

Stepping Towards Improved Audit Quality: The Outcome of Caesarean Section Using the Robson Ten Group Classification System at Mnazi Mmoja Hospital, Zanzibar

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Abstract: *Introduction:* There is a rising concern regarding the escalating rates of caesarean section (CS) in various countries, including Tanzania. This study aimed to evaluate the rate of CS by using Ten-Group Robson Classification system at the obstetric unit of Mnazi Mmoja Hospital, Zanzibar. *Materials and Methods:* Observational retrospective study was conducted involving 56,314 women who gave birth at the obstetric unit of Mnazi Mmoja Teaching Hospital between January 2018 and December 2022. Relevant information pertaining to the study participants was retrieved from their respective delivery records. Data analysis was performed using SPSS Statistics for Windows, version 10. *Results:* The CS rate was 65%, among the different groups, the most significant contributors to the CS rate were as follows: multiparous women with previous CS, single, cephalic, term (group 5) accounted for 16.9%; nulliparous women and women with the preterm single cephalic, term (group 10) accounted for 13.8%; single cephalic term multiparous women in spontaneous labour (group 3) accounted for 13.5%; and nulliparous single cephalic, term, with spontaneous labour (group 1) accounted for 12.6%. The most common indication for CS was previous CS (10,571 cases; 28.8%), followed by hypertensive disorders (7,735 cases; 21.1%) and poor progress in labour (6,692 cases; 18.3%). The analysis of maternal outcomes was 204 maternal deaths, cases of Post partum haemorrhage (PPH) (22.6%), wound infection (24%) and cesarean hysterectomy (15.2%). Regarding neonatal outcomes, stillbirth accounted for 46.6%, lower Apgar Score 28.9% and Neonatal sepsis 24.5%. *Conclusion:* We observed a significant increase in the CS rate at Mnazi Mmoja Hospital. Based on our analysis of Robson classification and with maternal and neonatal outcomes, it is evident that improvements in labor management at the hospital are necessary. By prioritizing this enhancement, we can strive to optimize

maternal and neonatal care, leading to healthier outcomes for both mothers and their babies.

Keywords: Cesarean Section, Maternal Outcome, Neonatal Outcome, Robson 10-Group Classification System

1. Introduction

CS is an essential obstetric procedure that can be life-saving for both the mother and the baby. It is typically performed when it is determined that vaginal delivery could pose risks to either the mother or the baby. The procedure involves an incision on the mother's abdomen and uterus after the age of viability in order to deliver the fetus safely.

The survey across 150 countries revealed an average global CS rate of 18.6% [1]. The CS rates vary significantly between countries, with the lowest rates found in Africa at 7.3%, and the highest in Latin America and the Caribbean at 40.5% [2]. Additionally, there is variation in CS rates within the same country across different health facilities. For example, 21.6% and 32.9% facility-level CS rates in Tanzania, were reported in Iringa Regional Referral Hospital and St. Francis Referral Hospital, respectively [3, 4].

There is a growing global concern regarding the increasing CS rates, particularly in many middle- and high-income countries [5]. However, the extent of this rise is relatively lower in low-income countries [6]. In 1985, the World Health Organization (WHO) stated that a CS rate higher than 10% to 15% was not justified based on their review of data primarily from northern European countries, which had achieved favorable maternal and perinatal outcomes within that range [7]. Since then, numerous studies have examined the relationship between CS rates and maternal and neonatal mortality, aiming to determine an optimal limit or range associated with minimal risks. However, the various limitations in these studies have made it challenging to interpret the results conclusively.

World Health Organization (WHO) and the International Federation of Gynecology and Obstetrics (FIGO) endorse the The Ten-Group Robson classification system as an effective monitoring tool for comparing CS rates within and between obstetric units [8]. This classification system utilises obstetric characteristics, such as parity, gestational age, previous CS, labour onset (spontaneous or induced), presentation, and the number of fetuses (singleton or multiple), to categorise women into ten groups.

Evidence suggests that implementing the Robson classification system for auditing CS in healthcare facilities can potentially reduce CS rates [9]. By identifying the groups contributing significantly to the overall CS rate, healthcare providers can implement targeted interventions and strategies to address the underlying factors and promote appropriate

obstetric care. This approach allows for more accurate monitoring of CS rates over time and facilitates meaningful comparisons between different healthcare facilities. Our study aimed to assess the CS rates among group of mothers utilising the Robson classification system and to comprehensively analyse maternal and perinatal outcomes for each group at Mnazi Mmoja Hospital in Zanzibar, Tanzania.

