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Women and Birth

Comparing the course of anxiety in women receiving their first or repeated caesarean section: A prospective cohort study

N.K. Schaal[a,*], T. Fehm[b], O.T. Wolf[c], P. Gielen[a], C. Hagenbeck[b], M. Heil[a], M. Fleisch[d], P. Hepp[b,d]

[a] Department of Experimental Psychology, Heinrich-Heine-University, Düsseldorf, Germany
[b] Clinic for Gynecology and Obstetrics, Heinrich-Heine-University, Düsseldorf, Germany
[c] Department of Cognitive Psychology, Institute of Cognitive Neuroscience, Faculty of Psychology, Ruhr-University Bochum, Germany
[d] Clinic for Gynecology and Obstetrics, HELIOS University Clinic, Wuppertal, University Witten/Herdecke, Germany

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ABSTRACT

Background: Around 30% of births are through caesarean section and repetition rates for receiving a caesarean section are high.
Aim: The aim of the prospective study was to compare the course of anxiety in women undergoing their first caesarean section and women experiencing a repeated caesarean section.
Participants: 304 women with an indication for an elective caesarean section took part. 155 received their first caesarean section and 149 received a repeated caesarean section.
Methods: In order to measure the course of anxiety on the day of the caesarean section subjective anxiety levels were measured and saliva samples for cortisol determination were taken at admission, during skin closure and two hours after the surgery. Blood pressure and heart rate were documented at skin incision and skin closure.
Results: Women experiencing their first caesarean section displayed significantly higher anxiety levels compared to women with a repeated caesarean section. Scores of the STAI-State and visual analogue scale for anxiety differed significantly at admission ($p = .006$ and $p < .001$) and heart rate and alpha amylase levels were significantly higher at skin closure ($p = .027$ and $p = .029$).
Conclusion: The results show that previous experience with a caesarean section has a soothing effect. The study aims to sensitize surgeons, anesthetists, nurses and midwives when treating women receiving a caesarean section and encourage them to incorporate soothing interventions, especially for women receiving their first caesarean section to reduce anxiety levels and consequently improve postoperative recovery and patients' satisfaction.

Statement of significance

Problem or issue
A previous caesarean section is a strong predictor for the need of another caesarean section but research looking at the psychological differences between a first and repeated CS is lacking.

What is already known
High preoperative anxiety levels before a caesarean section have been shown to be linked to slower recovery from the caesarean section, higher post caesarean pain levels and reduced satisfaction. In other areas of medicine research has shown that experience with a specific operation or anesthesia method reduces anxiety levels when going through the same procedure again

What this paper adds
Women experiencing their first caesarean section displayed significantly higher anxiety levels compared to women with a repeated caesarean section. Therefore, previous experience with a caesarean section has a soothing effect. The results should sensitize surgeons, anesthetists, nurses and midwives when treating women receiving a caesarean section and encourage them to incorporate soothing interventions, especially for women receiving their first caesarean section to reduce anxiety levels and consequently improve postoperative recovery and patients' satisfaction.

* Corresponding author at: Heinrich-Heine-University Düsseldorf, Department of Experimental Psychology, Universitätsstraße 1, 40225, Düsseldorf, Germany.
E-mail address: nora.schaal@uni-duesseldorf.de (N.K. Schaal).

1. Introduction

The birth of a child is a significant life event and women may experience a variety of emotions including anxiety.[1–3] It has been shown that antenatal anxiety is related to low birth weight infants[4] as well as to more frequent requests of pain relief during vaginal deliveries and higher requests for cesarean sections.[5,6] To date, about 30% of the deliveries in many developed countries are through caesarean section (CS).[7–10] The CS is therefore the most common surgery in gynecology and widely seen as a routine procedure.[11] However the physical detriments for the women are part of everyday consent and further also psychological side effects accompany this intervention.[12] Additionally, high preoperative anxiety levels before a CS have been shown,[13,14] which are linked to slower recovery from the CS, higher post caesarean pain levels and reduced satisfaction.[15,16] There are several reasons why women are in need of aCS such as anomalies of the fetal presentation and cephalopelvic disproportion to name two of the most common ones.[11,17] One additional main indication for an elective CS is a uterine scar from a preceding CS.[17,18]

