Master's thesis

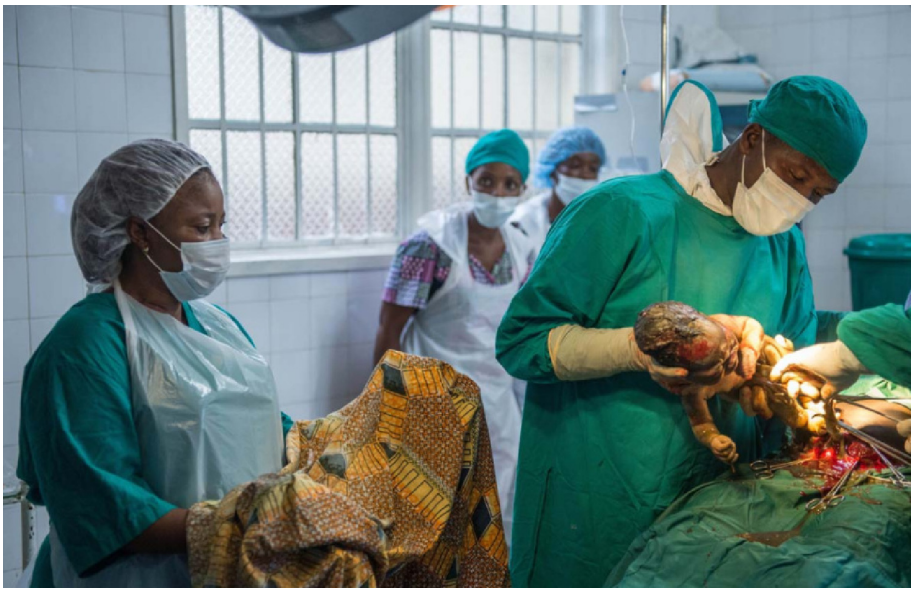
NTNU
Norwegian University of Science and Technology
Faculty of Medicine and Health Sciences
Department of Clinical and Molecular Medicine

Helena Bonde
Nora Iminza Tjåland

Chronic post-surgical pain one year after caesarean section in Sierra Leone

A prospective observational cohort study

Master's thesis in medicine
Supervisor: Alex van Duinen and Håkon A. Bolkan
January 2021



CapaCare.org

NTNU
Norwegian University of Science and Technology

CapaCare

Helena Bonde
Nora Iminza Tjåland

Chronic post-surgical pain one year after caesarean section in Sierra Leone

A prospective observational cohort study

Master's thesis in medicine
Supervisor: Alex van Duinen and Håkon A. Bolkan
January 2021

Norwegian University of Science and Technology
Faculty of Medicine and Health Sciences
Department of Clinical and Molecular Medicine

NTNU
Norwegian University of
Science and Technology

Introduction

Caesarean section (CS) is one of the most commonly performed surgical procedures globally. In the last decades there has been a considerable increase in CS rates, Sub-Saharan Africa not excluded. In 2015, the global total of CS was estimated to be 29.7 million [1], 6,8 million more than in 2012 [2].

With an increasing number of CSs being performed, the number of people living with the adverse effects of the procedure is also growing. Abdominal pain, scarring and a magnified risk of complications in subsequent pregnancies constitutes a part of this [3], and so, CS should only be performed with the appropriate indication, which requires more research and knowledge on the benefits and disadvantages of the procedure.

Chronic post-surgical pain (CPSP) affects approximately 10% of surgical patients [4]. It is defined as pain after surgery which persists for at least three months [4]. Weibel et al. al. [5] found a CPSP incidence of 11.2% one year after a CS. Because of the high rate of CS, such an incidence constitutes millions of women worldwide. The chronic nature of the condition makes the impact even more consequential, and even a small reduction of risk of CPSP may have a significant effect on post-CS morbidity.

Currently, studies on associated risk factors for CPSP after CS provide diverging answers. The systematic review by Sun et al. [6] showed that choice of surgical and anaesthetic methods may impact the risk of CPSP. These perioperative factors are particularly interesting because identifying them may lead to a change in obstetric practice. In a systematic review in 2019 [7], no conclusion could be drawn regarding risk factors, due to weak evidence.

