Adjustment of Robson Classification System to Body Mass Index might improve the predictability for Operative delivery and reduce its false-positive results

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Abstract

Objectives: To determine the impact of obesity on decision-making concerning mode of delivery and to compare these data versus the reliance on the Ten-group Robson Classification System (RCS) alone.

Patients & Methods: 554 parturient free of pregnancy-associated medical diseases were evaluated clinically at time of enrolment for RCS class and at time of admission for delivery, for body mass index (BMI) grading. Mode of delivery was predetermined according to RCS class and clinical judgment taking in consideration maternal age and BMI. Parturient distribution after labor according to mode of delivery was compared to that predetermined by clinical and RCS evaluation.

Results: According to RCS class, elective CS was predicted for 204, spontaneous deliveries for 166 and 184 parturient were predicted to require induction of labor. Clinically, 163 parturient were predicted to have unaided vaginal delivery, 95 parturient will have CS and 296 parturient will require induction of labor. The probability to have CS was significantly higher on reliance on RCS grading system. Actually, 327 women had unaided and 23 had instrumental vaginal delivery and 204 required CS. The actual frequency of CS was related to nulliparity, history of previous CS, BMI and RCS grading. Statistical analyses defined nulliparity as the significant sensitive and high BMI as the significant specific predictor for CS. In comparison to parturient had ≤ 32 kg/m^2, the cumulative hazard to have CS was increased by 10% with BMI >32-34 kg/m^2, 45% with BMI 34-35 kg/m^2 and by 100% at BMI$\geq$ 36.5 kg/m^2.

Conclusion: The Robson Classification System had good true negative, but high false positive predictive values for CS. Adjustment according to BMI within Robson groups significantly reduced the need for CS and may improve the decision for augmentation, instrumental and operative delivery.

Keywords: Robson Ten-group Classification System, Body mass index, Mode of delivery, cesarean section

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Introduction

Current labor practices showed acceleration in interventions for initiation, monitoring, acceleration or termination of the physiological process of pregnancy and childbirth [1]. These practices aim to reduce the rate of cesarean section (CS), attendance to emergency rooms, length of hospital stay and need for intensive care units for both the parturient and the newborn; however, these variables showed significant regional variations and need to be standardized [2].

Risk factors for getting operative delivery are multiple, but the most common include age older than 35 years especially for primigravida, obesity [3], smoking, multiple pregnancies, previous diseases and/or current pregnancy-associated diseases as diabetes, preeclampsia [4], previous CS, history of abortions, need for induction [5], and emotional factors as anxiety [6].

The World Health Organization (WHO) statement for the optimal CS rate at both population and hospital level [7], and the association between CS and maternal and neonatal mortality [8] demonstrated that if the CS rate rises up to 10–15%, the number of maternal and newborn deaths decreases, but at rate above 15% did not grantee any better rates of mortality and morbidity [9].

Robson Classification System (RCS) allocates pregnant women at the time of delivery into 10 groups, which are based on parity, onset of labor, gestational age, fetal presentation, and number of the fetuses. RCS was recommended as a global standard for assessing, monitoring, and comparing CS rates within healthcare facilities over time, and between facilities [10].

Hypothesis

RCS was based on only 5 of the variables suggestive of the possibility of getting CS. However, RCS did not take in account other important risk factors for CS as obesity that may modify the classification groups if it is considered.

Objectives

The current study aimed to determine the impact of obesity on decision making concerning mode and outcome of delivery and to compare these data versus the reliance on RCS alone.

Design

Prospective single-center comparative study

Setting

Obstetrics and Gynecology Department, Tanta and Benha University Hospitals and Some private obstetric centers

Patients & Methods

All pregnant women who attended the obstetrics outpatient clinic were eligible for evaluation. According to the conditions of the Local Ethical Committee all women were clinically evaluated and underwent ultrasonographic imaging for evaluation for inclusion and exclusion criteria.