Even though it is possible to give birth vaginally after a CS, a previous CS is a strong predictor for another CS.[8,11] A study by Schemann et al.[18] showed that 82% of the women who gave birth by CS with their first child also received a CS for their second child. As this shows that the repetition rate of a CS is very high, it is surprising that research looking at the psychological differences between a first and repeated CS is lacking. In other areas of medicine, for example cataract surgery, research has shown that experience with a specific operation or anesthesia method reduces anxiety levels when going through the same procedure again[19,20] indicating that previous experience with the situation has a soothing effect on anxiety levels.

The aim of the present study was to compare the course of anxiety on the day of the CS in women undergoing their first or repeated CS in a between-group design. We expected that women receiving their first as opposed to repeated CS would show higher anxiety levels, especially before the surgery.

2. Methods

2.1. Participants

The final sample of the prospective cohort study consisted of 304 women, who were recruited at the Clinic for Gynecology and Obstetrics at the University hospital in Düsseldorf between March 2015 and August 2017. Only women with an indication for an elective CS were included. 155 received their first caesarean section (fCS) whereas 149 had already given birth by CS and therefore received a repeated caesarean section (rCS). Exclusion criteria were non-sufficient German language skills, known severe comorbidities of the patient or illnesses of the fetus (e.g. gastroschisis, severe malformation, and severe cardiac defects). The study was approved by the ethics committee of the Medical Department of the Heinrich-Heine-University in Düsseldorf and is registered in the "Deutsche Register Klinischer Studien". All participants gave informed written consent prior to participation. For the present study, 412 patients gave informed written consent. One hundred and eight women had to be excluded from the study because they did not fulfill the inclusion criteria anymore at birth (i.e. gave birth vaginally or received an emergency CS or a CS at preterm; N = 62) and due to technical difficulties (N = 46). Patients were part of a larger project, the SAMBA-Study [21].

2.2. Material and methods

To evaluate the patients subjective anxiety levels, the State-Trait-Anxiety Inventory (STAI)[22] and the visual analogue scale for anxiety (VAS-A) were used. The STAI is an introspective questionnaire, which consists of two parts with 20 questions each evaluating general tendencies towards anxiety (STAI-Trait) on the one hand and anxiety levels induced temporarily by a specific situation (STAI-State) on the other hand. With the VAS-A participants can indicate their subjective anxiety level by making a cross on a continuous 10 cm line between two end-points (i.e. 0 = not at all anxious to 10 = extremely anxious). Saliva samples were collected in order to determine cortisol and alpha-amylase levels as two proxy measures of stress. Hereby, salivary cortisol is a marker of the activation of the hypothalamic-pituitary-adrenal axis, whereas salivary alpha-amylase is an indirect marker of the autonomic activity.[23] For the saliva samples, patients had to thoroughly insalivate a cotton swab given to them by the midwife in charge. The saliva samples were kept frozen at −20° until analyzed following the methods described elsewhere.[24] Heart rate and blood pressure values were obtained at skin incision as well as at skin closure. Heart rate and blood pressure values were taken from the anaesthesia records. Heart rate was measured using a pulse oximeter and blood pressure was measured with an automatic device applying the Riva-Rocci method.

At the preoperative assessment, around fourteen days before the scheduled CS, patients were offered participation. After signing the informed written consent form on the day of the preoperative assessment appointment approximately two weeks before the CS, they filled in the STAI-Trait questionnaire. On the day of the CS the women were asked to fill in the STAI-State questionnaire as well as the VAS-A and to give a saliva sample at the following three time points: at admission in the morning of the CS (T1), during skin closure (T2) and two hours after the end of the surgery (T3). Heart rate and blood pressure measures were documented during skin incision (t1) and at skin closure (T2). As the participants were part of a larger project, the SAMBA-Study, which evaluated the effect of a music intervention during the CS, half of the women heard music during the CS in the operating theatre. The results of the effect of the music intervention are published in another paper of the group.[21]