The literature on CPSP from low-income countries with a high maternal and perinatal death rate like Sierra Leone [8] is still scarce. Subsequently, the knowledge regarding risk factors like perinatal death, surgical task sharing, and ketamine anaesthesia is limited. These were examined alongside other perioperative risk factors.

The primary aim of this prospective observational cohort study was to assess the occurrence of CPSP in Sierra Leonean women one year after their CS, together with associated risk factors. The secondary aim was to determine the relationship of CPSP with quality of life.

Methods

Study setting

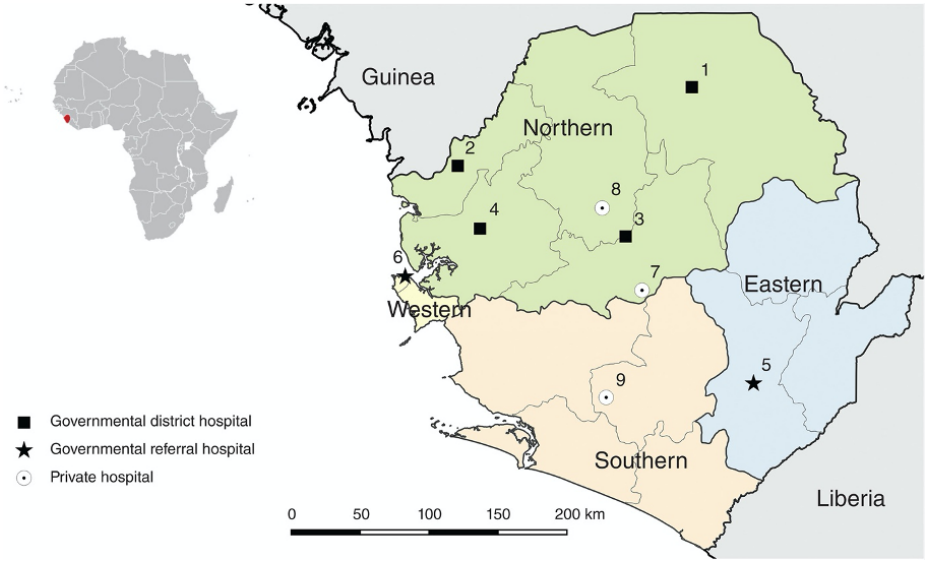
Sierra Leone is still recovering from the civil war that ended in 2002. With a population of approximately 7.5 million, it is one of the world's poorest countries and has one of the world's highest recorded maternal mortality ratios with 1,120 maternal deaths per 100,000 live births [9]. Increasing the surgical capacity of CS for pregnant women is crucial for improving the access for women in need for obstetric care. In Sierra Leone, the CS was as low as 2.9% in 2016 [10]. WHO states that a CS rate of 10-15% should be adopted, and that lower rates are associated with higher maternal and child mortality [11].

In 2011, CapaCare initiated a surgical training programme in Sierra Leone, in cooperation with the Ministry of Health and Sanitation. The programme enables associate clinicians (AC) to perform surgical procedures, such as CS [12]. Training of ACs makes the operation more available – surgical capacity in Sierra Leone has increased by nearly 40% since 2012, mainly because of AC activity [13]. The programme is evaluated by including women in a study that will follow the women for five years. The first follow-up was done 30 days after the CS [14].

Design and methodology

This was a prospective observational cohort study of women who had a CS in Sierra Leone. The study is part of the 5-year follow-up of the cohort mentioned above. CS patients from any of the nine hospitals in Sierra Leone (figure 1) where both ACs and MDs performed caesarean section in 2016-2017 were invited to participate in the study. Patients were excluded if the foetus weighed less than 500 g or if essential data were missing. The patients were given an oral explanation of the study. Before, or as soon as possible after the procedure, written consent was obtained.

Figure 1



Nine hospitals in Sierra Leone where both medical doctors and associate clinicians performed caesarean section. 1, Kabala Governmental Hospital; 2, Kambia Governmental Hospital; 3, Magburaka Governmental Hospital; 4, Port Loko Governmental Hospital; 5, Kenema Governmental Hospital; 6, Princess Christian Maternity Hospital, Freetown; 7, Lion Heart Medical Centre; 8, Magbenteh Community Hospital; 9, Serabu Catholic Hospital

Data collection

Follow-up data was collected approximately one year after the CS, from September 2017 till December 2018. Home visits were carried out by trained data collectors, supervised by the primary investigator, using case report forms and the quality of life form SF-36 [15]. Abdominal pain was detected with an open question, and follow-up questions to assure that the pain debuted post-surgery and was not related to menstruation. Collected data was entered into a spreadsheet database.

