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Medical audit using the Ten Group Classification System and its impact on the cesarean section rate

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ABSTRACT

Objective: The aim of this study is to implement the Ten Group Classification System (TGCS) and evaluate whether the introduction of the medical audit cycle reduces the cesarean section (CS) rate without increasing maternal–fetal risk.
Study design: A prospective cohort study was performed including all women who gave birth during 21 months. The study was subdivided into three consecutive periods: (1) implementation of the TGCS identifying the major CS rate contributor groups (three months), (2) audit and report changes in the CS rates to the medical and midwifery staff according to the TGCS (6 months) and (3) discontinue interventions but continue auditing the CS rates (6 months).
Results: The first period CS rate of 36.8% was reduced to 26.5% after the introduction of interventions in the second period (RR 0.71 IC 0.63–0.81). After the intervention was stopped, the CS rate increased again to 31.8% (RR 1.19 IC 1.09–1.32). This is a decrease of 5.08% from the basal period (RR 0.86 IC 0.76–0.97). The asphyxia rate remained unchanged for the periods studied.
Conclusion: Auditing through the TGCS and feedback is an effective, safe, and easy-to-implement strategy to reduce the CS rate. Its diffusion would allow reduction of the CS rates in countries as ours, and by means of the TGCS, figures can be compared within individual entities and others.

1. Introduction

Cesarean delivery was originally conceived as a life-saving procedure with the objective of reducing maternal and fetal mortality. Nevertheless, in the last 50 years, several factors, including improved surgical and anesthetic techniques, demographic and nutritional factors, health systems and malpractice concerns, have increased its frequency [1–3]. In 1985, the World Health Organization (WHO) stated that there is no justification for a cesarean section (CS) rate higher than 10–15% [4]. While there are huge disparities in CS rates globally, with African nations averaging about 5%, most developed countries have seen a fourfold increase in CS rates since 1970 [5]. Latin America is the region with the highest cesarean section rate worldwide (29–36% of all deliveries) [2,6,7], with an estimated 1.5 million "unnecessary" CS done every year, causing about 100 maternal deaths and 40,000 cases of neonatal respiratory morbidity [2,8–11]. Chile is the world leader in this matter with an estimated rate of 40%, almost three times the WHO recommendation [9,12].

Several strategies have been proposed to reduce CS rates. One of most effective has been named the medical audit cycle [13,14]. In 2001, Robson proposed a new classification system, named the Robson Ten Group Classification System (TGCS). Widespread in the literature, the TGCS provides a framework for auditing and analyzing cesarean sections [7,15–18]. The aim of this study was to implement the TGCS in order to identify the main contributors to the CS rate and to evaluate whether the introduction of the medical audit system would reduce the CS rate without increasing maternal–fetal risk.

2. Materials and methods

At the Van Buren Hospital maternity ward, we did a prospective interrupted time series (ITS) study that lasted 21 months. The research protocol was admitted, accepted and approved by the Van Buren Hospital institutional review board. All pregnant women admitted in spontaneous labor or for pregnancy interruption between March 2007 and November 2008 were included. We excluded all newborns under 500 g as well as deliveries by private physicians. The latter represented 4.61% (131/2837) of all hospital

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Table 1
Ten Group Classification System (TGCS).

1. Nulliparous with single cephalic ≥37 weeks, in spontaneous labor
Nulliparous, single cephalic, ≥37 weeks: 2 a: with induced labor. b: CS before labor.
3 Multiparous (excluding prev. CS), single cephalic, ≥37 weeks, in spontaneous labor.
Multiparous (excluding prev. CS), single cephalic, ≥37 weeks: 4 a: with induced labor. b: CS before labor.
Multiparous with a Previous CS, single cephalic, ≥37 weeks: 5 a: 1 previous CS. b: ≥2 previous CS
6 All nulliparous breeches. 7 All multiparous breeches, with or without previous CS. 8 All multiple pregnancies, with or without previous CS. 9 All single pregnancies with abnormal lies, with or without previous CS. 10 All single cephalic, ≤36 weeks, with or without previous CS.

births in 2006, and were excluded because these patients are not admitted to the same labor ward and are not managed by the maternity day work team.

The Van Buren Hospital is a regional health center, part of the Chilean National public system of health and holds an agreement with the University of Valparaiso working as a University/Public Hospital. Each day four midwives and three medical doctors share different responsibilities. The former are in charge of the "low risk" cases, and the latter of the dystocic deliveries, and therefore are responsible for the CS indications. The work day is organized in shifts, with a total of 12 midwives and 18 medical doctors in charge of the labor ward.