2.3. Statistical analysis

For the statistical analysis SPSS 24[25] was used. Mixed design ANOVAs were conducted independently for the four dependent variables (STAI-state, VASA, amylase and cortisol) with time (admission vs skin closure vs 2 h post caesarean) as the repeated variable and group (fCS vs rCS) as the between-subject variable. For blood pressure and heart rate also mixed design ANOVAs were applied but here the repeated factor time only had two measures (skin incision vs skin closure). Greenhouse-Geisser corrections are reported when sphericity was violated. For the Greenhouse-Geisser correction the degrees of freedom are adjusted in order to produce a more accurate significance value.[26] Planned post-hoc independent or paired t-tests were applied where appropriate in order to disentangle significant interactions and main effects. Additionally, we calculated difference scores in order to reflect the change in anxiety levels from admission to skin closure in order to compare the change (i.e. increase or decrease of anxiety levels) between groups using an independent-samples t-test. Sample size estimation was calculated a priori using G*Power.[27]

As the patients also took part in the SAMBA study, investigating the effect of music during the CS, half of the sample listened to music during the CS (music group) while the other half did not (control group). A chi-square-test confirmed that there was no difference between the number of women in the music and control group for the fCS (N = 76/79) and rCS (N = 78/71) group (p = .484). Additionally, when taking the factor music-group (music vs control group) into account in the analysis, no significant group*music-group interactions were revealed.

3. Results

3.1. Characteristics of the study sample

The mean ages were 32.3 (SD = 5.4) for the fCS group and 34.9 (SD = 5.2) for the rCS group The mean gestation age was 38 + 3 (SD = 8 days) for fCS group and 38 + 2 (SD = 7 days) for the rCS group.

An independent-samples t-tests revealed that the two *groups* (fCS vs rCS) differed regarding the age of the women, $t(300) = 4.32$, $p < .001$. Women receiving their fCS (M = 32.3 ± 5.4) were significantly younger than the rCS group (M = 34.9 ± 5.2). The duration of the operation was significantly longer in the rCS group (M = 46.8 min ± 10.57) compared to the fCS group (M = 38.8 min ± 8.75), $t(300) = 7.24$, $p < .001$. An independent-samples t-test for STAI-Trait showed a non-significant result for the factor *group*, $t(270) = 1.28$, $p = .202$.

Regarding the health outcome of the mothers and newborns, the two groups did not differ regarding APGAR at 5 min. and arterial pH values of the newborn (p-values > .320) or maternal hemoglobin levels after the caesarean (p = .072).

In the first CS group 40 women received a CS because of breech position of the fetus, 40 women because of maternal reasons (i.e. placenta previa, diabetes), 16 women because of fetal reasons (i.e. macrosomia) and 59 women received a CS on patients request. In the repeated CS group the indication for a CS was breech position for 11 women, maternal reasons for 9 women, fetal reasons for 3 women and 126 received a caesarean section on patients request after information was given regarding the risks of vaginal births after a previous CS.

An Overview of the characteristics and dependent variable s with mean values and standard deviations are given in Table 1.

3.2. Subjective measures

For the STAI-State scores the mixed-design ANOVA revealed a significant main effect for *time*, $F(1.79, 456.76) = 460.43$, $p < .001$, $\eta p^2 = .644$, a significant effect of *group*, $F(1, 254) = 4.12$, $p = .043$, $\eta p^2 = .016$ and a significant *time*group* interaction, $F(1.79, 456.76) = 4.93$, $p = .010$, $\eta p^2 = .019$. Post-hoc paired samples t-tests showed that STAI-State scores significantly declined from admission (M = 48.13 ± 11.21) to skin closure (M = 32.96 ± 7.95) as well as from skin closure to 2 h post OP (M = 30.27 ± 6.54) [p-values < .001]. Independent-samples t-test for STAI-state showed a

significant result for the factor *group* at admission, $t(254) = 2.80$, $p = .006$, whereas the difference between groups were non-significant at skin closure and 2h post CS (p-values > .626). Women receiving their fCS showed significantly higher STAI-state scores at admission (M = 49.86 ± 10.78) compared to women receiving a rCS (M = 46.04 ± 11.10). At skin closure and 2h post op the scores were comparable (see Fig. 1A). Additionally an independent-samples t-test with the change of STAI-state (STAI-state at admission – STAI-state at skin closure) as the dependent variable showed a significant difference $t(254) = 2.42$, $p = .016$ indicating that the women in the fCS showed a significant higher reduction (M = −16.43 ± 9.86) of anxiety from admission to skin closure compared to the rCS group (M = −13.33 ± 10.57).

