An Evaluation of Cesarean Delivery Rates According to Robson Classification in the Black Sea Region of Turkey

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ABSTRACT

Objective: To analyse cesarean deliveries (CD) using the Ten Group Classification System (TGCS) for reducing cesarean rates.
Study Design: Cross-sectional study.
Place and Duration of Study: Ordu University Medical Faculty Training and Research Hospital, Ordu, Turkey, from 1st January 2008 to 31st December 2020.
Methodology: A total of 29,885 deliveries during the 13-year study period were analysed. Group sizes and annual, overall, absolute, and relative CD rates were calculated to analyse the effect of the Robson groups (RGs)/TGCS. The data were analysed using the two-way Chi-square test and two-proportion Z-test with Bonferroni correction.
Results: The overall CD rate was 59.22% (17,697). The principal contributors to the overall CD rate were RG5 (54.48%), RG1 (12.52%), and RG2 (10.06%). The relative CD rate in preterm pregnancies (RG10) increased approximately five-fold over the 13-year study period due to the increase in both group size and absolute CD rate (p<0.001).
Conclusion: TGCS shows the cesarean delivery trends in terms of cesarean rates and identifies those groups requiring special precautions. The target groups (RG5, RG1, RG2 and RG10) need more in-depth research to reduce CD rates. Various approaches need to be implemented including individualised cesarean indication, encouragement of vaginal delivery after cesarean delivery, expectant management in nulliparous women, and spontaneous labor for preterms labor.

Key Words: Cesarean section, Elective cesarean section, Induction of labor, Vaginal birth after cesarean section, Robson classification, Preterm deliveries.

INTRODUCTION

Cesarean delivery (CD) is a life-saving surgery when performed with indications such as dystocia, uterine rupture, and placenta previa. However, overuse has potentially adverse effects on both mother and newborn health.[1] In particular, there is growing concern regarding maternal complications in the long term. Individualising cesarean indications and determining optimised CD rates are therefore highly important for public health.[2]

The fear of labor pain and concerns about complications related to vaginal delivery are the most common causes of rising cesarean rates.[3] Malpractice pressure is the principal reason why obstetricians prefer to avoid vaginal delivery. Factors such as an excessive delivery load in the hospital, a shortage of nurses/midwives, lack of training in vaginal delivery, and insufficient patient-doctor relationships may also lead to a preference for CD.[4]

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The World Health Organisation (WHO) describes an acceptable CD rate as between 10% and 15%. Turkey has the fourth highest CD rate in the world, at 53.1%, a figure exceeded only by the Dominican Republic, Brazil, and Egypt.[1] In 2015, the WHO adopted the Ten Group Classification System (TGCS) as a global standard for evaluating, analysing, and optimising CD rates.[5,6] RG1 is defined as nulliparous/singleton/cephalic/term/spontaneous labor; RG2 as nulliparous/singleton/cephalic/term/induced labor or cesarean section before labor; RG3 as multiparous without previous cesarean section/singleton/cephalic/term/spontaneous labor; RG4 as multiparous without previous cesarean section/singleton/cephalic/term/induced labor or caesarean section before labor; RG5 as multiparous with prior cesarean section/singleton/cephalic/term; RG6 as all nulliparous breeches; RG7 as all multiparous breeches; RG8 as all multiple pregnancies; RG9 as all pregnancies with transverse/oblique lie; RG10 as singleton/cephalic/preterm.[6]

The main goal of this study was to evaluate the reasons and pace of change in the causes of cesarean section over the years, and to provide a data source for Health Authorities to consider while providing institutional arrangements and preventive health services.

METHODOLOGY

This cross-sectional study was conducted at Ordu University Medical Faculty Training and Research Hospital. The research commenced following the receipt of approval from the Ordu University Medical Faculty Clinical Research Ethics Committee (no: KAEK-2021/59). All women who delivered at the hospital from 1st January, 2008 to 31st December 2020, were grouped under the TGCS and included in the analysis.

