Morgan Stanley
Children's Hospital
of NewYork-Presbyterian
Columbia University Medical Center

Pulmonary Hypertension in Pregnancy: The American Anesthesia Consortium

Meng Marie-Louise,[1] Reitman E,[1] Viktorsdottir O,[2]
Banayan J,[3] Grant T,[3] Bateman B,[4] Smiley R,[1] Landau R.[1]

Department of Anesthesiology

[1]Columbia University Medical Center, New York City, USA,
[2]Landspitali University Hospital Fossvogur, Reykjavik, Iceland,
[3]University of Chicago, Chicago, USA,
[4]Brigham and Women's Hospital, Boston, USA

No Disclosures
No conflicts of Interest

Pulmonary Hypertension & Pregnancy

PH Etiology (WHO Class)

1. PAH/Congenital HD/ES
2. Left Heart Disease
3. Lung Disease
4. Thrombotic Disease
5. Miscellaneous/Multifactorial

PH Severity

- Mild:
  Mean PAP>25mmHg
- Severe:
  Mean PAP>50mmHg or
  Systolic PAP>70mmHg

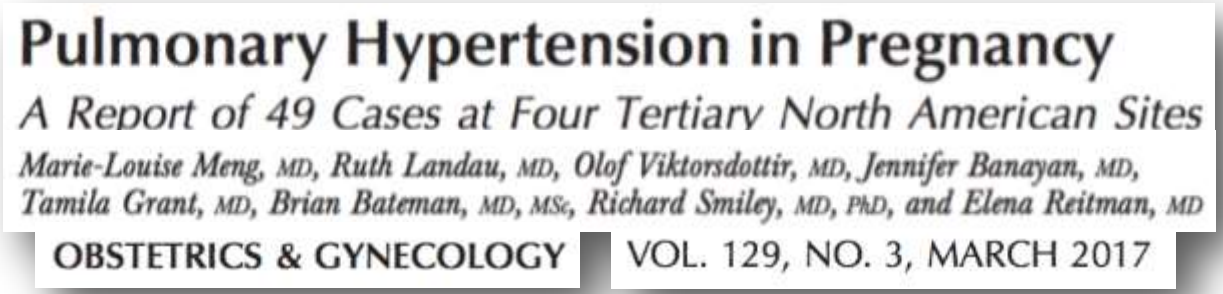
- ***PH*** of any cause ***WHO IV*** (pregnancy contraindicated)
  - Right heart failure/hemodynamic collapse
  - Thrombosis/thrombocytopenic/anticoagulation
  - Tolerance of delivery & anesthesia & postpartum
  - CD preferred

Pulmonary Hypertension & Pregnancy

- Study Aim:
  - To compare pregnancy outcomes by ***PH Etiology*** & ***PH severity***
  - Treatments & Delivery Modes associated with Reduced Mortality
- Hypothesis:
  Vaginal Deliveries will have Comparable (Superior?) Maternal Mortality to Cesarean Deliveries in Referral Centers with Experience

Methods

- Multicenter Study (52 Cases)
  - Retrospective (2001-2015): CUMC, BWH, MGH, UofC


Pulmonary Hypertension in Pregnancy

A Report of 49 Cases at Four Tertiary North American Sites

Marie-Louise Meng, MD, Ruth Landau, MD, Olof Viktorsdottir, MD, Jennifer Banayan, MD, Tamila Grant, MD, Brian Bateman, MD, MSc, Richard Smiley, MD, PhD, and Elena Reitman, MD

OBSTETRICS & GYNECOLOGY VOL. 129, NO. 3, MARCH 2017

  - Prospective: Continuing to add cases from other centers

- Retrospective EMR Data
  - ICD9 Billing codes:
    - Pulmonary Hypertension (416.0–416.9)
    - complication of pregnancy/childbirth, & puerperium (630–679)

