Brigham and Women's Hospital
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HARVARD MEDICAL SCHOOL

Etiologies and Management of Maternal Cardiac Arrest During Peripartum Anesthetic Care

A Study from the Multicenter Perioperative Outcomes Group Consortium

Findings and Lessons Learned

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*No disclosures

Background

Prior studies utilizing national hospitalization-level data to study maternal cardiac arrest are limited in granular assessments

More detailed, contemporary studies are registry-based and rely on manual reporting (NAP7, CAPS)

U.S. lacks studies assessing maternal cardiac arrest with this level of detail

Aims: Describe the frequency, risk factors, etiology, and management of maternal cardiac arrest during peripartum anesthetic care

Mhyre *Anesthesiology* 2014 | Ford *Ann Intern Med* 2023 | Lucas *Anaesthesia* 2024 | Beckett *BJOG* 2017

Methods

Inclusion criteria:

- All anesthetic records for delivery + any associated anesthetic records within 7 days
- 2015-2022
- Ages 15-44

Screening criteria:

- ICD/CPT codes
- ACLS medications
- MPOG electronic record concepts/events
- Free-text notations

Manual review:

- Two anesthesiologists independently evaluated each case
- Granular data manually abstracted from anesthetic records

MPOG
MULTICENTER PERIOPERATIVE OUTCOMES GROUP

Results

778,000 delivery hospitalizations

87 cardiac arrests during anesthetic care

11.2 per 100,000 deliveries (95% CI 9.1, 13.8)

Overall risk 1:8,944

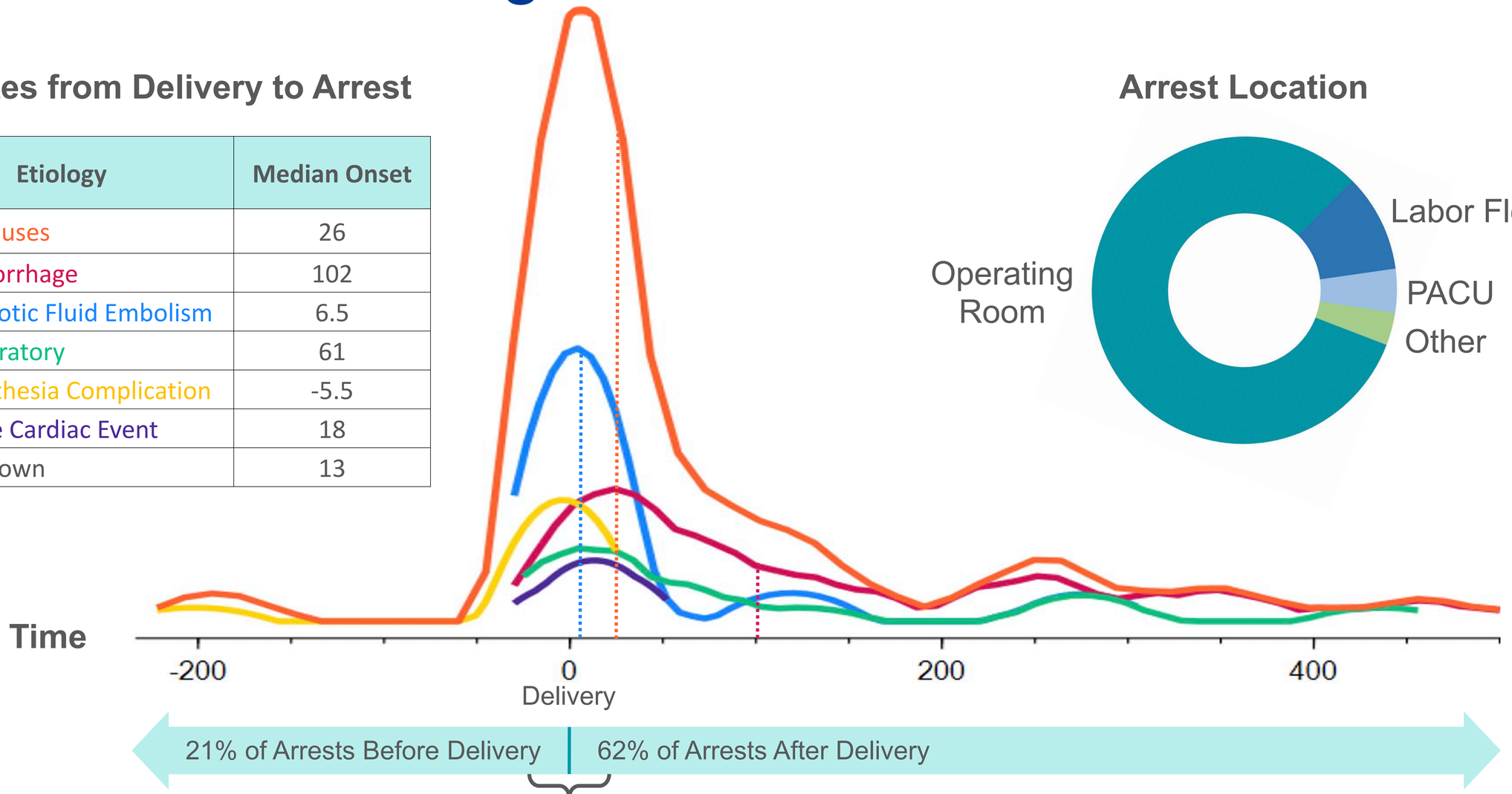
Patient Factors	Odds Ratio (95% CI)	Risk
Age 40+	2.13 (1.02, 4.5)	1:4,527
BMI 40+	2.90 (1.61, 5.2)	1:4,477
Black Race	1.82 (1.08, 3.08)	1:5,843