Exclusion criteria

Presence of pregnancy-associated medical diseases; gestational diabetes, hypertensive diseases, anemia or kidney disease, placental abnormal location, fetal congenital anomalies, coagulopathies, preconception cardiac, liver or kidney diseases. Women who refused to give birth at the participating hospital were also excluded

Inclusion criteria

Women had straightforward pregnancy course free of pregnancy-associated diseases and signed the written fully informed consent and gave birth at hospitals participating the study, either on elective or emergency basis were enrolled in the study.

Study protocol

All women fulfilling the inclusion criteria were graded at time of enrolment for the RCS classes and at time of admission for giving labor for BMI by assistants who were blinded about the study hypothesis. BMI (in kg/m2) was determined at the last visit to the clinic and women were graded according to the WHO classification of weight as underweight (BMI<18.5), average weight (BMI: 18.5-24.9), overweight (25-29.9), obese class I (BMI: 30-34.9), class II (BMI: 35-39.9) and obese class III (BMI>40), [11,12].

The decision-taking for the mode of delivery was taken by authors, who were blinded about RCS grading, according clinical judgment. The actual mode of delivery was compared as the independent variable versus the predetermined mode of delivery according to BMI and RCS grades for the following:

1. The success rate of decision-making depending on RCS grades for prediction of mode of delivery versus to the actual mode of delivery

2. The impact of BMI on the decision for the choice of the actual mode of delivery.

3. The predictability of each grading system separately and in combination on the decision concerning the mode of delivery.

Study outcome

The principle study outcome is the impact of BMI grading on decision-making concerning mode of delivery depending on RCS only

Statistical analysis

The obtained data were presented as mean, standard deviation (SD), numbers and percentages. The success rate was defined as the percentage of parturient that had CS in relation to the blinded diagnosis of elective CS. Correlations between studied variables were performed using Spearman's correlation of non-parametric data. Regression analysis, Stepwise method, was used to determine the predictors for CS. Kaplan-Meier regression analysis was used to determine the cutoff point of BMI that can predict CS. Statistical analysis was performed using SPSS software package, 2015. P value of <0.05 was considered significant.

Results

During the duration of study, 586 women were eligible for evaluation; 18 women were excluded for not fulfilling the inclusion criteria and 568 women signed consent to give labor under supervision of the authors. Unfortunately, 14 women could not attend and were also excluded from the study and 554 women who gave labor under supervision of the authors were included in the study (Fig. 1).
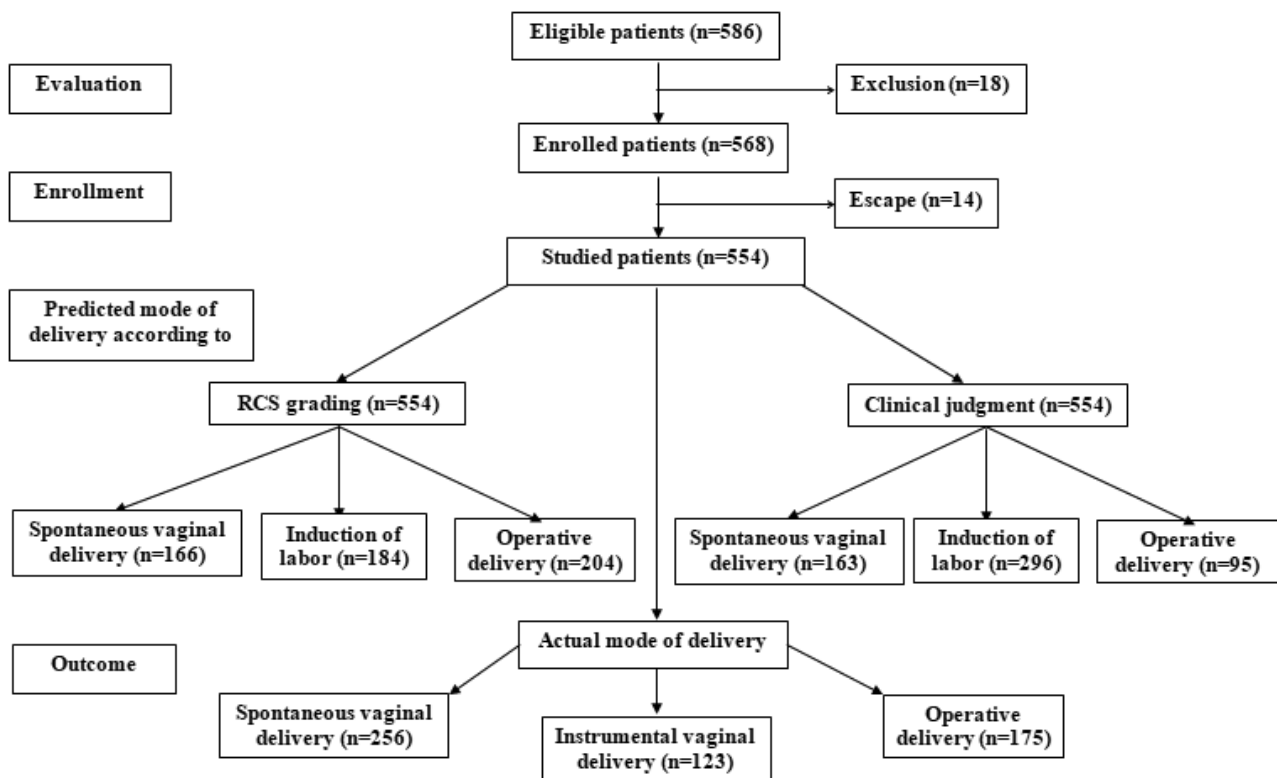
Fig. (1): Study Flow Chart