2. Materials and Method

2.1. Study Area

Mnazi Mmoja Hospital serves as the main referral hospital in Zanzibar, which is a semi-autonomous archipelago of Tanzania. The hospital handles approximately 30% of all facility-based deliveries in Zanzibar, with an annual count of around 14,000 deliveries. The in-hospital maternal mortality ratio at Mnazi Mmoja Hospital is estimated to be around 350 per 100,000 live births.

2.2. Study Design

This observational retrospective study was conducted within the obstetric care units of Mnazi Mmoja Hospital, located in Zanzibar, Tanzania.

2.3. Sample Size

The study encompassed all women who gave birth at MMH from January 2018 to December 2022, ensuring that the entire population of women during that period was included in the analysis.

2.4. Data Collection

The case files of all women included in the study were retrieved, and relevant information was extracted. A specifically designed data capture sheet was used to collect information on maternal characteristics, including age, level of education, parity, gestational age, number of fetuses, fetal presentation, clinical indications for surgery, induction of labor (Yes or No), type of cesarean section (elective or emergency), maternal and fetal outcome. The cesarean sections performed during the study period were categorized using the Robson ten-group classification system with subdivisions [10] (Table 1). The Robson group for each cesarean section was recorded on the data capture sheet.

Table 1. Robson Classification System.

Robson group	Clinical Characteristics
Group 1	Nulliparous women, single cephalic, ≥ 37 weeks, in spontaneous labor
Group 2	Nulliparous women, single cephalic, ≥ 37 weeks, induced or C-section before labor
Group 3	Multiparous women without a previous C-section, single cephalic, ≥ 37 weeks, in spontaneous labor
Group 4	Multiparous women without a previous C-section, single cephalic, ≥ 37 weeks, induced or caesarean section before labor

Robson group	Clinical Characteristics
Group 5	Previous C-section, single cephalic, ≥ 37 weeks
Group 6	All nulliparous women with a single breech pregnancy
Group 7	All multiparous women with a single breech pregnancy (including previous C-section)
Group 8	All multiple pregnancies (including previous C-section)
Group 9	All women with a single pregnancy with a transverse lie (including previous C-section)
Group 10	All women with a single cephalic pregnancy ≤ 37 weeks (including previous C-section)

2.5. Data Analysis

Data analysis was performed using SPSS Statistics software. An analysis of the CS within each Robson group was conducted to assess the contribution of each group to the total CS. This was calculated by dividing the number of CS in the specific group by the total number of women who underwent CS. Additionally, the group's contribution to the overall CS rate was determined by dividing the number of CS in the particular group by the total number of women who gave birth. Continuous variables such as maternal age, gestational age at delivery, birth weight, and Apgar scores were summarized using median values. Categorical variables were summarized using frequencies and percentages.

3. Results

During the study period from 2018 to 2022, a total of 56,314 women were included in the analysis. The median age of the

study participants was 28 years. Among the participants, 30,888 women (54.8%) were 29 years of age or younger. In terms of education, approximately 30.1% of the women had secondary education, 22.3% had primary education, and a few (14.3%) had no education. Multiparous women accounted for 29,882 participants (53.1%) in the study. The majority of women, 33,346 (59.2%), gave birth at term, with a median gestational age at delivery of 38 weeks, ranging from 37 to 39 weeks. Among the participants, 41,324 women (71.7%) had multiple pregnancies with cephalic presentation. When considering birth weight, most babies, 36,628 (63.6%), weighed between 2.5 and 3.8 kg, with a median birth weight of 3.2 kg. The majority of babies, 49,281 (85.6%), had a fifth-minute Apgar score of seven or higher, indicating good overall health. During the study period, 12,655 women (22.5%) underwent induction of labor, while 38007 women (67.5%) delivered by cesarean sections. The majority of women, 45,955 (81.6%), were self-admitted to the hospital for delivery. Please refer to Table 2 for more detailed information (Table 2).

Table 2. Demographic Characteristic.