Comorbidities	Odds Ratio (95% CI)	Risk
Pulmonary Hypertension	60.4 (22.1, 165.0)	1:155
Placenta Accreta Spectrum	35.9 (19.1, 67.7)	1:284
Chronic Ischemic Heart Disease	27.0 (9.9, 73.6)	1:347

Location and Timing

Minutes from Delivery to Arrest

Etiology	Median Onset
All Causes	26
Hemorrhage	102
Amniotic Fluid Embolism	6.5
Respiratory	61
Anesthesia Complication	-5.5
Acute Cardiac Event	18
Unknown	13



Arrest Location

Etiologies and Outcomes

Etiology	N (%)	ROSC N (%)	30 Day Survival N (%)	Median LOS Among Survivors (Days)	Trach/G-tube Among Survivors N(%)
All Causes*	87	67 (77.0)	60 (69.0)	6	3 (5.0)
Hemorrhage	35 (40.2)	23 (65.7)	22 (62.9)	8	1 (4.55)
Amniotic Fluid Embolism	27 (31.0)	23 (85.2)	20 (74.1)	8	3 (15.0)
Respiratory	12 (13.8)	9 (75.0)	6 (50.0)	4	1 (16.7)
Anesthesia Complication	10 (11.5)	10 (100.0)	9 (90.0)	4	-
Acute Cardiac Event	8 (9.2)	7 (87.5)	6 (75.0)	13.5	-
Trauma	3 (3.5)	0 (0.0)	0 (0.0)	-	-
Venous Thromboembolism	3 (3.5)	2 (66.7)	1 (33.3)	5	-
Air Embolism	1 (1.2)	0 (0.0)	0 (0.0)	-	-
Unknown	9 (10.3)	7 (77.8)	7 (77.8)	2	-

* Some cases had multiple etiologies

Management

14 cases

11 survived case

8 survived to 30 days

Delayed resuscitative hysterotomy

Epinephrine

Amiodarone

Interventions	N (%)	Adjuvant Medications	N (%)
Advanced Airway		Epinephrine (1 milligram)	76 (87.4)
Pre-existing	45 (51.7)	Amiodarone	10 (11.5)
New	35 (40.2)	Atropine	22 (25.3)
Arterial Access		Sodium Bicarbonate	46 (52.9)
Pre-existing	22 (25.3)	Calcium Chloride	40 (46.0)
New	40 (46.0)	Vasopressor Infusions+	53 (60.9)
Central Venous Access		Ino-chronotrope Infusions++	31 (35.6)
Pre-existing	5 (5.8)	Pulmonary Vasodilators	6 (6.9)
New	26 (29.9)	Blood Products	44 (50.6)
Transesophageal Echo	17 (19.5)	Factor Concentrates	8 (9.2)
Transthoracic Echo	9 (10.3)	Lipid Emulsion	1 (1.1)
ECMO (VA or VV)	14 (16.1)		
Deviation from ACLS Guidelines	16 (18.4)		