The variables collected for TGCS included obstetric characteristics such as gestational age at delivery, parity, fetal presentation, number of fetuses, presence of uterine scar, and the onset of labor. Inclusion criteria were defined as all births in 13 year period. Women giving birth during the study period to live newborns after at least 24 weeks' gestation and/or with a birth weight of at least 500 grams (g) were included in the study. Birth weight below 2500 g was regarded as preterm ($\geq$37 weeks). Exclusion criteria were patients for whom complete file data could not be obtained. The total number of women in each group and group sizes and CD rates are shown in Tables 1-3. Three groupings by years (2008-2010/2013-2015/2018-2020) were established in order to reveal the chronological changes in cesarean trends.

Two-way Chi-square test was used to determine whether the group sizes in Robson groups changed in a time-dependent manner. Two-proportion Z-test with Bonferroni correction was applied to compare absolute CD rates between two periods. All statistical analyses were performed on SPSS v26 (IBM Inc., Chicago/IL/USA) statistical software. A p-value (two-sided) less than 0.05 was regarded as statistically significant.

RESULTS

A total of 29,885 women gave birth at our hospital during the 13-year study period. RG5 was identified as the largest group (32.47%). Nulliparous and multiparous women with spontaneous labor represented 21.64% and 19.87% of the study population, respectively. The labor induction rate was 16.34%. Preterm cephalic singletons represented 5.51% of all deliveries. The malpresentation rate was 3.1%. Three hundred twenty-one women (1.07%) had multiple pregnancies.

An increase in the number of deliveries was observed in RG5 ($p<0.001$) and RG10 ($p<0.001$) from 2008 to 2020, together with a decrease in RG2 ($p=0.000$) and RG4 ($p<0.001$), especially after 2011. A horizontal course was determined in the other Robson groups. At group size comparisons, RG1 was 2.45-fold larger than RG2 overall (1.47:1/6.90:1), and RG3 was 2.63-fold larger than RG4 overall (1.56:1/8.32:1). In other words, spontaneous initiation of labor was preferred over the induction of labor or elective cesarean delivery in nulliparous and multiparous women. On the one hand, the increased group sizes in RG5 and RG10 caused a significant increase in the relative CD rates due to the already high absolute CD rate ($p=0.000$). However, on the other hand, the decreasing group sizes and absolute CD rates in RG2 and RG4 caused a significant decrease in the relative CD rate ($p<0.001$).

The overall CD rate was 59.22% (17,697). The lowest CD rate over the 13-year study period was in 2012, at 52.42%, while the highest was in 2010, at 65.93%. The absolute CD rates in each group ranged from 13.92% in RG3 up to 100% in RG9. Absolute CD rates decreased significantly over the years in RG1 ($p=0.000$), RG2, RG3, and RG4 (all $p<0.001$), while a statistically significant increase was observed in RG10 ($p<0.001$). RG5 was the greatest relative contributor to the overall CD rate, at 54.48%, followed by RG1, RG2, RG4, RG10, and RG3. In terms of the relative contribution of the group to overall CD rates by years, relative CD rates decreased significantly in RG1, RG2, and RG3, and RG4 (all $p<0.001$), while statistically significant increases were observed in RG5 ($p<0.001$) and RG10 ($p<0.001$).

DISCUSSION

The CD rate is one of the best indicators of the quality of a health system.[7] Previous studies have shown that an optimal CD rate reduces maternal and neonatal mortality.[4] The overall CD rate in the present study was 59.22%, compared to 53.1% in Turkey as a whole. The CD rate at the study centre was even higher than that in the Dominican Republic (58.1%), the country with the highest global CD rates.[1]

Traditional classification systems using common cesarean indications are not by themselves capable of explaining the leading factors contributing to high CD rates. Although it is not commonly employed in Turkey, many countries report controlling CD rates using the TGCS. This system can be employed to develop health policies and preventive strategies for specific groups with greater impacts on CD rates.[5]

An annual decrease in birth numbers was observed in the present study. Although there was a slight decrease in CD rates until 2016, these then increased rapidly and today exceed 60%. This widespread overuse of CD is an important issue because of the potential maternal and perinatal risks that increase healthcare costs and exacerbate inequality in access to maternity healthcare.[8] RG5, RG1, and RG2 were the main drivers of the overall CD rate in the hospital. Since the number of CDs in these three groups constituted 77.06% of overall CD, these were identified as our target groups.

