



Background

- Maternal obesity rates are increasing to epidemic figures
- Obesity is associated with higher Cesarean delivery (CD) rates & increased risk of complications
- Procedural time & anesthesia time may increase as body mass index (BMI) increases
 - May influence neuraxial technique selection
- Understanding the influence of BMI on CD duration can:
 - Support clinical decisions
 - Guide optimal anesthetic technique



Objectives

Specific Aims

Aim 1: To determine if BMI increases the duration of CD

Aim 2: Determine if block placement, patient preparation, and case duration are increased for obese patients undergoing CD

Aim 3: To determine if a history of prior CD or concurrent procedures impacts duration of CD and/or choice of anesthesia

Study Hypothesis

Obese pregnant patients undergoing scheduled CD will have significantly longer case duration compared to non-obese patients

Outcomes

Primary Outcome: Duration of CD (block placement to incision closure)

Secondary Outcomes:

- Impact of BMI on specific time periods:
 - Time to complete neuraxial block
 - Overall CD duration time
 - Block to incision (Surgical preparation time)
 - Incision to delivery
 - Delivery to closure
- The impact of prior CD and concurrent procedures on CD procedure time
- Factors influencing the choice of neuraxial anesthesia technique
 - OB anesthesia fellowship training
- General anesthesia (GA) conversion rate
- Rate of epidural blood patch as a marker of post-dural puncture headache (PDPH)

Methods

Approval from Mayo Clinic Institutional Review Board (IRB)

- Retrospective superiority study**
- Mayo Clinic Rochester (MCR) & Mayo Clinic Health System (MCHS)
 - Total of 4,304 patients
 - MCR 1,631
 - MCHS 2,673
- Meaningful change: 15 minutes or greater
- Data from the electronic health record
 - June 2018 to October 2022

Statistical Analysis

- Analyses were performed separately for MCR and MCHS
 - Patient and procedural characteristics are summarized
- Continuous variables
 - Mean (SD)
 - ANOVA
- Categorical variables
 - Count (%)
 - Chi-square test or Fisher's exact test

Results

Patient & Procedure Characteristics-MCR

Table 1-A. Patient and Procedural Characteristics: MCR

Characteristic	Overall (N=1631)	According to Body Mass Index							p*
		24.9 or less (N=145)	25.0 to 29.9 (N=463)	30.0 to 34.9 (N=449)	35.0 to 39.9 (N=285)	40.0 to 44.9 (N=146)	45.0 to 49.9 (N=73)	50.0 or more (N=70)	
BMI-kg/m ²	33.6 (7.8)	23.4 (1.3)	27.5 (1.4)	32.4 (1.4)	37.4 (1.4)	42.2 (1.4)	47.3 (1.4)	55.4 (5.5)	<.001
Gestational age-weeks	37.3 (3.1)	37.0 (3.2)	37.5 (3.2)	37.4 (2.8)	37.4 (2.4)	36.6 (4.5)	36.8 (2.8)	36.8 (2.9)	0.009
Parity									0.001
1 or less	329 (20%)	41 (28%)	111 (24%)	82 (18%)	43 (15%)	27 (18%)	17 (23%)	8 (11%)	
2	731 (45%)	59 (41%)	204 (44%)	228 (51%)	124 (44%)	53 (36%)	34 (47%)	29 (41%)	
3	366 (22%)	33 (23%)	99 (21%)	88 (20%)	69 (24%)	38 (26%)	17 (23%)	22 (31%)	
4	126 (8%)	6 (4%)	35 (8%)	33 (7%)	25 (9%)	18 (12%)	2 (3%)	7 (10%)	
5 or more	79 (5%)	6 (4%)	14 (3%)	18 (4%)	24 (8%)	10 (7%)	3 (4%)	4 (6%)	
Prior cesarean									<.001
0	679 (42%)	79 (54%)	221 (48%)	185 (41%)	91 (32%)	54 (37%)	28 (38%)	21 (30%)	
1	938 (58%)	65 (45%)	237 (51%)	261 (58%)	193 (68%)	92 (63%)	43 (59%)	47 (67%)	
2 or more	14 (1%)	1 (1%)	5 (1%)	3 (1%)	1 (0%)	0 (0%)	2 (3%)	2 (3%)	
Concurrent procedure									0.023
No	1382 (85%)	125 (86%)	402 (87%)	391 (87%)	238 (84%)	116 (79%)	58 (79%)	52 (74%)	
Yes	249 (15%)	20 (14%)	61 (13%)	58 (13%)	47 (16%)	30 (21%)	15 (21%)	18 (26%)	
Type of block									<.001
CSE	287 (18%)	20 (14%)	57 (12%)	60 (13%)	59 (21%)	33 (23%)	18 (25%)	40 (57%)	
SPINAL	1344 (82%)	125 (86%)	406 (88%)	389 (87%)	226 (79%)	113 (77%)	55 (75%)	30 (43%)	

*Characteristics were compared across BMI categories using analysis of variance (ANOVA) for continuous variables and the chi-square test for categorical variables.