- Descriptive Statistics

Methods

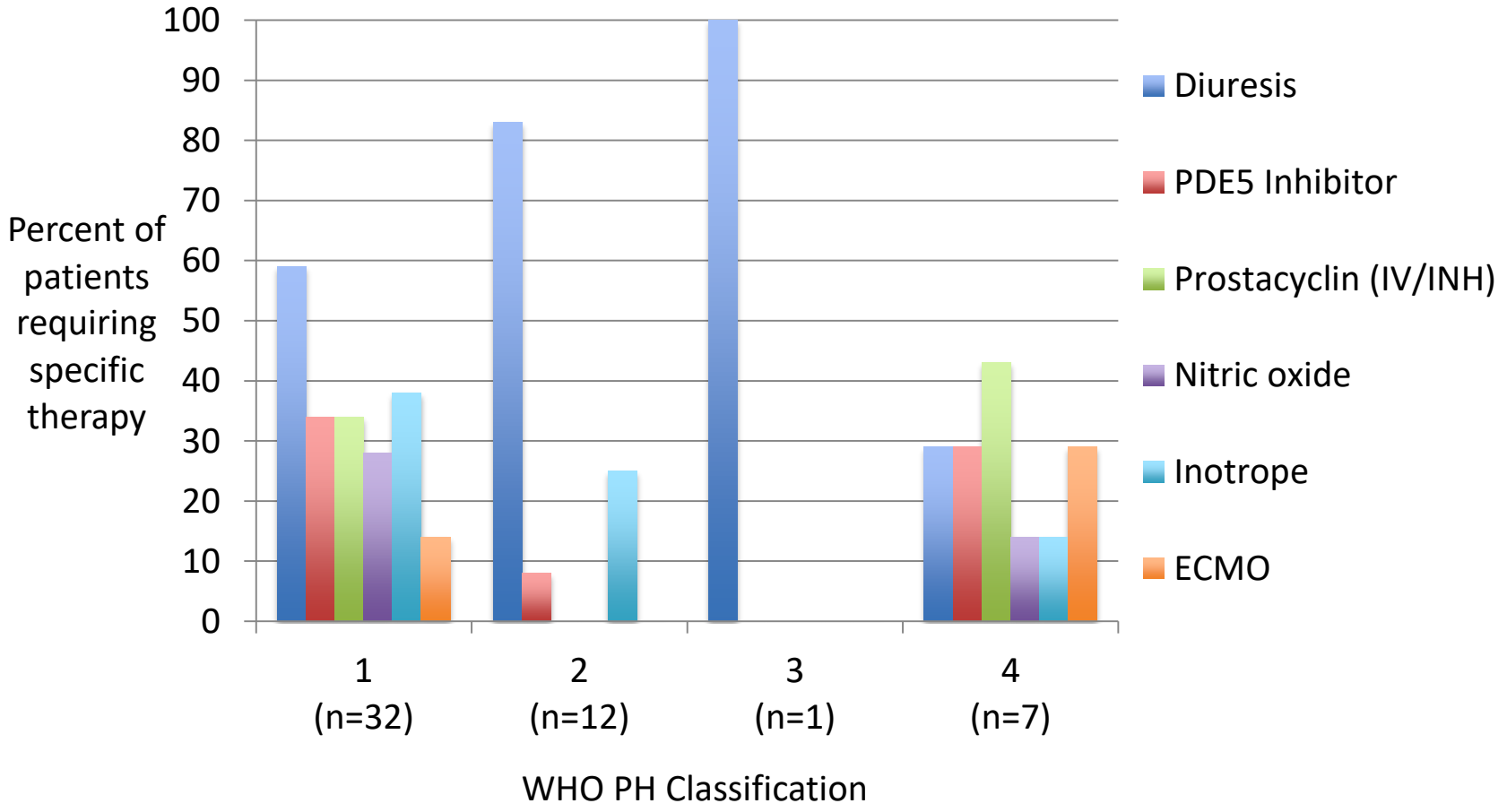
- Information collected per case:
  - WHO Etiology PH classification
  - NYHA classification
  - Pulmonary vascular pressure (TTE &Cath)
  - Medical treatments
  - Mode of delivery
  - Anesthetic management
  - ECMO use
  - Maternal mortality
  - Fetal outcomes
- Patient data de-identified and stored in REDCAP

Characteristics of the Cohort (N=52)

