.1016/j.anclin.2016.06.011



Randomized Controlled Trial > Br J Anaesth. 2022 Oct;129(4):478-486.
doi: 10.1016/j.bja.2022.06.027. Epub 2022 Aug 23.

Continuous intra-arterial versus intermittent oscillometric arterial pressure monitoring and hypotension during induction of anaesthesia: the AWAKE randomised trial

Karim Kouz ¹, Mirja Wegge ¹, Moritz Flick ¹, Alina Bergholz ¹, Parisa Moll-Khosrawi ¹, Rainer Nitzschke ¹, Constantin J C Trepte ¹, Linda Krause ², Daniel I Sessler ³, Christian Zöllner ¹, Bernd Saugel ⁴

Affiliations + expand

PMID: 36008202 DOI: 10.1016/j.bja.2022.06.027



Arterial lines for everyone?

- Invasive BP monitoring may be called for in a higher percentage of vasculopath, but...



Beyond hemodynamics

Review > [Curr Opin Anaesthesiol.](#) 2023 Aug 1;36(4):414-421.
doi: 10.1097/ACO.0000000000001280. Epub 2023 Jun 8.

How obesity affects the disposition of intravenous anesthetics

Shinju Obara ¹, Keisuke Yoshida, Satoki Inoue

Affiliations + expand

PMID: 37314170 DOI: 10.1097/ACO.0000000000001280



Postoperative Considerations

> [Syst Rev.](#) 2019 Dec 6;8(1):308. doi: 10.1186/s13643-019-1241-z.

Risk of postoperative pulmonary complications in adult surgical patients with metabolic syndrome: a systematic review and meta-analysis protocol

Philip Norris ¹, Bianca Viljoen ², Nicholas Ralph ², Jeff Gow ³, Natalie Silvey ⁵

Affiliations + expand

PMID: 31810501 PMCID: PMC6896345 DOI: 10.1186/s13643-019-1241-z



> [Angiology.](#) 2017 Apr;68(4):306-314. doi: 10.1177/0003319716664283. Epub 2016 Sep 29.

The Influence of the Metabolic Syndrome on the Short- and Long-Term Outcome After Carotid Endarterectomy

Linda Visser ¹, Bas M Wallis de Vries ¹, Douwe J Mulder ², Maarten Uyttenboogaart ³, Sterre van der Veen ¹, Clark J Zeebregts ¹, Robert A Pol ¹

Affiliations + expand

PMID: 27571767 DOI: 10.1177/0003319716664283



Some Data Sharply Disagree

> [J Vasc Surg.](#) 2009 May;49(5):1172-80.e1; discussion 1180. doi: 10.1016/j.jvs.2008.12.011.

Metabolic syndrome: A predictor of adverse outcomes after carotid revascularization

Clinton D Protack ¹, Andrew M Bakken, Jiaqiong Xu, Wael A Saad, Alan B Lumsden, Mark G Davies

Affiliations + expand

PMID: 19394545 DOI: 10.1016/j.jvs.2008.12.011



Review > [Cancers \(Basel\).](#) 2022 May 28;14(11):2684. doi: 10.3390/cancers14112684.

Pancreatic Cancer and Microenvironments: Implications of Anesthesia

Hou-Chuan Lai ¹, Yi-Wei Kuo ², Yi-Hsuan Huang ¹, Shun-Ming Chan ¹, Kuang-I Cheng ², Zhi-Fu Wu ¹

Affiliations + expand

PMID: 35681664 PMCID: PMC9179559 DOI: 10.3390/cancers14112684



Further directions

- Innumerable studies on various aspects of CMS
- Not that much known about the effects on anesthesia
 - (or vice versa)
- Stay tuned for more research
 - Chronic inflammatory states
 - Insulin resistance
 - Metabolic dysregulation
 - Exercise



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Thank you!