Similarly to other studies, multiparous women in RG5 were an increasingly important determinant of overall CD rates.[9] The absolute group CD rate was 99.36%, meaning that the management of women from RG5 in this hospital involved cesarean section (CS) being scheduled without any trial of labor.

Previous studies have reported a 70% success rate for vaginal birth after the previous cesarean section (VBAC). This high rate suggests that VBAC can be offered as a cost-effective option for multiparous women with one previous uterine scar.[10] The common culture of "once a CS, always a CS" among the population played a major role in the rejection of the VBAC option. As described in other studies, this global impact is observed in many countries.[11]

Table I: Distribution of the study population according to the TGCS system.

Robson Group		2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Total
1	n	807	673	556	414	490	409	461	611	529	419	321	431	346	6467
	%	21.20	19.70	20.11	21.54	21.21	21.50	21.94	22.88	27.68	23.82	18.57	21.91	21.29	21.64
2	n	548	432	341	208	213	157	162	175	113	78	66	86	50	2629
	%	14.40	12.64	12.33	10.82	9.22	8.25	7.71	6.55	5.91	4.43	3.82	4.37	3.08	8.80
3	n	757	665	513	327	449	362	448	595	414	393	286	397	333	5939
	%	19.89	19.46	18.55	17.01	19.44	19.03	21.32	22.28	21.66	22.34	16.54	20.18	20.49	19.87
4	n	485	396	314	157	172	137	146	146	78	66	52	63	40	2252
	%	12.74	11.59	11.36	8.17	7.45	7.20	6.95	5.47	4.08	3.75	3.01	3.20	2.46	7.54
5	n	857	932	822	636	781	656	689	891	614	628	806	757	635	9704
	%	22.52	27.28	29.73	33.09	33.81	34.49	32.79	33.36	32.13	35.70	46.62	38.49	39.08	32.47
6	n	114	91	55	36	43	40	35	51	33	32	20	46	37	639
	%	3.00	2.66	1.99	1.87	1.86	2.10	1.67	1.91	1.73	1.82	1.16	2.34	2.28	2.14
7	n	33	42	23	15	25	14	19	22	16	9	13	13	12	250
	%	0.87	1.23	0.83	0.78	1.08	0.74	0.90	0.82	0.84	0.51	0.75	0.66	0.74	0.84
8	n	62	48	25	17	19	15	16	21	23	14	20	17	24	321
	%	1.63	1.40	0.90	0.88	0.82	0.79	0.76	0.79	1.20	0.80	1.16	0.86	1.48	1.07
9	n	6	5	4	2	3	2	3	3	2	1	1	2	2	36
	%	0.16	0.15	0.14	0.10	0.13	0.11	0.14	0.11	0.10	0.06	0.06	0.10	0.12	0.12
10	n	137	133	112	110	115	110	122	156	89	119	144	155	146	1648
	%	3.60	3.89	4.05	5.72	4.98	5.78	5.81	5.84	4.66	6.77	8.33	7.88	8.98	5.51
Total delivery		3806	3417	2765	1922	2310	1902	2101	2671	1911	1759	1729	1967	1625	29885
CD rate (%)		64.98	65.53	65.93	54.79	52.42	55.89	55.31	52.71	49.61	55.20	62.98	62.79	62.89	59.22

n: Number of all deliveries (vaginal delivery and cesarean delivery) in each group; %: Group size (%) = number of women in the group / number of total deliveries; CD rate (%): Cesarean delivery rate (%) = number of cesarean deliveries / number of total deliveries.

Table II: Distribution of cesarean deliveries according to the TGCS system.