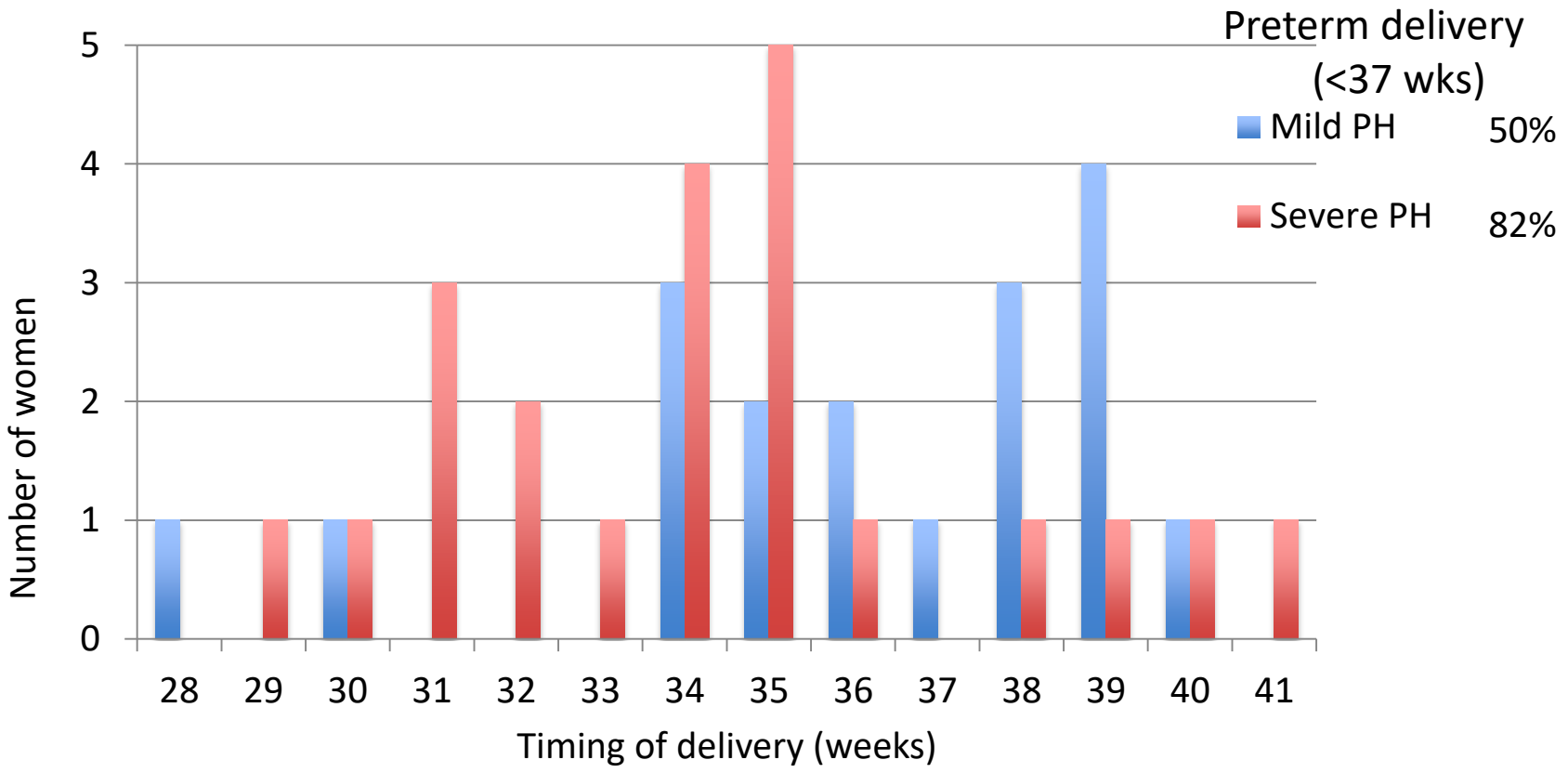
	WHO Classification of Pulmonary Hypertension			
	Group 1: Pulmonary arterial hypertension and Congenital Heart Disease N=32	Group 2: Left heart disease N=12	Group 3: Lung disease N=1	Group 4: Thrombotic disease N=7
Age (SD)	30 (6)	33(5)	29	32(6)
Nulliparous women (N=)	18 (56%)	3 (25%)	1 (100%)	2 (26%)
Severe PH (N=)	20 (63%)	4 (33%)	0	4 (57%)
Eisenmenger syndrome (N=)	7 (22%)	0	0	0
Termination/D&E (N=)	5 (16%)	3 (25%)	0	0
Preterm delivery (N=)	18 (56%)	2 (17%)[2]	1 (100%)	6 (85%)
Cesarean Delivery (N=)	14 (44%)	4 (33%)	0	4 (57%)
Vaginal Delivery (N=)	12 (38%)[1]	5 (42%)	1 (100%)	2 (26%)[1]
General anesthesia for CD (N=)	1 (3%)[1]	0	0	1 (14%)[2]
Maternal Mortality (N=)	7 (22%)[1]	0	0	1 (14%)