+ Phenylephrine, norepinephrine, vasopressin

++ Epinephrine, milrinone, dopamine

Conclusions

Risk of peripartum MCA during anesthetic care:
1:8,944

Highest risk comorbidities:
Pulmonary hypertension, placenta accreta spectrum, chronic ischemic heart disease

Most common etiologies:
Hemorrhage and AFE

Outcomes after MCA:
77% ROSC, 69% 30-Day Survival

Opportunities for improvement?

- Hemorrhage Outcomes
- ACLS

Lessons Learned: Needle in a Haystack

Screening criteria:

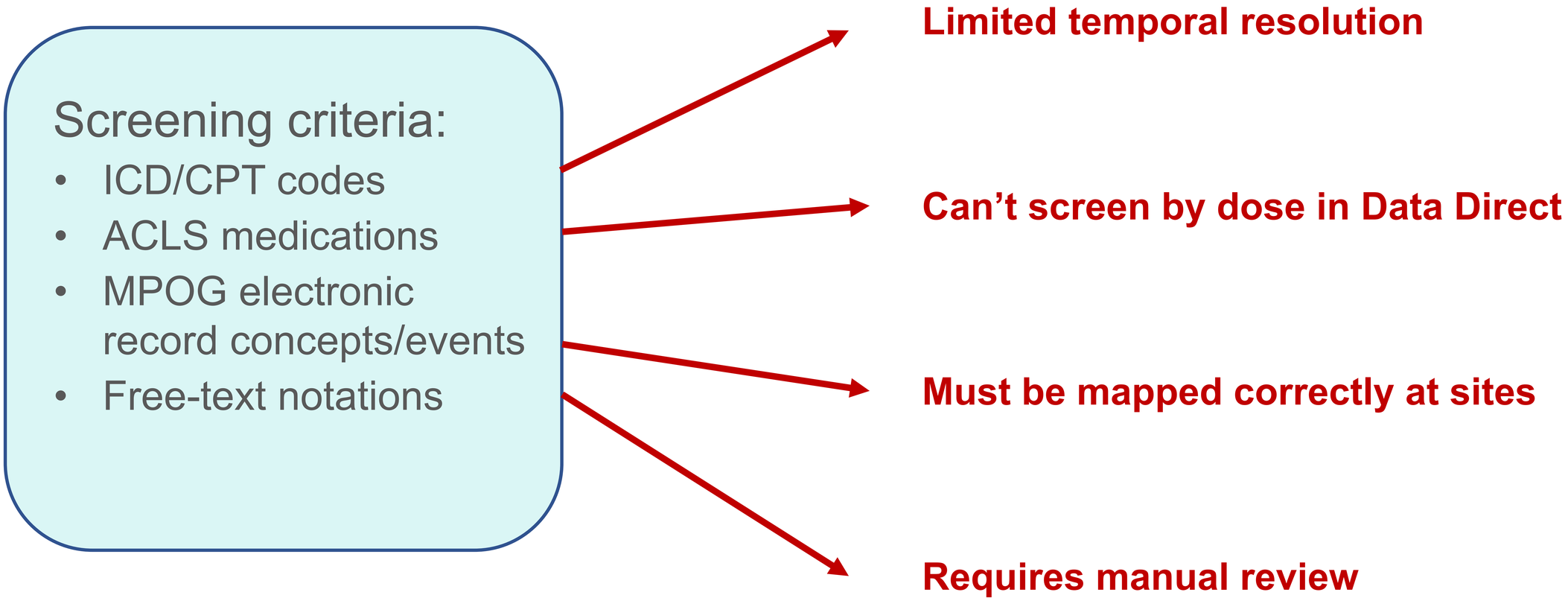
- ICD/CPT codes
- ACLS medications
- MPOG electronic record concepts/events
- Free-text notations

How do you screen for something exceedingly rare?