Table 1
Overview of characteristics and dependent variables (Mean ± standard deviation).

	First CS	Repeated CS	p-Value
Age	32.3 ± 5.4	34.9 ± 5.2	<**.001**
Duration of surgery	38.8 ± 8.75	46.8 ± 10.57	<**.001**
STAI-Trait	37.39 ± 8.76	36.06 ± 8.42	.202
HB post surgery	10.96 ± 1.21	11.22 ± 1.25	.072
APGAR 5 min.	9.75 ± .66	9.82 ± .62	.320
PH arterial	7.32 ± .52	7.32 ± .46	.485
STAI-State T1	49.86 ± 10.78	46.04 ± 11.10	**.006**
STAI-State T2	33.31 ± 7.81	32.82 ± 8.34	.626
STAI-State T3	30.47 ± 6.32	30.12 ± 6.99	.675
State decrease T2-T1	−16.43 ± 9.86	−13.33 ± 10.57	**.016**
VAS-A T1	5.66 ± 2.53	4.34 ± 2.80	<**.001**
VAS-A T2	1.58 ± 1.55	1.42 ± 1.49	.455
VAS-A T3	.92 ± 1.08	.79 ± 1.13	.364
VAS-A decrease T2-T1	−4.08 ± 2.65	−2.98 ± 2.62	**.002**
sAA T1	26.69 ± 31.53	23.62 ± 22.48	.522
sAA T2	186.57 ± 185.55	123.41 ± 137.46	**.029**
sAA T3	91.46 ± 80.05	100.92 ± 128.18	.607
sAA increase T2-T1	159.88 ± 177.69	99.79 ± 134.86	**.031**
Cortisol T1	14.57 ± 8.01	15.54 ± 8.27	.430
Cortisol T2	28.85 ± 15.42	29.67 ± 15.63	.736
Cortisol T3	13.67 ± 7.90	15.05 ± 8.21	.258
Heart rate t1	89.69 ± 19.92	91.18 ± 17.80	.483
Heart rate T2	80.97 ± 13.82	77.17 ± 14.18	**.027**
Systolic RR t1	133.66 ± 16.00	132.33 ± 16.16	.495
Systolic RR T2	120.83 ± 11.75	122.45 ± 13.34	.285
Diastolic RR t1	72.40 ± 10.01	71.02 ± 9.92	.255
Diastolic RR T2	64.04 ± 9.05	65.42 ± 9.08	.208

CS: caesarean section; STAI: State-Trait Anxiety Inventory; HB: Hemoglobin; APGAR: Appearance, Pulse, Grimace, Activity, Respiration; PH: hydrogen ion concentration; T1: at admission; T2: at skin closure; T3: 2 h post surgery; VAS-A: visual analogue scale for anxiety; sAA: salivary alpha amylase; t1: at skin incision; RR: blood pressure.
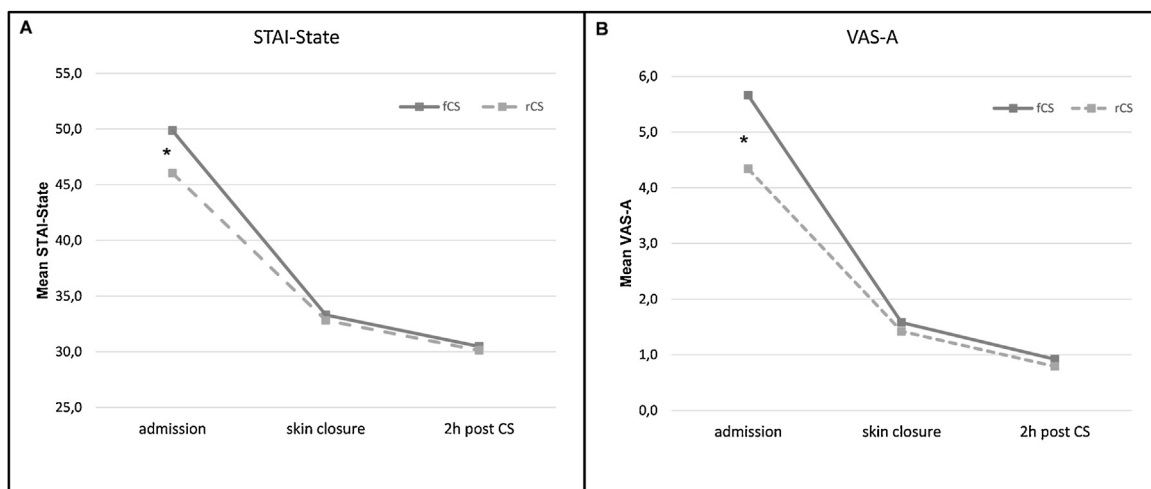