Continuous values presented as mean ± standard deviation (SD)
Severe PH was defined as mean PAP ≥ 50 mmHg or systolic PAP ≥ 70 mmHg
There were no women with a WHO Classification of PH Group 5
[1]One case with missing data
[2]Two cases with missing data

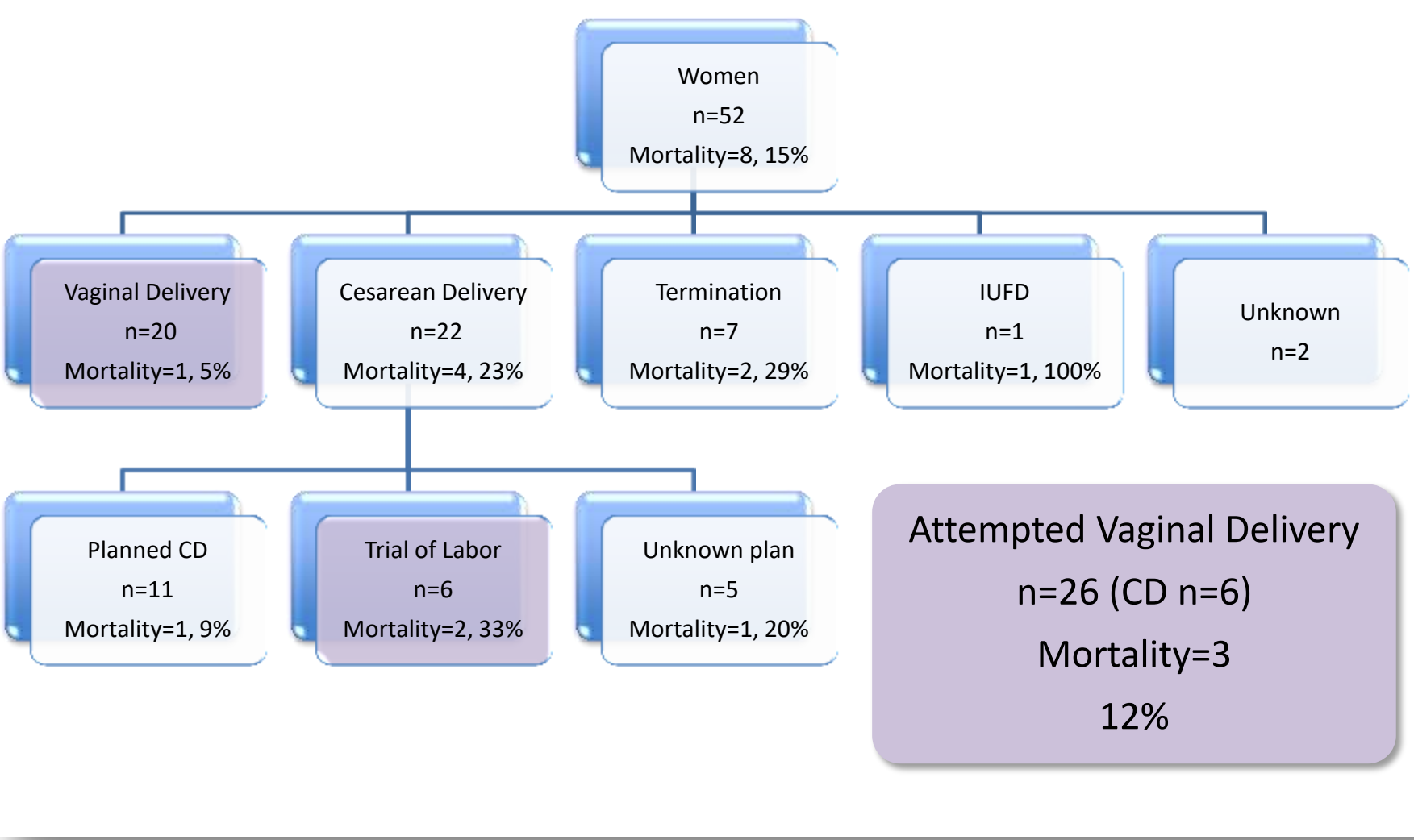
PH Therapy Use



DELIVERY TIMING



Mode of Delivery and Mortality



ECMO Use

WHO Group: Etiology	PH Severity	Medical Treatment	Delivery mode	Anesthesia	ECMO	Timing & cause of death
1: VSD with ES	Severe	Digoxin, prostacyclin, oxygen, lasix	CD for breech at 31 wk	Epidural	PPD4 VA ECMO at time of cardiac arrest	PPD4 cardiac arrest
1: ASD with ES	Severe	Prostacyclin, nitric oxide, milrinone, lasix	TOL/STAT CD for cord prolapse at 34 wk	Epidural	PH crisis 24h after CD. PPD3 partial closure of ASD with VV ECMO. PPD5 converted to VA ECMO and LVAD	PPD16 cardiopulmonary failure, withdrawal of ECMO support
1: PDA with ES	Severe	Prostacyclin, sildenafil, nitric oxide, milrinone, dobutamine, epinephrine, dopamine, lasix	TOL/CD resulting from maternal cardiopulmonary decompensation at 35 wk	Epidural	VV ECMO, 2 d before delivery, POD13 cardiopulmonary collapse switch to VA ECMO	PPD 89 unwitnessed presumed cardiac arrest
1: Idiopathic PH	Severe	Epoprostenol	Termination at 13 wk	MAC	Yes (no details)	POD2 after D&E