Mean age of enrolled women was 28.7±4.5 years and 90 women were younger than 25 years, 50 women were older than 35 years, and the majority of women were in range of 25-35 years. According to body weight and calculated BMI at time of admission for labor there were only 2 women (0.36%) had average BMI, 43 women (7.76%) were overweight, 386 women (66.42%) were obese grade I and 123 women (25.46%) were obese grade II. There were 283 nullipara (51%) and 271 multipara women; 105 multipara (19%) had previous CS. Twenty-four parturient had preterm labor at <37 weeks, 7 women had multiple pregnancy, another 7 parturient had a singleton fetus in oblique lie and 14 parturient had singleton fetus in breech presentation, while 502 parturient had singleton fetus in cephalic presentation and had gestational age of >37 weeks.

Table (1): Patients' enrolment data

Data		Findings
Age (years)	<25	90 (16.25%)
	25-30	265 (47.82%)
	>30-35	149 (26.9%)
	>35-40	38 (6.86%)
	>40	12 (2.17%)
	Mean (±SD)	28.7±4.5
BMI (kg/m^2)	Average (<24.9)	2 (0.36%)
	Overweight (25-29.9)	43 (7.76%)
	Obese I (30-34.9)	386 (66.42%)
	Obese II (35-39.9)	123 (25.46%)
	Mean (±SD)	26±9.6

Gravidity	Nulliparous		283 (51%)
	Multipara	Previous CS	105 (19%)
		No previous CS	166 (30%)
Number of fetuses	Singleton		547 (98.74%)
	Multiple		7 (1.26%)
Pregnancy duration (weeks)	Preterm (<37 weeks)		24 (4.33%)
	Full term (>37 weeks)		530 (95.67%)
Presentation	Cephalic		533 (96.21%)
	Breech		14 (2.53%)
	Transverse/oblique lie		7 (1.26%)

Data are presented as numbers; percentages; mean; standard deviation

According to RCS, 204 women were predicted to have elective CS, 166 women were predicted to have spontaneous delivery and 184 women were predicted to require induction of labor (Table 2).

Table (2): Patients' distribution and predicted line of management according to RCS