Characteristics Associated with Procedure Duration (mean time in minutes)-MCR

Characteristic	Overall		Block to incision		Incision to delivery		Delivery to closure	
	Est (95% CI)	p	Est (95% CI)	p	Est (95% CI)	p	Est (95% CI)	p
BMI								
24.9 or less	1.1 (-2.4, 4.6)	<.001	0.3 (-0.4, 1.1)	<.001	-0.6 (-1.5, 0.2)	<.001	1.3 (-1.5, 4.1)	<.001
25.0 to 29.9	Reference		Reference		Reference		Reference	
30.0 to 34.9	0.1 (-2.4, 2.5)		-0.4 (-0.9, 0.1)		0.2 (-0.4, 0.9)		0.5 (-1.5, 2.4)	
35.0 to 39.9	5.1 (2.4, 7.9)		0.0 (-0.6, 0.6)		1.8 (1.1, 2.5)		3.6 (1.4, 5.8)	
40.0 to 44.9	8.1 (4.6, 11.6)		0.6 (-0.1, 1.4)		2.2 (1.3, 3.1)		5.4 (2.6, 8.2)	
45.0 to 49.9	12.4 (7.7, 17.0)		1.5 (0.5, 2.5)		3.6 (2.4, 4.7)		7.5 (3.8, 11.1)	
50.0 or more	16.5 (11.8, 21.2)		1.6 (0.6, 2.6)		4.4 (3.2, 5.6)		10.4 (6.6, 14.1)	
Prior cesarean		<.001		0.233		<.001		0.001
No	Reference		Reference		Reference		Reference	
Yes	6.7 (4.8, 8.6)		0.2 (-0.2, 0.6)		2.5 (2.0, 2.9)		4.1 (2.6, 5.6)	
Concurrent procedure		<.001		0.142		0.686		<.001
No	Reference		Reference		Reference		Reference	
Yes	12.4 (9.8, 14.9)		0.4 (-0.1, 1.0)		0.1 (-0.5, 0.8)		11.8 (9.8, 13.8)	

Characteristics Associated with Procedure Duration (mean time in minutes)-MCHS

Characteristic	Overall		Block to incision		Incision to delivery		Delivery to closure	
	Est (95% CI)	p	Est (95% CI)	p	Est (95% CI)	p	Est (95% CI)	p
BMI								
24.9 or less	-0.7 (-3.2, 1.7)	<.001	0.2 (-0.6, 1.1)	<.001	0.1 (-0.6, 0.7)	<.001	-1.1 (-3.1, 1.9)	<.001
25.0 to 29.9	Reference		Reference		Reference		Reference	
30.0 to 34.9	1.1 (-0.2, 2.4)		0.0 (-0.4, 0.4)		0.5 (0.2, 0.8)		0.6 (-0.5, 1.6)	
35.0 to 39.9	3.0 (1.6, 4.4)		0.3 (-0.2, 0.7)		0.8 (0.4, 1.1)		1.9 (0.8, 3.0)	
40.0 to 44.9	6.1 (4.6, 7.7)		1.2 (0.7, 1.7)		1.4 (1.0, 1.8)		3.3 (2.1, 4.6)	
45.0 to 49.9	7.9 (5.9, 9.9)		1.7 (1.1, 2.4)		2.0 (1.5, 2.5)		4.2 (2.5, 5.9)	
50.0 or more	15.5 (12.6, 18.4)		4.0 (3.1, 5.0)		3.1 (2.3, 3.8)		8.2 (5.9, 10.6)	
Prior cesarean		<.001		0.512		<.001		0.001
No	Reference		Reference		Reference		Reference	
Yes	2.9 (1.9, 3.9)		0.1 (-0.2, 0.4)		1.4 (1.2, 1.7)		1.3 (0.5, 2.1)	
Concurrent procedure		<.001		0.979		0.082		<.001
No	Reference		Reference		Reference		Reference	
Yes	8.5 (7.5, 9.5)		0.0 (-0.3, 0.3)		0.2 (0.0, 0.5)		8.2 (7.4, 9.1)	