Variable	Number (n)	Percentage (%)
Level of Education (n=56,314)		
No education	8046	14.3
Primary	12578	22.3
Secondary	16946	30.1
High School	9498	16.9
University	9246	16.4
Parity (n=56,314)		
Nulliparous	26432	46.9
Multiparous	29882	53.1
Gestational age (weeks) (n=56,314)		
Preterm < 37	22968	40.8
Term > 37	33346	59.2
Fetal Presentation (n=57603)		
Cephalic	31298	54.3
Transverse	9766	17
Breech	16539	28.7
Type of pregnancy (n=57603)		
Single	16279	28.3
Multiple	41324	71.7
Newborn Birth weight (kg) (n=57603)		
< 2.5	8502	14.8
2.5–3.8	36628	63.6
≥ 4.0	12473	21.6
Apgar Score (5min) (n=57603)		
< 7	18705	32.5
≥ 7	49281	85.6
Induction of labour (n=56,314)		
Yes	12655	22.5
No	43659	77.5
Caesarean Section (n= 38007)		
Elective	25872	68.1
Emergency	12135	31.9
Referral status (n=56,314)		

Variable	Number (n)	Percentage (%)
Self-admitted	45955	81.6
Referred from another facility	10359	18.4

Table 3 provides an overview of the contribution of each Robson obstetric group to the overall CS rates. Among the 56,314 deliveries during the study period, 38,007 women underwent CS, resulting in an overall CS rate of 65%. Robson group 5 had the highest number of CS cases, accounting for 16.9% of the total, and contributed the most to the overall CS

rate at 11.4%. Conversely, Robson group 6 had the lowest number of CS cases, comprising only 4.7% of the total, and contributed the least to the overall CS rate at 3.2%. It is noteworthy that the majority of women in groups 10 underwent CS, resulting in a group-specific CS rate of 95% for all groups.

Table 3. Robson Classification of cesarean section rate.

Groups	n1	(n1/N1) %	n2 (C/S)	(n2/n1) %	(n2/N2) %	(n2/N1) %
G1	6170	11	4790	77.6	12.6	8.5
G2	7975	14.2	2417	30.3	6.4	4.3
G3	6524	11.6	5142	78.8	13.5	9.1
G4	6997	12.4	4509	64.4	11.9	8
G5	7764	13.8	6417	82.7	16.9	11.4
G6	1796	3.2	1796	100	4.7	3.2
G7	5360	9.5	2377	44.3	6.3	4.2
G8	5181	9.2	2289	44.2	6	4.1
G9	3009	5.3	3009	100	7.9	5.3
G10	5538	9.8	5261	95	13.8	9.3
Total	56,314	100	38007		100	65

* N1 = Total births (447); N2 = Total CS births (229); n1 = number of women in each Robson group; n2 = number of CS births in each Robson group; NA = not applicable; n1/N1 = Relative size of Robson group; n2/n1 = Group specific CS; n2/N2 = Group input to total CS; n2/N1 = Group input to overall CS rate.

The most common indication for cesarean section was a previous cesarean section, accounting for 10,571 cases (28.8%). This was followed by hypertensive disorders, with

7,735 cases (21.1%), and poor progress of labor, with 6,692 cases (18.3%) (Table 4).

Table 4. Indication for cesarean section within each Robson group.

Column1	G1	G2	G3	G4	G5	G6	G7	G8	G9	G10	Total (%)
Antepartum haemorrhage	0	0	0	0	391	0	0	0	0	1237	1628 (4.4)
Hypertensive disorders	0	1376	0	1637	1557	0	0	0	0	3165	7735 (21.1)
Breech presentation	223	0	0	199	0	796	483	0	0	0	1701 (4.6)
Malpresentation	0	0	0	23	0	0	0	1189	1231	0	2443 (6.7)
Cephalopelvic disproportion	673	1001	238	430	0	0	0	0	0	0	2342 (6.4)
Shoulder dystocia	0	0	169	0	0	0	0	0	0	0	169 (0.5)
Previous caesarean section	0	0	302	1128	5495	0	1089	1100	0	1457	10571 (28)
Fetal distress	1363	42	674	0	0	0	0	0	0	1295	3374 (9.2)
Poor progress in labour	2002	998	1759	0	123	0	0	0	0	1810	6692 (18.3)
Total (%)	4261 (11.6)	3417 (9.3)	3142 (8.6)	3417 (9.3)	7566 (20.6)	796 (2.2)	1572 (4.3)	2289 (6.2)	1231 (3.4)	8964 (24.5)	36655 (100)

Adverse maternal outcomes were observed in 12.2% (4,477 out of 36,655) of all women who underwent cesarean section. Out of these cases, a total of 204 women (4.6%) died due to complications related to the cesarean section. The majority of maternal deaths were attributed to postpartum hemorrhage, while others were caused by septicemia. Among the different groups, adverse maternal outcomes occurred in 60% (2,674 out of 4,479) of multiparous women with a history of cesarean section and 24% (1,081 out of 36,655) of single preterm cases, including those with a previous scar. Additionally, there were

681 women admitted due to cesarean hysterectomy, 556 due to antepartum hemorrhage, specifically placenta previa, accreta, and percreta, 701 due to wound infection, and 498 due to severe anemia. Moreover, 356 women experienced wound dehiscence, and 257 had internal organ injuries related to the cesarean section. The most common neonatal outcomes include stillbirth, which accounts for 46.6% (489/1049) of cases, lower Apgar scores accounting for 28.9% (303/1049), and neonatal sepsis accounting for 24.5% (257/1049) of all neonatal outcomes (Tables 5 & 6).