class	Description	Number (%)
1	Nulliparous women with a single cephalic pregnancy, ≥37 GW in spontaneous labor	95 (17.15%)
2A	Nulliparous women with a single cephalic pregnancy, ≥37 GW who had labor induced	137 (24.73%)
2B	Nulliparous women with a single cephalic pregnancy, ≥37 GW who were delivered by CS before labor	36 (6.5%)
3	Multiparous women without a previous uterine scar, with a single cephalic pregnancy, ≥37 GW in spontaneous labor	71 (12.82%)
4A	Multiparous women without a previous uterine scar, with a single cephalic pregnancy, ≥37 GW who had labor induced	47 (8.48%)
4B	Multiparous women without a previous uterine scar, with a single cephalic pregnancy, ≥37 GW who were delivered by CS before labor	22 (4%)
5	All multiparous women with at least one previous uterine scar, with a single cephalic pregnancy, ≥37 weeks gestation	94 (17%)
6	All nulliparous women with a single breech presentation	11 (2%)
7	All multiparous women with a single breech presentation, including women with a previous uterine scar	3 (1.26%)
8	All women with multiple pregnancy, including women with a previous uterine scar	7 (1.26%)
9	All women with a single pregnancy with a transverse or oblique lie, including women with a previous uterine scar	7 (1.26%)
10	All women with a single cephalic pregnancy <37 GW, including women with a previous uterine scar	24 (4.33%)

According to clinical judgment, 163 women (29.42%) were predicted to have spontaneous vaginal delivery and 95 women (17.15%) to have elective CS, while 296 women (53.43%) were predicted to require induction of labor. Induction of labor resulted in 164 unaided vaginal delivery, 23 instrumental vaginal delivery and 109 women required CS. Thus, 327 women had unaided vaginal delivery, 23 had instrumental vaginal delivery and 204 required CS.

Thus, the predicted rate of CS as the mode of delivery was significantly higher (p<0.0001) if decision was taken according to RCS grading system in comparison to the that based on clinical judgment with respecting age and BMI (Fig. 2).
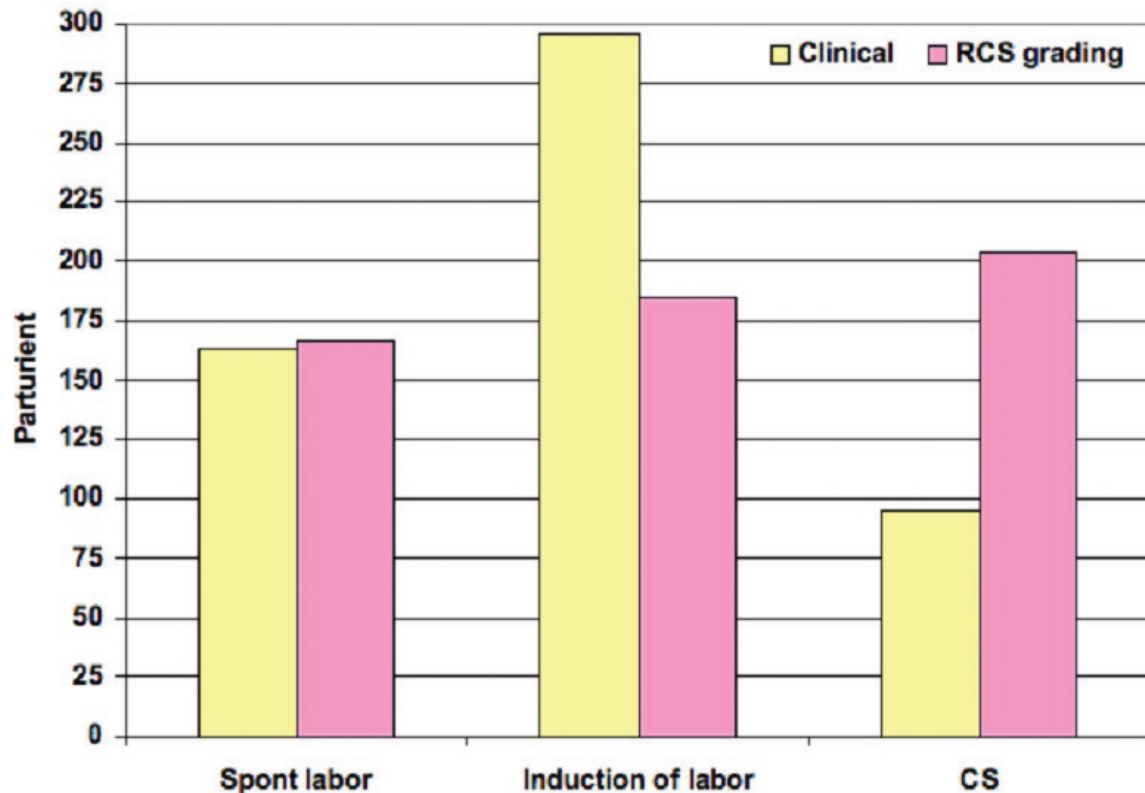