The intervention to be evaluated was based on a process of audit and feedback delivered by three members of the hospital (AS, VC and MS). Although supported by the head of the maternity, none of three was a chief or section supervisor. In summary, the intervention consisted of the following steps: implementation of the TGCS in order to identify the main contributors to the overall cesarean section rate; presentation and discussion of these causes with the hospital staff; and finally, analysis and feedback of the changes in CS rates by means of the TGCS.

In order to do this, the study was subdivided into three periods:

(1) *Basal period* of three months (from 1st March to 31st May 2007) when the TGCS (Table 1) was implemented to identify the main contributors to the overall CS rate. The aim was to identify the groups (named "groups of interest") for whom efforts should be made to reduce the CS rate. For a better analysis, group 5 of the TGCS was divided into two, separating those with one prior low-transverse CS (group 5a) from the rest (group 5b) in consideration of the fact that only the former group would undergo a trial of labor.

(2) *Intervention period* of nine months (from 1st June 2007 to 28th February 2008) in which strategies were introduced to reduce the CS rate in the selected groups. A series of activities was performed (Fig. 1):
   a. A first meeting was held between the investigators and the maternity staff during June 2007. In this meeting, the aim of the study, the schedule of the interventions (explained below at points b and c) and the results obtained in the basal period were presented. Examples of CS performed without clinical justification were shown and discussed, emphasizing the need to safely reduce the number of CS in the groups of interest. No changes were made to the maternity guidelines, and the authors asked only that the medical team follow existing procedures. After the meeting, we proceeded with the following.
   b. The TGCS was audited monthly. Tables and figures showing changes in the TGCS and the overall CS rates were distributed by letter to every staff member (eight reports in total).
   c. Every three months, medical-midwifery staff meetings were held (three in total including the one reported above at point "a"). In each meeting, we reported changes in the CS rate according to the TGCS classification and the rate of 5-min Apgar scores below 7. This information was shown as aggregate data and also divided according to the different duty-day shift that rotates through the week, ranking them from worst to best according to their CS rates in the groups of interest. Although not every staff member at the hospital attended these meetings, at least one physician and one midwife from each duty-day had to be present. As stated at point "b", a report of the TGCS was provided by letter to every maternity staff member.

(3) *Post-intervention period* of nine months (1st March to 30th November 2008) where intervention ceased and only the

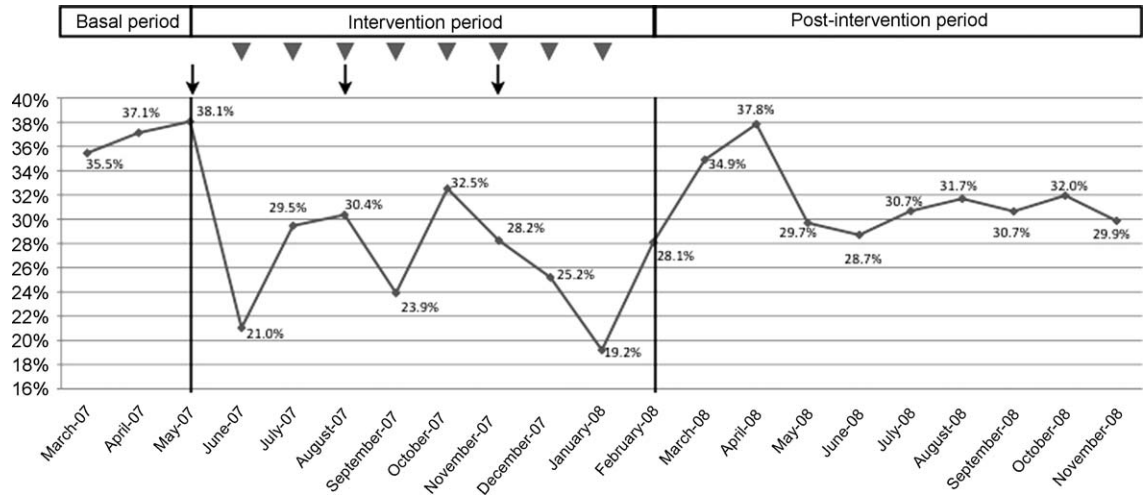

Fig. 1. . Monthly total cesarean delivery rates during the three period studied. Arrows show periodicity of the meetings held between the investigators and the maternity staffs. Triangles show periodicity of the TGCS reports provided by letter to the maternity staff members.

Table 2
Basal Period Ten Group Classification System (TGCS) showing group size and cesarean section (CS) rates (March–May trimester).