Table 5. Maternal outcomes within each Robson group.

C/S outcomes	G1	G2	G3	G4	G5	G6	G7	G8	G9	G10	Total
Maternal mortality	0	0	43	14	102	0	0	0	0	45	204 (4.6)
Sepsis	0	0	0	0	186	0	0	0	0	27	213 (4.8)

C/S outcomes	G1	G2	G3	G4	G5	G6	G7	G8	G9	G10	Total
Severe anaemia	11	0	0	0	289	0	0	0	0	198	498 (11.1)
Wound infection	0	0	0	45	457	0	0	0	0	199	701 (15.70)
Wound dehiscence	0	0	0	0	301	0	0	0	0	55	356 (8%)
Postpartum haemorrhage	0	0	347	110	402	0	56	96	0	0	1011 (23)
Caesarean hysterectomy	0	0	0	0	558	0	0	0	0	123	681 (15.2)
Antepartum haemorrhage	0	0	0	0	211	0	0	0	0	345	556 (12.4)
Internal organ injury	0	0	0	0	168	0	0	0	0	89	257 (5.6)
Total	11 (0.3)	0 (0)	390 (8.7)	169 (3.7)	2674 (60)	0 (0)	56 (1.3)	96 (2)	0	1081 (24)	4477 (100)

Table 6. Neonatal outcomes within each Robson group.

C/S outcomes	G1	G2	G3	G4	G5	G6	G7	G8	G9	G10	Total
Still birth	0	0	0	0	111	0	0	0	0	378	489 (46.6)
Low Apgar Score	0	0	1	0	12	0	0	0	0	290	303 (28.9)
Neonatal Sepsis	0	0	0	0	100	0	0	0	0	157	257 (24.5)
Total	0 (0)	0 (0)	1 (0.1)	0 (0)	223 (21.3)	0 (0)	0 (0)	0 (0)	0	825 (78.6)	1049 (100)

4. Discussion

The study reported an overall CS rate of 65%, with previous CS being the most common indication for the procedure. Among the Robson groups, groups 5, 10, 3, and 1 were found to have the highest contribution to the CS deliveries in the health facility. It is worth noting that the CS rate of 65% observed in this study is considerably higher than the rate recommended by the World Health Organization (WHO).

Babab et al. conducted a study in a public tertiary health facility in Tanzania and reported a CS rate of 51.3% [3]. Other authors who have worked in public tertiary health facilities in Tanzania have reported varying CS rates, such as 21.4% in Iringa and 42.4% in St. Francis Referral Hospital, Morogoro [4]. These variations in CS rates across different facilities reflect the diverse obstetric practices and clinical contexts within Tanzania. The consistent implementation of the Robson classification across all health facilities can play a crucial role in identifying the specific obstetric populations that contribute significantly to the high CS rate. By closely monitoring these specific groups, targeted interventions can be implemented, with the aim of reducing non-medically indicated CSs. Such interventions have the potential to positively impact overall CS rates and promote evidence-based practices in obstetric care.

The interpretation of the Robson classification results, in line with WHO recommendations, necessitates assessments in three key domains: data quality, type of obstetric population, and CS rates [11]. These considerations are crucial for understanding and contextualizing the information provided by the Robson classification, allowing for informed decision-making and interventions aimed at optimizing obstetric care and reducing CS rates where appropriate. One approach to assessing data quality is to examine the CS rate in group 9 of the Robson classification [12]. It is expected that this rate should be close to 100%, as group 9 consists of pregnancies with transverse lie with previous C/S. In this study, if the CS rate in group 9 aligns with this expectation, it indicates that the data collection and classification process have been accurately implemented,

enhancing the reliability of the study findings.