Patient & Procedure Characteristics-MCHS

Table 1-B. Patient and Procedural Characteristics: MCHS

Characteristic	Overall (N=2673)	According to Body Mass Index							p*
		24.9 or less (N=107)	25.0 to 29.9 (N=613)	30.0 to 34.9 (N=752)	35.0 to 39.9 (N=585)	40.0 to 44.9 (N=365)	45.0 to 49.9 (N=180)	50.0 or more (N=71)	
BMI-kg/m ²	35.0 (7.0)	23.5 (1.3)	27.9 (1.4)	32.6 (1.4)	37.3 (1.4)	42.1 (1.4)	47.1 (1.4)	54.0 (4.0)	<.001
Gestational age-weeks	38.4 (1.3)	38.3 (1.2)	38.4 (1.3)	38.5 (1.2)	38.4 (1.3)	38.4 (1.2)	38.4 (1.3)	38.0 (1.3)	0.14
Parity									0.013
1 or less	373 (14%)	29 (27%)	99 (16%)	104 (14%)	70 (12%)	36 (10%)	24 (13%)	11 (15%)	
2	1235 (46%)	44 (41%)	288 (47%)	342 (45%)	273 (47%)	180 (49%)	78 (43%)	30 (42%)	
3	649 (24%)	22 (21%)	144 (23%)	187 (25%)	146 (25%)	93 (25%)	46 (26%)	11 (15%)	
4	276 (10%)	8 (7%)	52 (8%)	81 (11%)	62 (11%)	39 (11%)	24 (13%)	10 (14%)	
5 or more	140 (5%)	4 (4%)	30 (5%)	38 (5%)	34 (6%)	17 (5%)	8 (4%)	9 (13%)	
Prior cesarean									0.005
0	933 (35%)	53 (50%)	231 (38%)	268 (36%)	186 (32%)	115 (32%)	59 (33%)	21 (30%)	
1	1709 (64%)	51 (48%)	375 (61%)	480 (64%)	393 (67%)	243 (67%)	117 (65%)	50 (70%)	
2 or more	31 (1%)	3 (3%)	7 (1%)	4 (1%)	6 (1%)	7 (2%)	4 (2%)	0 (0%)	
Concurrent procedure									0.009
No	1955 (73%)	86 (80%)	475 (77%)	550 (73%)	423 (72%)	246 (67%)	128 (71%)	47 (66%)	
Yes	718 (27%)	21 (20%)	138 (23%)	202 (27%)	162 (28%)	119 (33%)	52 (29%)	24 (34%)	
Type of block									0.003*
CSE	7 (0%)	0 (0%)	0 (0%)	0 (0%)	2 (0%)	1 (0%)	3 (2%)	1 (1%)	
SPINAL	2666 (100%)	107 (100%)	613 (100%)	752 (100%)	583 (100%)	364 (100%)	177 (98%)	70 (99%)	

*Characteristics were compared across BMI categories using analysis of variance (ANOVA) for continuous variables and the chi-square test for all categorical variables except for type of block and ultrasound guided which were compared using Fisher's exact test.

Procedure Duration-MCR

Table 2-A Procedure Duration: MCR

Characteristic	Procedure Duration, minutes*			
	Overall duration	Block to incision	Incision to delivery	Delivery to closure
Overall	83.7 (21.3)	17.0 (4.2)	10.2 (5.4)	56.2 (16.4)
According to BMI, kg/m ²				
24.9 or less	80.9 (20.0)	17.2 (4.7)	8.4 (4.0)	54.7 (16.3)
25.0 to 29.9	79.9 (20.3)	16.9 (4.2)	9.1 (4.9)	53.5 (15.5)
30.0 to 34.9	80.4 (20.1)	16.6 (4.0)	9.5 (4.9)	54.2 (15.6)
35.0 to 39.9	87.3 (22.3)	17.0 (4.1)	11.6 (5.7)	58.5 (17.6)
40.0 to 44.9	88.5 (19.1)	17.3 (4.2)	11.5 (6.0)	59.5 (14.1)
45.0 to 49.9	94.3 (21.4)	18.5 (4.4)	13.1 (5.9)	62.5 (15.9)
50.0 or more	100.0 (23.4)	18.7 (4.1)	14.2 (6.6)	66.5 (19.1)