Overall cesarean section (CS) rate: 231/627 (36.8%)				
Group	Number of CS over total number of women in each group	Relative size of groups (%)	CS rate in each group (%)	Absolute contribution by each group to the overall CS rate (%)
1	35/162	25.8%	21.6%	5.6%
2a	22/53	8.5%	41.5%	3.5%
2b	18/18	2.9%	100.0%	2.9%
3	10/172	27.4%	5.8%	1.6%
4a	4/32	5.1%	12.5%	0.6%
4b	14/14	2.2%	100.0%	2.2%
5a	51/74	11.8%	68.9%	8.1%
5b	26/27	4.3%	96.3%	4.1%
6	4/4	0.6%	100.0%	0.6%
7	12/13	2.1%	92.3%	1.9%
8	10/11	1.8%	90.9%	1.6%
9	1/1	0.2%	100.0%	0.2%
10	24/46	7.3%	52.2%	3.8%

Table 3
Groups of interest and overall CS rate in the periods studied and relative risk (RR).

Period	Groups of interest (1, 2a, 5a, 10)	Overall
Basal	39.4% (132/335)	36.8% (231/627)
Intervened	27.46% (312/1136)	26.5% (555/2097)
Post-intervention	33.31% (402/1207)	31.8% (672/2116)
RR basal/intervened (95% CI)	0.69 (0.59–0.82)	0.71 (0.63–0.81)
RR intervened/post-intervention (95% CI)	1.21 (1.07–1.37)	1.19 (1.09–1.32)
RR basal/post-intervention (95% CI)	0.85 (0.72–0.99)	0.86 (0.76–0.97)

follow-up data were registered according to the TGCS, without reporting the information to the staff.

Data were obtained from the Patient Health Record before patient discharge. Each record was crosschecked with the labor ward book and entered into the Perinatal Clinical Record (Sistema Informático Perinatal, SIP) by a single senior midwife (MS). She was responsible for checking that each patient was correctly classified according to the TGCS. The Perinatal Adverse Events Committee of our maternity ward reported to the Research Team newborns with neonatal asphyxia (American Pediatric Association Criteria) [19] and 5-min Apgar scores below 7. No changes in the data collection protocol occurred during the three periods studied.

Data were analyzed using Stata/SE 10.0 statistical software (Statacorp, Texas, USA). The chi-square test of two-proportion difference and relative risk (RR) calculation were used. A p-value of less than 0.05 was regarded as significant. Using a power of 0.80 and an alpha of 0.05, 260 subjects in each group were calculated to be necessary to detect an 8% decrease in the CS rates.

3. Results

During the 21-month study period, 4813 women met the inclusion criteria. All of them were included in the study.

During the basal period (first period), 231 CS occurred out of 627 labors, a CS rate of 36.8%. Table 2 shows that the TGCS groups with the greatest contribution to the overall CS rate were the following: 1: Nulliparous, single cephalic, ≥37 weeks, in spontaneous labor; 2a: Nulliparous, single cephalic, ≥37 weeks, with induced labor; 5a: Multiparous with one previous CS, single cephalic, ≥37 weeks; and 10: All single cephalic, ≤36 weeks, with or without a previous CS. These groups explained 57.1% of the cesarean sections and were identified as "groups of interest".

The interventions were done fulfilling the previously described steps. The overall CS rate was 36.8% in the basal period, 26.5% in the intervention period and 31.8% in the post-intervention period.

Table 4
Number of CS over total number of women in each group for the different periods studied.

Group	Basal period (March–May)	Intervention period (June–February)	Post-intervention period (March–November)
1	35/162 (21.6)	81/545 (14.9)*	105/598 (17.6)
2a	22/53 (41.5)	56/158 (35.4)	67/187 (35.8)
2b	18/18 (100)	34/34 (100)	35/35 (100)
3	10/172 (5.8)	26/568 (4.6)	36/550 (6.5)
4a	4/32 (12.5)	20/163 (12.3)	26/145 (17.9)
4b	14/14 (100)	22/22 (100)	26/26 (100)
5a	51/74 (68.9)	110/226 (48.7)*	138/236 (58.5)**
5b	26/27 (96.3)	75/75 (100)	53/53 (100)
6	4/4 (100)	20/23 (87)	24/25 (96)
7	12/13 (92.3)	27/29 (93.1)	38/41 (92.7)
8	10/11 (90.9)	14/15 (93.3)	30/32 (93.8)
9	1/1 (100)	5/5 (100)	2/2 (100)
10	24/46 (52.2)	65/207 (31.4)*	92/186 (49.5)**

* Basal/intervention period difference $p < 0.05$.
** Intervention/post-intervention period difference $p < 0.05$.

Table 5
Asphyxia and Apgar <7 rates for the periods studied.