1: Scleroderma	Mild	Prednisone, azathioprine, carvedilol	Termination at 21 wk	Spinal	VA ECMO after arrest during placement of AICD (8d post D&E)	POD8 cardiac arrest POD10 death
1: VSD with ES	**Severe**	**Nitric oxide, iloprost, lasix, sildenafil**	**Termination at 22 wk**	**Combined Spinal Epidural**	**Decompensation at time of D&E**	**Alive 8 months today**
4: Thrombotic disease from cancer	Mild	None	CD at 34 wk for maternal cardiopulmonary decompensation	Neuraxial	At time of arrest	POD1 PEA arrest

Conclusions

- Maternal mortality 15% (6/8 severe PH)
  - WHO Group 1 22%
  - Eisenmenger Syndrome 43%
- Advanced Therapies used mostly
  - WHO Group 1 PH
  - Eisenmenger Syndrome
- 1st peripartum ECMO with Survival (8 months)
- *Gaps in Knowledge:*
  1. *Safest mode of Delivery*
  2. *Anticoagulation*
  3. *Benefits of ECMO*

Case #52 (Dec. 2017)

- 35 G1P0 @ 31 Wks
- IPAH (PASP 65), NYHA1
- Medication: Nifedipine
- Admission for Worsening RV function
- Plan: Induction of Labor @ 36 Wks & Assisted VD
- Team 24/7: MFM, OB/CT Anesthesia, PH specialist, Surgeons & Perfusionists (ECMO)
- Invasive monitoring, Femoral ECMO sheaths
- TTE peridelivery
- Neuraxial anesthesia prior to Induction
- Nasal NO, Dobutamine
- Assisted Vaginal Delivery after 32 hours of Labor
- ICU 9 Days, Home on Day 10

THANK YOU