Robson Group		2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	p*	Total
1	n	369	309	265	118	131	126	149	159	126	122	76	146	119		2215
	Absolute CD rate (%)	45.72a	45.91a	47.66a	28.50bc	26.73bc	30.81bc	32.32bc	26.02bc	23.82c	29.12bc	23.68bc	33.87b	34.39b	0.000	34.25
	Relative CD rate (%)	14.92	13.80	14.54	11.21	10.82	11.85	12.82	11.29		12.56	6.98	11.82	11.64	0.862	12.52
2	n	478	363	272	109	100	86	93	83	39	42	24	57	35		1781
	Absolute CD rate (%)	87.23a	84.03a	79.77a	52.40bc	46.95bc	54.78bc	57.41bc	47.43bc	34.51c	53.85bc	36.36c	66.28b	70.00b	0.000	67.74
	Relative CD rate (%)	19.33	16.21	14.92	10.35	8.26	8.09	8.00	5.89	4.11	4.33	2.20	4.62	3.42	0.000	10.06
3	n	175	151	131	27	27	34	43	49	33	35	21	55	46		827
	Absolute CD rate (%)	23.12a	22.71a	25.54a	8.26b	6.01c	9.39bc	9.60bc	8.24bc	7.97bc	8.91bc	7.34bc	13.85b	13.81b	0.000	13.92
	Relative CD rate (%)	7.08	6.74	7.19	2.56	2.23	3.20	3.70	3.48	3.48	3.60	1.93	4.45	4.50	0.953	4.67
4	n	339	258	193	52	48	48	56	48	24	24	9	33	22		1154
	Absolute CD rate (%)	69.90a	65.15a	61.46a	33.12c	27.91c	35.04bc	38.36bc	32.88bc	30.77bc	36.36bc	17.31c	52.38ab	55.00ab	0.000	51.24
	Relative CD rate (%)	13.71	11.52	10.59	4.94	3.96	4.52	4.82	3.41	2.53	2.47	0.83	2.67	2.15	0.051	6.52
5	n	852	927	817	631	776	651	684	886	609	626	801	752	630		9642
	Absolute CD rate (%)	99.42	99.46	99.39	99.21	99.36	99.24	99.27	99.44	99.19	99.68	99.38	99.34	99.21	0.999	99.36
	Relative CD rate (%)	34.45c	41.40c	44.82c	59.92b	64.08b	61.24b	58.86b	62.93b	64.24b	64.47b	73.55a	60.89b	61.64b	0.000	54.48
6	n	112	90	54	36	42	40	34	50	33	31	20	46	37		625
	Absolute CD rate (%)	98.25	98.90	98.18	100	97.67	100	97.14	98.04	100	96.88	100	100	100	0.948	97.81
	Relative CD rate (%)	4.53	4.02	2.96	3.42	3.47	3.76	2.93	3.55	3.48	3.19	1.84	3.72	3.62	0.999	3.53
7	n	29	37	19	14	22	12	17	20	15	9	13	13	12		232
	Absolute CD rate (%)	87.88	88.10	82.61	93.33	88.00	85.71	89.47	90.91	93.75	100	100	100	100	0.773	92.80
	Relative CD rate (%)	1.17	1.65	1.04	1.33	1.82	1.13	1.46	1.42	1.58	0.93	1.19	1.05	1.17	0.947	1.31
8	n	60	46	23	16	18	14	16	20	22	13	20	17	24		309
	Absolute CD rate (%)	96.77	95.83	92.00	94.12	94.74	93.33	100	95.24	95.65	92.86	100	100	100	0.937	96.26
	Relative CD rate (%)	2.43	2.05	1.26	1.52	1.49	1.32	1.38	1.42	2.32	1.34	1.84	1.38	2.35	0.927	1.75
9	n	6	5	4	2	3	2	3	3	2	1	1	2	2		36
	Absolute CD rate (%)	100	100	100	100	100	100	100	100	100	100	100	100	100	-	100
	Relative CD rate (%)	0.24	0.22	0.22	0.19	0.25	0.19	0.26	0.21	0.21	0.10	0.09	0.16	0.20	-	0.20
10	n	53	53	45	48	44	50	67	90	45	68	104	114	95		876
	Absolute CD rate (%)	38.69c	39.85c	40.18c	43.64c	38.26c	45.45bc	54.92bc	57.69bc	50.56c	57.14c	72.22a	73.55a	65.07ab	0.000	53.16
	Relative CD rate (%)	2.14	2.37	2.47	4.56	3.63	4.70	5.77	6.39	4.75	7.00	9.55	9.23	9.30	0.463	4.95