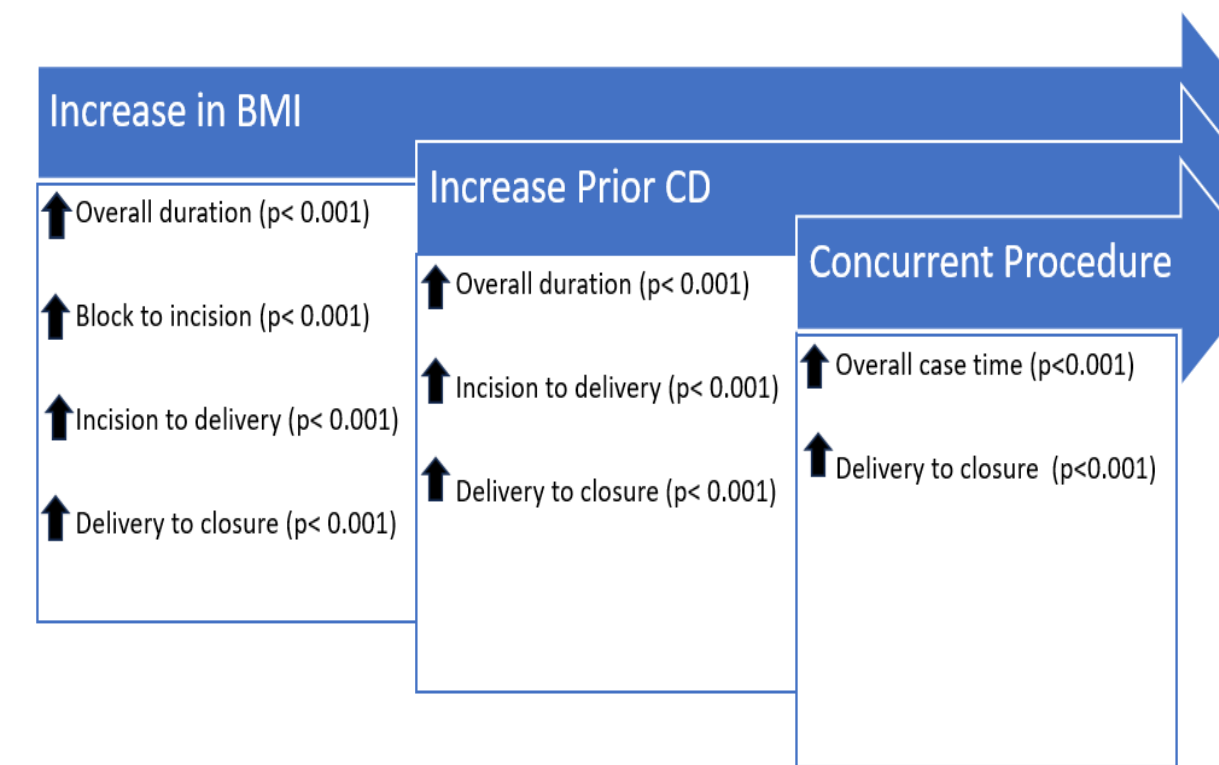
Procedure Duration-MCHS

Table 2-B Procedure Duration: MCHS

Characteristic	Procedure Duration, minutes*			
	Overall duration	Block to incision	Incision to delivery	Delivery to closure
Overall	65.8 (17.2)	15.6 (4.6)	8.0 (4.2)	42.2 (13.4)
According to BMI, kg/m ²				
24.9 or less	59.8 (15.3)	15.0 (4.7)	6.7 (3.3)	38.1 (12.3)
25.0 to 29.9	62.1 (15.0)	15.0 (4.5)	7.0 (3.5)	40.0 (12.0)
30.0 to 34.9	64.9 (17.0)	15.1 (4.4)	7.9 (4.1)	41.8 (13.3)
35.0 to 39.9	66.7 (17.7)	15.6 (4.3)	8.2 (4.4)	42.8 (13.7)
40.0 to 44.9	70.0 (18.2)	16.3 (4.6)	8.6 (4.3)	44.8 (14.4)
45.0 to 49.9	69.9 (17.6)	16.7 (5.0)	9.1 (4.7)	44.1 (13.1)
50.0 or more	78.4 (17.6)	18.9 (4.8)	10.3 (5.1)	49.0 (13.2)

Key Findings

Reference: BMI (25.0-29.9), non-prior CD & no concurrent procedure



Discussion & Conclusion

Discussion

- Maternal obesity offers unique challenges & increased risks
- Obese women have longer CD duration
 - Multiple factors contribute to the increase in time such as BMI, number of previous CD, & concurrent procedure
- CSE may provide prolonged anesthesia duration and time for placement is similar to spinal in patients with BMI 50 or greater
- Spinal anesthesia is adequate for majority of CD cases

Limitations

- Retrospective study design
- Unable to determine the reason behind neuraxial technique choice
- Unable to assess maternal satisfaction with the anesthetic chosen
- The patient population in this study may not translate to all patient populations

Future Research Consideration

- Administration of adjunct anesthetics during CD as spinal anesthesia begins to subside
 - Further