Fig. 1. Subjective anxiety measures. Women receiving their first CS section display higher preoperative anxiety levels measured by STAI-State (A) and VAS-A (B) at admission compared to women receiving a repeated CS. * p < .01.

The analysis with VAS-A as the dependent variable revealed a significant main effect of *time*, $F(1.41, 305.11) = 396.49$, $p < .001$, $\eta p^2 = .646$, a significant effect of *group*, $F(2, 217) = 8.07$, $p = .005$, $\eta p^2 = .036$ and a significant *time*group* interaction, $F(1.41, 305.11) = 8.48$, $p = .001$, $\eta p^2 = .038$. Paired-sample t-tests revealed a significant successive decline also for VAS-A scores (admission: 5.02 ± 2.76, skin closure: 1.53 ± 1.54, 2 h post OP = .83 ± 1.09) [p-values < .001]. Additionally, independent-samples t-test for VAS-A also exposed a significant result for the factor *group* at admission, $t(217) = 3.61$, $p < .001$ whereas the difference between groups were non-significant at skin closure and 2h post op (p-values > .36). Women receiving their fCS showed significantly higher VAS-A scores at admission ($M = 5.66 \pm 2.53$) compared to women receiving a rCS ($M = 4.35 \pm 2.80$). At skin closure and 2h post op the scores were comparable (see Fig. 1B). Additionally an independent t-test with the slope of reduction of VAS-A scores (VAS-A at admission – VAS-A skin closure) as the dependent variable showed a significant difference $t(217) = 3.08$, $p = .002$ (fCS: $M = -4.08 \pm 2.65$) and rCS: $M = -2.98 \pm 2.62$).

3.3. Physiological measures

For heart rate a mixed-factors ANOVA with *group* and *time* (begin surgery vs skin closure) revealed a significant main effect of *time*, $F(1266) = 109.27$, $p < .001$, a non-significant effect of *group* and a significant *group*time* interaction, $F(1266) = 5.93$, $p = .016$. A paired sample t-test showed a significant decrease in heart rate from the beginning of the surgery to skin closure, $t(266) = 10.23$, $p < .001$. Independent-samples t-tests revealed that at the beginning of the operation the groups display comparable heart rates (p = .483) whereas at skin closure the women receiving a fCS displayed higher heart rates ($M = 80.97 \pm 16.92$) than the rCS group ($M = 77.17 \pm 14.18$), $t(266) = 2.22$, $p = .027$ (Fig. 2B).

For blood pressure the systolic and diastolic values significant main effects of *time* were revealed (p-values < .001) respectively, whereas all group comparisons as well as interaction-effects were non-significant (p-values > .114).

The analysis with amylase levels as the dependent variables revealed a significant main effect of *time*, $F(2, 272) = 60.80$, $p < .001$, $\eta p^2 = .309$, a non-significant effect of *group*, $F(1, 136) = .16$, $p = .689$ and a significant *time*group* interaction, $F(2, 272) = 3.32$, $p = .038$. Paired-samples t-tests revealed an increase in amylase levels from admission to skin closure [$t(132) = 9.41$, $p < .001$ as well as a significant decrease from skin closure to 2h post CS [$t(132) = 4.71$,

$p < .001$]. Independent-samples t-tests detected a significant result for the factor *group* at skin closure, $t(131) = 2.21$, $p = .029$ whereas the groups did not differ at admission nor 2h post OP (p-values > .522). At skin closure, the group receiving a fCS showed higher levels of amylase ($M = 186.57 \pm 185.55$) compared to the rCS group ($M = 123.41 \pm 137.46$). Also the comparison of the change in amylase levels from admission to skin closure was significantly different between groups, $t(131) = 2.18$, $p = .031$ (Fig. 2A).