n: Number of CD in each group = number of all cesarean deliveries in each group; Absolute CD rate (%): Absolute group CD rate (%) = number of cesarean deliveries in the group / number of all deliveries in the group; Relative CD rate (%): Relative contribution of the group to the overall CD rate (%) = number of cesarean sections in the group / number of total cesarean deliveries; -: Not calculated; *:Chi-square test; a,b,c: The difference between rates for years that do not share a common letter is statistically significant (p<0.05)

While encouraging the patient to deal with VBAC, it should also be emphasised that repeated CS can lead to abnormal placentation and subfertility. In addition, repeated CS results in adverse effects on national economies. The impact is greater in underdeveloped countries with high fertility rates and limited resources with which to perform basic obstetric interventions.[12]

Measures should be taken to reduce the CD rates in RG5. In the first stage, it may be beneficial to establish dedicated VBAC clinics in hospitals. These specialised clinics can select women with a high probability of delivery by the vaginal route among members of this group. In addition, research has revealed that most obstetricians discourage VBAC due to their busy schedules. Educating midwives working in the VBAC clinic will also reduce the clinician workload, one of the causes of increased CD rates in this group.[13]

Nulliparous population in RG1 and RG2 was the most frequent contributor to the overall CD rate in the present study, after RG5. The adverse consequences of the increases in these groups on women's health have been shown in previous studies.[14,15] A higher CD rate was observed in RG2 compared to RG1 in the present study due to labor induction (67.74/34.25, respectively). In addition, the CD rates in both groups (RG1 and RG2) fluctuated over the years. Despite the high rates of CS, the contribution to the relative CD rate of RG2 decreased in line with the sharp decrease in the group size.

Table III: Changes in group size, and absolute and relative CD rates by years (2008-2010/2011-2012/2013-2015/2016-2017/2018-2020).

Robson Group		2008-2010	2013-2015	2018-2020	p*
1	Group Size (%)	20.38[b]	22.19[a]	20.64[ab]	0.015
	Absolute CD rate (%)	46.32[a]	29.30[b]	31.06[b]	0.000
	Relative CD rate (%)	14.43[a]	11.95[b]	10.19[b]	0.000
2	Group Size (%)	13.23[a]	7.40[bc]	3.80[c]	0.000
	Absolute CD rate (%)	84.25[a]	53.04[b]	57.43[b]	0.000
	Relative CD rate (%)	17.03[a]	7.21[b]	3.47[c]	0.000
3	Group Size (%)	19.37[b]	21.05[a]	19.09[b]	0.009
	Absolute CD rate (%)	23.62[a]	8.97[c]	12.01[b]	0.000
	Relative CD rate (%)	6.99[a]	3.47[b]	3.47[b]	0.000
4	Group Size (%)	11.96[a]	6.43[b]	2.91[c]	0.000
	Absolute CD rate (%)	66.11[a]	35.43[b]	41.29[b]	0.000
	Relative CD rate (%)	12.09[a]	4.18[b]	1.91[c]	0.000
5	Group Size (%)	26.14[c]	33.50[b]	41.30[a]	0.000
	Absolute CD rate (%)	99.43	99.33	99.32	0.873
	Relative CD rate (%)	39.72[b]	61.13[a]	65.24[a]	0.000
6	Group Size (%)	2.60[b]	1.89[b]	1.94[b]	0.002
	Absolute CD rate (%)	98.46	98.41	100.00	0.444
	Relative CD rate (%)	3.92	3.41	3.08	0.087
7	Group Size (%)	0.98	0.82	0.71	0.213
	Absolute CD rate (%)	86.73	89.09	100.00	0.065
	Relative CD rate (%)	1.30	1.35	1.14	0.702
8	Group Size (%)	1.35[b]	0.78[b]	1.15[ab]	0.003
	Absolute CD rate (%)	95.56	96.15	100.00	0.254
	Relative CD rate (%)	1.97	1.38	1.82	0.089
9	Group Size (%)	0.15	0.12	0.09	0.636
	Absolute CD rate (%)	100.00	100.00	100.00	-
	Relative CD rate (%)	0.23	0.22	0.15	0.695
10	Group Size (%)	3.82[c]	5.81[b]	8.36[a]	0.000
	Absolute CD rate (%)	39.53[c]	53.35[b]	70.34[a]	0.000
	Relative CD rate (%)	2.31[c]	5.70[b]	9.35[a]	0.000
Total delivery		9988	6674	5321	
CD rate (%)		65.43	54.44	62.88	