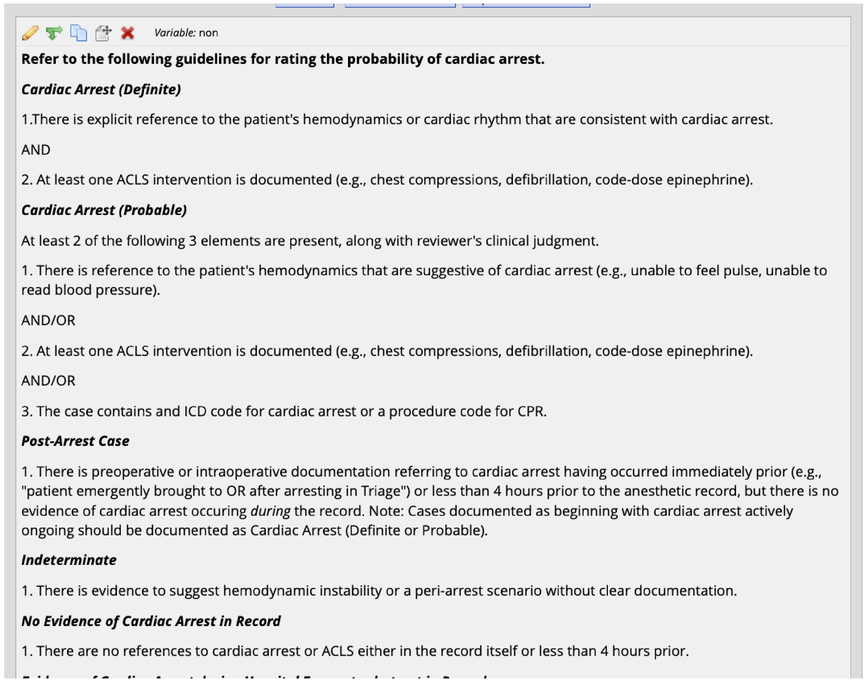
Multiple search criteria will increase sensitivity, but at the expense of specificity

A preliminary ‘chart biopsy’ is essential to identify the right screening criteria

Lessons Learned: Needle in a Haystack



Lessons Learned: “I know it when I see it”



Variable: non

Refer to the following guidelines for rating the probability of cardiac arrest.

Cardiac Arrest (Definite)

1.There is explicit reference to the patient's hemodynamics or cardiac rhythm that are consistent with cardiac arrest.

AND

2. At least one ACLS intervention is documented (e.g., chest compressions, defibrillation, code-dose epinephrine).

Cardiac Arrest (Probable)

At least 2 of the following 3 elements are present, along with reviewer's clinical judgment.

1. There is reference to the patient's hemodynamics that are suggestive of cardiac arrest (e.g., unable to feel pulse, unable to read blood pressure).

AND/OR

2. At least one ACLS intervention is documented (e.g., chest compressions, defibrillation, code-dose epinephrine).

AND/OR

3. The case contains and ICD code for cardiac arrest or a procedure code for CPR.

Post-Arrest Case

1. There is preoperative or intraoperative documentation referring to cardiac arrest having occurred immediately prior (e.g., "patient emergently brought to OR after arresting in Triage") or less than 4 hours prior to the anesthetic record, but there is no evidence of cardiac arrest occuring *during* the record. Note: Cases documented as beginning with cardiac arrest actively ongoing should be documented as Cardiac Arrest (Definite or Probable).

Indeterminate

1. There is evidence to suggest hemodynamic instability or a peri-arrest scenario without clear documentation.

No Evidence of Cardiac Arrest in Record

1. There are no references to cardiac arrest or ACLS either in the record itself or less than 4 hours prior.

Manual review can help extract inconsistently documented parameters, or capture complex concepts

Be judicious – time commitment scales *fast* with manual review detail and sample size

Share the load as much as you can, inversely with complexity

Lessons Learned: “I know it when I see it”

Cardiac Arrest?

Arrest Timing?

Location?

Duration?

Airway?

Lines?

Echo?

Resuscitative Hysterotomy?

Rhythm?

Medications?

Outcome?

Etiology?

Manual review can help extract inconsistently documented parameters, or capture complex concepts

Be judicious – time commitment scales *fast* with manual review detail and sample size

Share the load as much as you can, inversely with complexity

You only want to do this once…

Thank you!

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