The Impact of Maternal Body Mass Index on Rates of Invasive Monitoring During Labor

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Fetal heart rate monitoring is a tool to aid in the evaluation of fetal oxygenation status during labor. The accuracy of continuous external fetal monitoring decreases as maternal body mass index (BMI) increases. This often necessitates placement of invasive fetal monitoring devices including fetal scalp electrodes and/or intrauterine pressure catheters.

The study was a retrospective chart review. Patients were grouped by maternal BMI at time of admission with 255 patients in the obese group and 178 patients in the non-obese group. Inclusion criteria were ages between 18-45. Exclusion criteria were cesarean delivery without a trial of labor and fetal demise. Data was analyzed using categorical data analyses tests.

Rates of invasive monitoring were significantly greater in the obese group (P=.0001). The use of pitocin for induction of labor or augmentation was also significantly higher in the obesity group (P=.0138). For patients who presented in active labor, the use of both invasive monitoring (P=<.0001) and pitocin (P=<.0001) were significantly decreased.

Our research shows the use of invasive monitoring increases as maternal BMI increases. Patients who present in active labor are less likely to require invasive monitoring or receive pitocin. Invasive monitoring is not without risk and patients should be counseled appropriately on the use of these devices during their labor course. These are risks taken everyday by patients and their providers, often without proper informed consent. Understanding the rates of use by maternal BMI would allow physicians to more appropriately counsel their patients.

The Impact of Maternal Body Mass Index on Rates of Invasive Monitoring During Labor

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Abstract

Fetal heart rate monitoring is a tool to aid in the evaluation of fetal oxygenation status during labor. The accuracy of continuous external fetal monitoring decreases as maternal body mass index (BMI) increases. Increased BMI often necessitates placement of invasive fetal monitoring devices including fetal scalp electrodes and/or intrauterine pressure catheters. Invasive monitoring is not without risk and patients should be counseled appropriately on the use of these devices during their labor course. This study was a retrospective chart review. Patients were grouped by maternal BMI at time of admission with 255 patients in the obese group and 178 patients in the non-obese group. Inclusion criteria were subjects between the age of 18 to 45. Exclusion criteria were cesarean delivery without a trial of labor and fetal demise. Statistics were obtained utilizing categorical data analyses testing. Rates of invasive monitoring were significantly greater in the obese patients during labor (p=.0001). The use of pitocin for induction of labor or augmentation was also significantly higher in the obese group (p=.0138). For patients who presented in active labor, the use of both invasive monitoring (p=<.0001) and pitocin (p=<.0001) were significantly decreased. These results indicate the use of invasive monitoring increases as maternal BMI increases. Patients who present in active labor are less likely to require invasive monitoring or receive pitocin. Understanding the rates of use of invasive fetal monitoring by maternal BMI would allow physicians to more appropriately counsel their patients.

Introduction

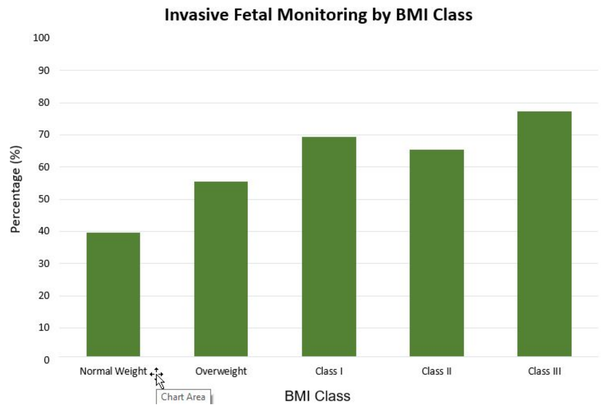
Continuous fetal monitoring during the intrapartum period has become increasingly common over the past several decades. This is because fetal heart rate (FHR) monitoring is used to determine fetal oxygenation status (2). With continuous external fetal monitoring, it becomes increasingly difficult to get an accurate continuous tracing as maternal body mass index (BMI) increases (1). This often necessitates placement of invasive fetal monitoring devices such as fetal scalp electrodes (FSE) and/or intrauterine pressure catheters (IUPC). American College of Obstetricians and Gynecologists (ACOG) guidelines recommend FHR evaluation every 15 minutes during the first stage of labor and every 5 minutes during the second stage, thus the need for accurate determination of FHR and uterine contractions is paramount. Brocato et al. examined how long fetal heart tones (FHTs) went unmonitored in patients from induction to amniotomy and found unmonitored time increased as maternal BMI increased. Ray et al., examined obesity as a whole during intrapartum care and found similar outcomes, that FHTs went unmonitored more often in obese women and lead to increased placements of FSEs and IUPCs. While these studies began to look at the impact of obesity on the accuracy of intrapartum electronic fetal monitoring, there is a lack of data corresponding to rates of FSE and IUPC based on maternal BMI, specifically stratified by BMI class. Without this information the clinician has been unable to accurately educate their patients in clinic appointments about the risks of invasive monitoring leading up to their labor. Risks associated with invasive monitoring differ depending on which device is used. With FSE, there are risks of bruising, laceration, infection, or malplacement into a structure other than the scalp. With IUPC, there are risks of infection or placement into the placenta. With both invasive monitors placed, research shows that rates of cesarean delivery are increased (5). The use of invasive monitoring imparts risks which are taken everyday by patients, often without proper informed consent. With the rates of invasive monitor use potentially dependent on maternal BMI, the clinician would be able to better inform their patients about risks they may be more prone to experience during labor.