Group size (%) = number of women in the group / number of total deliveries. Absolute CD rate (%): Absolute group CD rate (%) = number of cesarean deliveries in the group / number of all deliveries in the group. Relative CD rate (%): Relative contribution of the group to the overall CD rate (%) = number of cesarean sections in the group / number of total cesarean deliveries. CD rate (%): Cesarean delivery rate (%) = number of cesarean deliveries / number of total deliveries. -: Not calculated; *:Chi-square test; [a,b,c]: The difference between rates of years that do not share a common letter is statistically significant (p<0.05).

Consistent with the present study, previous research has emphasised the importance of RG1, and especially RG2.[16] As reported in a number of studies, a group size ratio between RG1 and RG2 below 2:1 indicates excessive application of labor induction. Stricter indications for the induction of labor in this group should therefore be formulated in clinics, and oxytocin must be used if essential.[17] This ratio increased gradually from 1.47 in 2008 to 6.91 in 2020. In other words, labor induction is less applied in case of nulliparous women in the clinic. This ratio should therefore be constantly monitored and kept high since a low ratio is directly related to a high primary CD rate.

The relative CD rate in RG10 increased approximately five-fold over the 13-year study period. It may be attributed to the study centre being a tertiary case university Hospital that provides neonatal intensive care services. On the other hand, induction of labor and elective CS, which the authors use for high-risk pregnancies, increase the odds of iatrogenic prematurity. Similar results have been reported in studies from institutions providing tertiary health services.[18] The perception that 'CS is protective' in preterms may be therefore inaccurate in some instances.

Similarly to previous studies, birth weight was also used instead of pregnancy estimation confirmed by first-trimester ultrasonography in preterm diagnosis in the present research. However, using birth weight in preterm diagnosis may result in growth-restricted neonates being misclassified as preterm. This may then result in a relative increase in the size of RG10.[19] There is no definite choice of delivery method that is internationally accepted and applied to the overall RG10 popu-

lation in preterm pregnancies. A Cochrane review concluded that there was no difference between caesarean and vaginal delivery groups in terms of neonatal asphyxia, low Apgar score, hypoxic-ischemic encephalopathy, or respiratory distress syndrome. However, the presence of one or more of the additional CS indications encourages obstetricians to decide in favor of CD.[20]

In addition, an examination of RG10 on a yearly basis revealed that the absolute CD rates increased rapidly, from 40% in 2008 to 65-73% in the last three years. Additional CS indications should therefore be examined objectively, and labor induction should be applied with limited indications in order to reduce the high CD rates in RG10.

CONCLUSION

This study used the TGCS to identify specific groups with the greatest contribution to overall CD over a 13-year period. RG5 emerged as the leading contributor to the overall CD rates, followed by RG1 and RG2. In addition, the contribution of preterm pregnancies (RG10) to the increasing CD rates increased considerably in a time-dependent manner. Measures that might be usefully adopted include encouraging VBAC, determining labor induction protocols in the nulliparous population in particular, and clarifying CS indications in preterm pregnant women.

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