Outcomes

The primary outcome was the rate and risk factors of CPSP approximately one year after a CS. In this study, CPSP was defined as persisting pain in the abdominal area that was not present before the CS, and not related to menstruation.

The examined risk factors were emergency CS, previous CS, ketamine anaesthesia, transverse vs. midline incision, hysterectomy, experience level and perinatal death. Perinatal deaths were defined as the sum of fresh stillbirths and deaths during the first seven days after birth.

The risk factors examined in this study were selected on the basis of which data was available. Therefore, the presence of acute abdominal pain was not examined. Likewise, data on preoperative risk factors like depression and chronic pain had not been collected.

The secondary outcome was the women's quality of life and its relationship with CPSP. The patients' views on their general health were measured using the general health score of SF-36.

Statistical analysis

A univariate analysis was performed in order to provide an outline of the study population. The association of risk factors and reported abdominal pain is assessed as descriptive data and p-values, determined with the chi-squared test. In order to reduce the risk of false positive results in the analysis, the number of risk factors were limited to include only those considered most important. Crude and adjusted odds ratios were only calculated for risk factors that were proven to be statistically significant. The adjusted odds ratio was calculated using logistic regression, adjusting for the data collector and education level of the women. Finally, the quality of life was measured with the mean of SF-36 general health score in the women with and without abdominal pain, and the association between pain and general health score was tested with an independent-samples T-test, assuming unequal variances.

Ethics

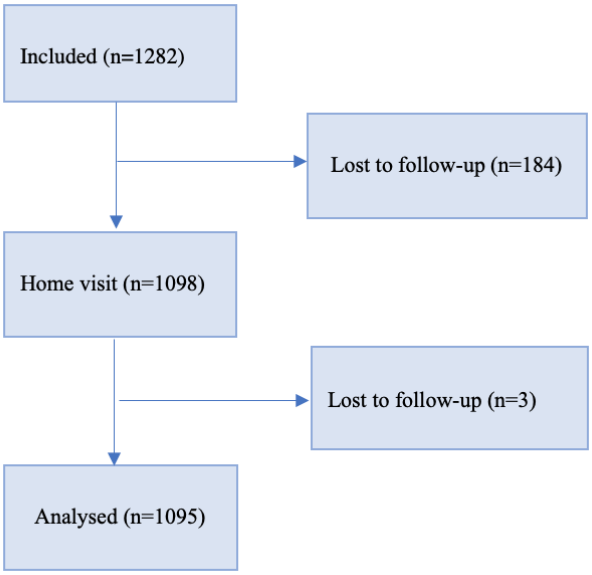
This study has approval from the Sierra Leone Ethics and Scientific Review Committee and the Regional Committees for Medical and Health Research Ethics in central Norway (ethical clearance number 2016/1163) and registered at the International Clinical Trial Registry (ISRCTN16157971).

Results

Nine hospitals took part in the study, and a total of 1282 CSs were performed either by an MD or an AC. One year after, 1098 patients were visited at home. Two maternal deaths were identified, and one was classified as missing data. Therefore, data from 1095 subjects were analysed (figure 2).

Figure 2

Study flow chart



In the univariate analysis, patient and operative characteristics were similar in the patients operated on by MDs and ACs. Almost 40% of the women had no education, and the mean age at the time of the CS was 26 years. Approximately 40% of the patients received ketamine anaesthesia alone, and MDs performed additional hysterectomy almost three times as often as the ACs. The results are presented in table 1.