	Basal period	Intervention period	Post-intervention period	*p*
Asphyxia rate (number of cases/1000 live births)	3.13‰ (2/639)	2.83‰ (6/2122)	5.12‰ (11/2150)	ns
Apgar <7 rate (number of cases/1000 live births)	15.65‰ (10/639)	16.49‰ (35/2122)	16.74‰ (36/2150)	ns

Changes in the CS rates between the three periods studied are statistically significant in terms of *p*-value and relative risk. Parallel to these results, the CS rates in the groups of interest show a reduction from 39.4% in the basal period to 27.4% in the intervention period, rising again to 33.3% in the post-intervention period. These results are also statistically significant. In both the groups of interest and the overall CS rates, post-intervention period rates were lower than rates in the basal period (Table 3). The RRs after introducing the interventions of 0.71 in the overall CS rate and 0.69 in the groups of interest represent, respectively, 217 and 136 fewer CS during the intervention period. Fig. 1 illustrates the monthly total CS rates during the periods studied.

When we look at the results stratified by the TGCS, most groups show a reduction in the CS rate between the basal and intervention periods, but only groups 1, 5a and 10 reached a statistically significant reduction ($p < 0.05$) (Table 4). The results of the TGCS between the intervention and the post-intervention periods show an ascending trend in CS rates (group 5a and 10 with $p < 0.05$). The CS rates of each TGCS remained unchanged between the basal and post-intervention period. The relative size of each group during the three periods studied remained unaffected during the studied periods (data not shown). No statistical differences in the rates of neonatal asphyxia and Apgar scores <7 were found in the three periods studied (Table 5).

4. Comments

This study shows that the implementation of an audit system through the TGCS and staff feedback is an effective and safe method to reduce the CS rates. The application of the proposed interventions in a Chilean Public Hospital resulted in a 27.9% reduction in the overall CS rate without modifying the asphyxia and Apgar <7 rates. The RR of 0.71 represents more than 200 CS not performed during the intervention period. The three groups showing the greatest effect from the intervention were nulliparous patients with single cephalic term pregnancy in spontaneous labor, multiparous patients with one previous CS single cephalic term pregnancy, and all single cephalic preterm pregnancies.

Consistent with the results of the present study, the implementation of medical auditing through the TGCS and feedback by other authors resulted in a decline in the overall CS rate from 12 to 9.5% in the Pembury Hospital in the United Kingdom [20] and from 44.9 to 37.1% in the Clinical Hospital of the Universidad de Chile [21]. Moreover, a meta-analysis assessing the effectiveness of different interventions on CS rates found that audit and feedback, by different means, was effective in reducing CS rates by 13% with a pooled RR of 0.87 (95% CI 0.81–0.93) [13]. Both figures are similar to those reported in this trial.

A methodological strength of this study is that it incorporates a post-intervention follow-up of nine months. As far as we know, there are no similar experiences previously published. During this period, increases in CS rates among the groups of interest and overall were statistically significant, but a difference remained between the pre- and post-intervention periods. We do not address whether this observable difference will endure. Applying a phenomenon described by economic sciences as the Hawthorne effect [22], which states that when an individual or group of people are aware of being observed their productivity increases, and that the permanence of this effect requires continuous surveillance; we believe that this difference will not persist.

Among the limitations of this study that merit mention, we find the following. First, we are unable to disentangle which components of the intervention were associated with the observed change in CS rates. Second, we did not use a comparator group to evaluate other factors that may have influenced changes. Last, an interrupted time series methodology has the potential bias that it does not control all variables, including the fact that seasonal variations can influence the results. We tried to correct this and other potential biases by establishing long periods of observation, large number of patients and by using a study design called an "ABA" model, in which a dependent variable is observed before, during and after withdrawing the intervention [23]. The fact that the level of the dependent variable changed in response to this manipulation increases the confidence that changes are due to the manipulation of the variable.

This study was designed in steps, in which the first period allowed us to identify the main groups contributing to the overall CS rate, so-called "groups of interest" that represent more than 50% of the cesarean sections in our maternity ward. Similar results are reported in the literature [7,16,17,24]. With respect to the relative sizes of the groups, it is notable that in our figures, the number of nulliparous and multiparous women with single, term, cephalic pregnancies subjected to an elective CS was three times bigger, and the rate of multiparous patients with a previous CS was 50% higher, than in other reports from national and foreign centers [15,24]. This means that our population is underexposed to labor and has more patients with a previous CS, which are possible explanations for our higher global CS rate in the basal period.

In conclusion, auditing by the TGCS and providing feedback is an effective, safe, economical and easy-to-implement strategy to reduce the CS rate. Its diffusion would allow reductions in the cesarean section rates and provides mechanisms to compare data within and between individual entities. We believe that complementary studies are required to corroborate this information, such as the performance of a cluster randomized trial.

Authorship

All authors have fulfilled condition required for authorship.

Conflict of interest

The authors have no conflicts of interest to declare.

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