The analysis with cortisol levels as the dependent variable and group as the between factors independent variable revealed a significant main effect of *time*, $F(2, 346) = 160.37$, $p < .001$, $\eta p^2 = .481$, a non-significant effect of *group*, $F(1, 173) = .72$, $p = .398$ and a non-significant *time*group* interaction, $F(2, 346) = .04$, $p = .961$.

4. Discussion

The aim of the present study was to compare anxiety levels on the day of the CS between women who receive their fCS and women receiving a rCS. The here presented results of the subjective values support the hypothesis that women receiving their fCS are significantly more anxious than the group of women with rCS, especially before the operation. The influence of the factor group on objective values showed that during their first compared to repeated CS women display higher heart rate and salivary alpha amylase levels at skin closure. Taken together, the results revealed that women receiving their fCS are more anxious than women who had experienced a CS before.

The results presented here, show that women receiving a CS are very anxious before the operation and then show a decline on subjective anxiety levels to skin closure when the baby is born. These results are in line with previous research.[13,14,28] In the light of the present research question, more emphasis should be given to the result that women who receive their fCS showed significantly higher subjective anxiety levels at admission in the morning of the CS and higher amylase levels and heart rates at skin closure than women with a rCS. This implies that previous experience with this situation has a soothing effect on anxiety levels. This is in line with prior research, which also showed that experience with a specific operation or anesthesia method has a positive effect on the physical state of the patient when he or she undergoes the same procedure again.[19,20,29] To the best of our knowledge only in one other study[13] it has been investigated as a secondary outcome whether there is a difference in anxiety levels depending on whether the women are receiving their first or repeated CS. In line
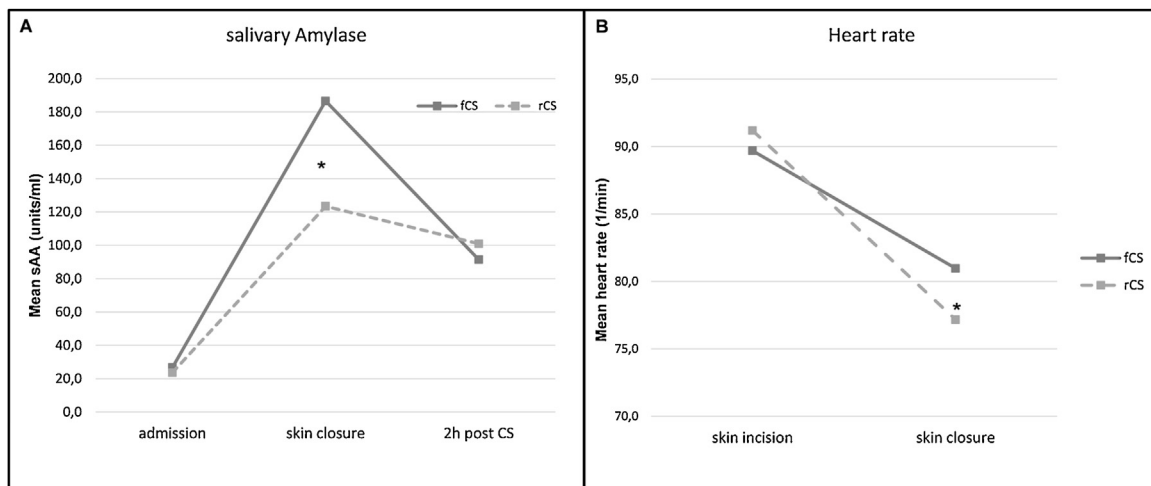

Fig. 2. Objective anxiety measures. Alpha amylase levels (A) and heart rates (B) were significantly higher at skin closure in women receiving their first CS compared to women with a repeated CS. * p < .05.

with our results, the pilot study by Wyatt et al.[13] also revealed that subjective anxiety was positively influenced by experience.