Fig. (2): Parturient's distribution according to the predicted mode of delivery according to clinical judgement and RCS grading

The actual number of women had CS showed positive significant correlation with nulliparity (Rho= 0.129, p=0.002), history of previous CS (Rho= 0.118, p=0.005), high BMI (Rho= 0.490, p<0.0001) and with RCS grading (Rho= 0.097, p=0.022). Regression analysis, defined older age (β=0.086, p=0.029), RCS grade (β=0.098, p=0.012) and high BMI (β=0.462, p<0.0001) as the significant predictor for CS as the mode of delivery. ROC curve analysis of these variables defined nulliparity as the significant sensitive and high BMI as the significant specific predictor for the mode of delivery to be operative delivery (Fig. 3).
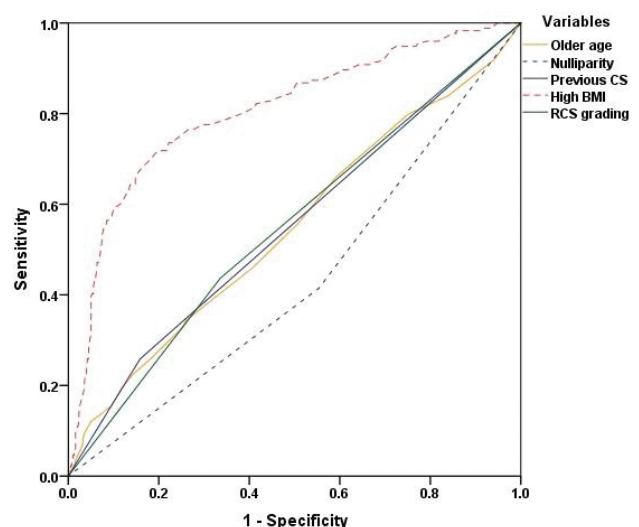

Fig. (3): ROC curve analysis of variables evaluated as predictors for oncoming CS as a decision for mode of delivery

Kaplan-Meier regression analysis for BMI values of studied parturient as a risk factor for having CS as a mode of delivery defined minimal cumulative risk of having CS at BMI up to ≤32 kg/m2. However, in comparison to women had BMI of ≤32 kg/m2, the cumulative hazard for having CS increased by about 10% in women had BMI in range of >32 to 34 kg/m2 by 45% in women with BMI in range of 34-35 kg/m2 and by 100% at BMI≥ 36.5 kg/m2 (Fig. 4).
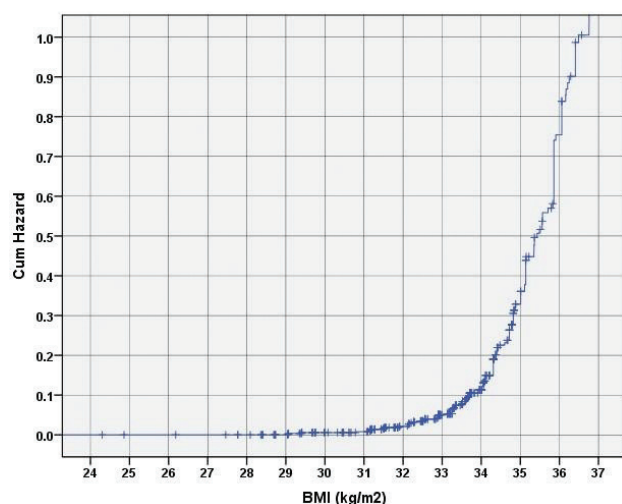

Fig. (4): Kaplan-Meier Regression analysis for cumulative hazard of for CS as a mode of labor stratified according to BMI of parturient

Discussion

Obesity of the studied parturient seriously affected the decision-making about the predicted mode of delivery. Moreover, BMI showed positive significant correlation with the actual mode of delivery applied for the studied women and statistical analyses defined BMI as a determinant parameter for the decision-making about the mode of delivery. Furthermore, Kaplan-Meier regression analysis showed progressively increasing cumulative hazard for CS with BMI of >32 kg/m² reaching a maximum of 100% cumulative hazard at BMI of 36.5 kg/m².