Methods

- A retrospective chart review of patients who delivered at Integris Southwest Medical Center between January 1 and December 31, 2018.
- Inclusion criteria: age criteria was between 18 and 45 at time of delivery, and patient must have delivered at INTEGRIS Southwest Medical Center between the dates of January 1 and December 31, 2018.
- Exclusion criteria: any subject younger than 18 years of age or older than 45 years of age, cesarean without attempt of labor, and fetal demise.
- Patients were then grouped based on their BMI classification into either obese or non-obese groups, with the obese group including subcategories of: overweight, class I obesity, class II obesity, or class III obesity. The non-obese group included underweight and normal weight patients.

Results

- After evaluation of inclusion and exclusion criteria, 433 patients were included in this study.
- Of 433 patients, 270 patients required an FSE, IUPC, or both (p=0.0001).
- Of 270 patients requiring FSE and/or IUPC, 178 patients were obese (p=0.0001).
- As BMI class increased, use of invasive fetal monitoring increased.
- Obese patients were more likely to need pitocin induction or augmentation during labor (p=0.0138).
- For patients who did not meet criteria for active labor on admission, use of pitocin (p=<0.001) and invasive fetal monitoring were higher (p=<0.0001) compared to patients admitted in active labor.
- Obese patients were more likely to have larger fetuses (p=0.0109).



Characteristics	Total	BMI status: Obese	BMI status: Non-obese	*p*-Value
Patients – no. (%)	433 (100)	255 (58.9)	178 (41.1)	N/A
Age – yr				0.460[b]
Median	26	26	25	
Range	14 – 43	15 – 43	14 - 43	
Fetus weight (grams)				0.0109[a]
Median	3267	3301	3212	
Range	1650-4383	1650-4242	1875-4383	
Race – no. (%)				0.194[b]
White or Caucasian	187 (43.7)	75 (40.1)	112 (59.9)	
Hispanic or Latino	133 (31.0)	48 (36.1)	85 (63.9)	
Native Hawaiian or Pacific Islander	15 (3.5)	8 (53.3)	7 (46.7)	
Black or African American	61 (14.3)	27 (44.3)	34 (55.7)	
American Indian or Alaskan Native	17 (3.9)	8 (47.1)	9 (52.9)	
Asian	12 (2.8)	9 (75.0)	3 (25.0)	
Other	3 (0.7)	1 (33.3)	2 (66.7)	
Insurance– no. (%)				0.388[b]
Medicaid	283 (69.5)	157 (55.5)	126 (44.5)	
Private	112 (27.5)	73 (65.2)	39 (34.8)	
Veterans Administration	3 (0.7)	2 (66.7)	1 (33.3)	
Champus	1 (0.25)	1 (100)	0 (0)	
Uninsured	8 (2.0)	4 (50.0)	4 (50.0)	
Fetal Scalp Electrode (FSE) – no. (%)				0.317[b]
Utilized	17 (3.9)	12 (70.6)	5 (29.4)	
Not utilized	416 (96.1)	243 (58.4)	173 (41.6)	
Intrauterine Pressure Catheter (IUPC) – no. (%)				0.567[b]
Utilized	49 (11.32)	27 (55.1)	22 (44.9)	
Not utilized	384 (88.7)	228 (59.4)	156 (40.6)	
FSE or IUPC – no. (%)				0.0002[b]
Utilized	204 (47.1)	139 (68.1)	65 (31.9)	
Not utilized	229 (52.9)	116 (50.7)	113 (49.3)	
FSE, IUPC or both – no. (%)				0.0001[b]
Utilized	270 (62.4)	178 (65.9)	92 (34.1)	
Not utilized	163 (37.6)	86 (52.8)	77 (47.2)	
Pitocin– no. (%)				0.0138[b]
Utilized	367 (85.0)	225 (61.3)	142 (38.7)	
Not utilized	65 (15.0)	29 (44.6)	36 (55.4)	
Delivery type – no. (%)				0.077[b]
Spontaneous vaginal delivery	339 (78.3)	190 (56.0)	149 (44.0)	
Primary low transverse cesarean section	69 (15.9)	46 (66.7)	23 (33.3)	
Vacuum assisted vaginal delivery	24 (5.5)	18 (75.0)	6 (25.0)	
Repeat low transverse cesarean section	1 (0.23)	1 (0.23)	0 (0)	

[a]Wilcoxon-Mann-Whitney test
[b]Fisher's exact test

	Total	Active labor	Not active labor	
Pitocin– no. (%)	402 (100)	100 (24.9)	302 (75.1)	<0.0001[c]
Utilized	345 (85.8)	62 (18.0)	283 (82.0)	
Not utilized	57 (14.2)	38 (66.7)	19 (33.3)	
Delivery device – no. (%)	403 (100)	100 (24.8)	303 (75.2)	<0.0001[c]
FSE, IUPC, or both	256 (63.5)	35 (13.7)	221 (86.3)	
Neither	147 (36.5)	65 (44.2)	82 (55.8)	

[c]Chi-Square

Conclusions

The primary outcome of this study showed that the use of invasive fetal monitoring is increased in patients who are obese compared to non-obese patients. This increases longitudinally within the obesity classes with the highest risk for invasive fetal monitoring in the class III obesity group. The secondary outcomes of statistical significance were as follows. First, that rates of pitocin administration were increased in those within the obesity group. Second, if patients were admitted in active labor the use of both pitocin and invasive fetal monitoring was decreased. Thus, these patients were less likely to undergo the risks associated with invasive fetal monitoring. Physicians should use this information during prenatal visits to counsel their obese patients about the possible need for both invasive fetal monitoring as well as pitocin administration during their labor course. Strengths of this study include the moderate case numbers with several statistically significant values based on maternal BMI class. A weakness of this study is that patients are selected from only one inter-community hospital. Future research is needed to further analyze the cost effectiveness of both devices. We hope that implications of this study will further encourage physicians to have in-depth counseling during the antenatal period regarding the risks versus benefits of invasive fetal monitoring during labor.

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