According to WHO recommendations, a higher ratio of 'group 3 to 4' compared to 'group 1 to 2' in the Robson classification indicates good data quality [6]. This ratio signifies that the rate of CS in group 3 (multiparous women in spontaneous labor) is higher than in group 4 (multiparous women with induced or CS before labour). This pattern suggests that the classification and data collection process have been accurately implemented, aligning with the expected trends based on obstetric characteristics. In this study, it is noteworthy that the combined population of 'groups 3 and 4' (24%) is slightly higher than the combined population of 'groups 1 and 2' (21%). This finding suggests a slightly larger proportion of multiparous women in the study population. Understanding the composition of the obstetric population according to the Robson classification provides valuable insights for evaluating the CS rates and identifying specific groups that contribute to the overall CS rate in the hospital [13].

As per recommendations, Group 5 is expected to contribute to approximately half of the total CS rate and should be less than 10% in settings with a low overall CS rate [14]. In this study, Group 5 accounted for 11.4% of the total CS rate of 65%. This finding suggests that Group 5 has contributed significantly to the high CS rate observed in the study. The substantial contribution of Group 5 to the high number of CS may indicate a lower rate of vaginal births after CS (VBAC) in the study population [10, 15]. Standard practice in many obstetric units involves considering VBAC for women with one previous CS and no contraindications, while recommending elective repeat CS for those with multiple previous CS or contraindications to VBAC [16].

In this study, the preterm single cephalic pregnancies, including those with a history of previous cesarean section (Robson group 10), made the second largest contribution to the total number of CS. This group had a high group-specific CS rate of 9.3%. Similarly, in Brazil, Robson group 10 was also found to be the largest contributor to the CS rate, with a CS rate of 9.4% [2, 17].

The third groups with higher rates of CS in this study are Group 1 and Group 3, accounting for a group-specific CS rate

of 8.5% and 9.1%, respectively. The higher CS rates observed in these groups may be attributed to poor progress in labour and unjustifiable CS procedures performed on these women. A study conducted at another tertiary health facility in Ibadan, Southwest Nigeria, also reported higher CS rates in Group 1 and Group 3 [18]. The reason identified for these higher rates was the early intervention of labor. These findings highlight the importance of evaluating the decision-making process regarding the timing of interventions during labor and the need for interventions aimed at reducing unnecessary CS in these specific groups.

All women in groups 6 (nulliparous breech) and 9 (transverse or oblique lie) underwent cesarean births, which is consistent with the fact that these groups represent cases of fetal malposition or abnormal lie. Similar findings have been reported in other studies as well [10]. Consequently, their contribution to the overall cesarean section rate was minimal. While these groups may have a higher likelihood of requiring cesarean delivery, their impact on the overall cesarean section rate in the study population was relatively low. The findings of this study align with previous research, indicating that previous CS is a common indication for CS in various settings [19]. In this study, previous CS accounted for 28.8% of all CS indications. This suggests that a significant proportion of women who have undergone a previous CS may require a repeat cesarean delivery for subsequent pregnancies.

Hypertensive disorders, accounting for 21.1% of the indications, and poor progress in labor, accounting for 18.3% of the indications, were also identified as significant contributors to the CS rate in this study. These findings are consistent with the known associations between these conditions and an increased likelihood of requiring a cesarean delivery for the safety of the mother and baby [20]. Similar studies conducted in Lagos, Tanzania, and Bangladesh have reported comparable rates of previous CS as the leading indication for cesarean delivery [21]. These findings highlight the global trend of previous CS being a major factor contributing to the overall CS rates.

The analysis of maternal outcomes in this study identified several significant findings. Postpartum hemorrhage (PPH) was the most common maternal outcome, accounting for 22.6% of cases. Wound infection was the second most prevalent outcome, affecting 24% of women who underwent CS, followed by cesarean hysterectomy at 15.2%, these finds are in consistence with the finds reported by Rookesh et al [22]. It is concerning to note that there were 204 cases of maternal death associated with CS complications, underscoring the importance of improving maternal care and reducing complications related to cesarean deliveries.

In terms of neonatal outcomes, the study reported 498 stillbirths, representing a distressing proportion of cases. Lower Apgar scores, an indicator of a newborn's immediate well-being, accounted for 303 cases (28.9%), indicating the need for close monitoring and interventions to improve neonatal resuscitation. Neonatal sepsis was another significant outcome, affecting 257 infants (24.5%). These findings highlight the importance of addressing both maternal and

neonatal well-being in the context of cesarean deliveries [23].

5. Conclusion

According to Robson's Ten-Group Classification, Group-5 and Group-10 deliveries were found to have a significant impact. The primary indication for cesarean sections was identified as previous cesarean, which was commonly observed. These findings provide valuable insights for potential interventions, particularly in reducing unnecessary cesarean sections. Implementing such interventions has the potential to enhance overall maternity care and improve outcomes.

Conflict of Interest

There are no conflicts of interest.

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