A study by Kindler et al.,[29] which evaluated patient characteristics that predispose high anxiety before receiving anaesthesia, showed that the anxiety dimension 'fear of the unknown' correlated strongest with STAI-State and VAS scores measuring preoperative anxiety. This is also in accordance with Mason[30] who postulated that the elements novelty and uncertainty are central stressors in the perception of specific situations. In this respect, our result of lower STAI-State and VAS scores at admission before the CS in the group receiving their rCS corresponds well, as this anxiety dimension is less prominent in mothers-to-be who already gave birth by CS, as they are aware of the procedure of the operation. In other medical contexts, studies have also shown that previous experience with a specific operation has a soothing effect on anxiety levels.[19,31]

Most studies showing a positive effect of previous experience with anaesthesia or a specific operation on anxiety only evaluated subjective measures.[20,29,31] The present study also included physiological markers by measuring salivary cortisol and amylase as well as heart rate and blood pressure. Women receiving their fCS displayed increased amylase levels and higher heart rates compared to the rCS group at skin closure whereas no influence of previous experience could be revealed for blood pressure and cortisol levels. This indicates that a soothing effect of previous experience with the situation may only be detected in some of the objective stress measures. Related to this, also a study by van Stegeren et al. revealed a significant increase only on alpha amylase levels and not cortisol levels in response to a mildly stressful aversive picture rating task[32] indicating that amylase might be a more sensitive marker in detecting differences in stress and anxiety. For the amylase levels in our study the measured peak was at skin closure and here a soothing effect of caesarean experience was revealed. The inclusion of salivary amylase as a stress marker during operations has not been well investigated to date. In the context of a CS, Guglielminotti et al.[33] revealed that pregnant women display significantly increased amylase levels in the operating theatre just before the CS compared to amylase levels measured several hours prior on the ward, which fits well to the course of amylase levels from our study. The maybe surprising finding that objective markers in the groups mainly differ at skin closure could be explained by the different time points. For heart rate the first measurement was taken at skin incision immediately before the start of surgery. This intense moment of tension and high anxiety seems not to be influenced by experience. As the presented results of the effect of previous experience with a CS on physiological markers of anxiety draws a complex picture, it would be desirable to investigate this further in future research including more time points of measurement in order to receive a more in depth picture of the course of anxiety in physiological parameters.

As studies have shown that preoperative anxiety is negatively linked to maternal satisfaction, post caesarean pain levels as well as recovery after the CS,[15,16] it is desirable to keep anxiety levels before and during the operation low. The results of the present study highlight that women receiving their fCS are especially anxious, indicating that these women need particular support before and during the operation. The medical team should be aware of this and it is advisable that soothing interventions before the CS such as listening to music[34,35] or using a stress ball[36] should be offered especially to mothers-to-be receiving their fCS. Additionally, it should be emphasized that emotional support by the women's partner or another close relative before and during the CS is an important factor which positively influences perceived anxiety and which improves maternal satisfaction.[15]

The present prospective study is based on a large sample of 304 women and examines anxiety on the day of the CS using several time points and a variety of subjective and objective measurements of anxiety and stress. Hence, the study gives a detailed overview of the course of anxiety on the day of the CS. A limiting factor of the study is that we did not include a time point of measurement of saliva samples, heart rate and blood pressure as well as VAS-A and STAI-State when the women entered the operating theatre. As it can be speculated that this is the most anxious moment of the CS,[33] it would be of interest to explore how experience would influence anxiety levels to this end in a future study.

5. Conclusion

The present study revealed that women receiving their fCS are more anxious than women who had experienced a CS before. This should sensitize surgeons, anesthetists, nurses and midwives when treating women receiving a CS. The results should encourage the medical team to integrate soothing interventions especially for women receiving their fCS in order to improve maternal satisfaction and recovery.

Conflict of interest

Ethical approval

Funding sources

Author contributions

Research data

The data is available on request from the corresponding author.

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