These results illustrate the contribution of BMI in the decision-making for the mode of delivery. Similarly, Szewczyk et al.,[13] reported that higher BMI was associated with increased odds of CS and obese women in class II had significantly higher odds of CS than normal weight women. Also, Carlhäll et al.,[14] found the time from admission until start of active labor increased successively with maternal obesity and women with BMI ≥40 kg/m2 had significantly longer duration of active labor, but if this occurs the chance for spontaneous vaginal delivery equals that of normal weight women, despite of the higher rate of CS. Moreover, Girault et al.,[15] documented those nulliparous obese women had significantly lower odds of having a shorter labor than women with BMI of less than 25 kg/m².

In support of the impact of BMI on decision-making, de Góes Salvetti et al.,[16], studied follow-up data of 1,574 at-risk pregnant women and found 43.1% preferred normal delivery, but only 17.3% had normal delivery and found CS was associated with overweight/obesity, physical inactivity and age and ICU admission was associated with age and BMI. Also, Stafford et al.,[17] studied 11,369 of low-risk women across all BMI classes and found the rate of induction and birth weight increased across BMI.

In line with respecting BMI as a determinant factor for decision-making, Gadeer et al., (18) detected a significant association between post-CS wound infection and BMI. Moreover, Otero-Naveiro et al.,[19] found obese women showed higher rates of prenatal complications and Stafford et al.,[17] reported higher risk of NICU admission with increasing maternal weight class.

Nulliparity was another determinant for decision-making especially for obese nulliparous women and the need for CS showed positive correlation with nulliparity. In line with this finding, Valente et al.,[20] found labor induction was significantly more frequent among obese nulliparous women who showed significantly prolonged latent phase and this group of parturient had a significantly higher

rate of CS in comparison to normal weight nulliparous women.

According to the RCS grading of parturient at time of hospital admission, 204 women (36.8% of total number) had to have CS, but of these 76 parturient (13.72%) required elective CS as a first-line decision and 99 parturient had CS after trial of induction, while 29 had vaginal delivery for a success rate of decision-making depending on RCS grade of 85.8%. Such figure for success depended on the inclusion of parity and previous CS as determinant variables of the scoring system as evidenced by the negative significant correlation between nulliparity and positive significant correlation between previous CS and decision to have CS. Interestingly, decision according to RCS showed non-significant correlation with BMI; a finding that point to the possibility of increasing the predictive values of the RCS grading system for the need for elective CS if grades were corrected and adjusted according to BMI.

In line with the necessity of adjustment of RCS classing of parturient according to BMI, Crequit et al., [21] found the overall CS was significantly higher for multipara obese women (Robson group 5) than multipara women without obesity with a significant association between maternal obesity and intrapartum CS. On the other side, Dalbye et al., [3] detected increased risk of intrapartum CS in obese nulliparous women with higher risk of intrapartum CS by increases of obesity class. Moreover, Dalbye et al., [3] found obese nullipara had increased risk of epidural analgesia, use of continuous fetal cardiac monitoring, amniotomy, oxytocin augmentation, obstetric anal sphincter injuries and postpartum hemorrhage, and so concluded that obese women in Ten-Group Classification System group 1 had increased risks of obstetric interventions and maternal complications.

Depending on the obtained data, the outcome of the work undertaken by Alsulami et al., [22] who considered Robson Class 1-4 as low-risk classes for CS and did not take into account the impact of obesity might be inadmissible, because the prevalence of obesity among Saudi women especially those in childbearing period was recently documented in published Saudi literature (23,24).

Conclusion

The Robson Ten-Group Classification System had good negative, but high false positive predictive values for CS. Adjustment of the decision-making for the mode of delivery according to BMI grading within Robson groups significantly reduced the need for CS and thus may improve the decision for augmentation, instrumental and operative delivery.

Recommendation

Multicenter studies for evaluation of the impact of pregnancy-associated diseases on the decision-making for the mode of delivery according to Robson classification.

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