Table 1

Patient and operative characteristics

Time from CS to home visit (months, mean ± SD)	15.1 ± 2.1
Age (year, mean ± SD)	26 ± 6.4
Parity	
Primipara, n (%)	363 (33.2%)
Multipara, n (%)	603 (55.1%)
Grand multipara, n (%)	129 (11.8%)
Previous CS, n (%)	219 (20.0%)
One, n (%)	153 (14.0%)
Two, n (%)	55 (5.0%)
Three, n (%)	11 (1.0%)
Highest educational level	
None	414 (37.8%)
Primary	147 (13.4%)
Secondary	414 (37.8%)
Tertiary	113 (10.3%)
≥3 antenatal clinic visits	985 (90.0%)
Number of foetuses	
Single, n (%)	992 (90.6%)
Twin, n (%)	101 (9.2%)
Triplet, n (%)	2 (0.2%)
Planned operation, n (%)	155 (14.2%)
Indication group	
Antepartum haemorrhage	129 (11.8%)
Obstructed and prolonged labour	607 (55.4%)
Uterine rupture	47 (4.3%)
Foetal indication	73 (6.7%)
Previous CS	145 (13.2%)
Other	94 (8.6%)
Travel time to hospital	
≤2 hours	889 (81.2%)
>2 hours	197 (18.0%)
Experience level	
MD, (%)	708 (64.7%)
AC, (%)	387 (35.3%)
Anaesthesia	

Spinal anaesthesia, n (%) Ketamine, n (%)	666 (60.6%) 432 (39.5%)
Duration of surgery (minutes, mean ± SD)	38 ± 22
Incision Midline, n (%) Pfannenstiel, n (%) Unknown n (%)	 95 (8.7%) 998 (91.1%) 2 (0.2%)
Additional procedures Caesarean section only, n (%) Hysterectomy, n (%) B-Lynch suture, n (%) Bilateral tubal ligation, n (%)	 975 (89.0%) 30 (2.7%) 32 (2.9%) 58 (5.3%)
Blood loss > 600 mL, n (%) Unknown	244 (22.3%) 5 (0.5%)
Postoperative wound infection	36 (3.3%)
Perinatal death	205 (18.7%)

Primipara; first pregnancy, Multipara; previously given birth ≥2 times, Grand multipara; previously given birth ≥5 times

Primary outcome

The rate of CPSP one year after the CS was 11.7%.

Experience level was the only factor significantly associated with abdominal pain one year after the CS. The odds ratio was 1.856 (1.280-2.690), corresponding to a risk ratio of 1.718 (1.243-2.375). When adjusted for data collector and education level, the odds ratio was 1.455 (0.980-2.162).

Table 2

Factors associated with abdominal pain one year after CS

Possible risk factor	**Persistent pain, n (%)**	**P value**
Planned vs. emergency Planned (n=155) Emergency (n=940)	 20 (12.9%) 108 (11.5%)	0.612
Previous vs. no previous CS Previous CS (n=219)	 31 (14.2%)	0.204

No previous CS (n=876)	97 (11.1%)	
Ketamine anaesthesia		0.149
Ketamine (n=432)	43 (10.0%)	
Non-ketamine (n=663)	85 (12.8%)	
Transverse vs. midline incision		0.508
Transverse (n=998)	120 (12.0%)	
Midline (n=95)	8 (8.4%)	
Hysterectomy		0.776
Hysterectomy (n=30)	4 (13.3%)	
No hysterectomy (n=1065)	124 (11.6%)	
Experience level		0.001
MD (n=708)	66 (9.3%)	
AC (n=387)	62 (16.0%)	
Perinatal death		0.339
Perinatal death (n=205)	20 (9.8%)	
No perinatal death (n=890)	108 (12.1%)	

CS=Caesarean section, CI=Confidence interval, MD=Medical doctor, AC=Associate clinician

Secondary outcome

The women with abdominal pain regarded their general health as slightly poorer compared to the women without pain, scoring a mean of 82% in the SF-36 general health score, whereas the women without pain scored 86%. The p-value was 0.002.

Discussion

In this prospective cohort study, 11.7% of the women experienced abdominal pain approximately one year after CS. The experience level of the performing surgeon was the only significant risk factor of CPSP, with patients who were operated upon by ACs reporting pain more often than those who were operated upon by MDs. Having abdominal pain correlated with a slightly lower general health score in the SF-36 questionnaire.

The risk factors examined in this study were selected on the basis of which data was available. Therefore, the presence of acute abdominal pain was not examined. Likewise, data on preoperative risk factors like depression and chronic pain had not been collected.

Interpretation

The meta-analysis by Weibel et. al [5] found an incidence of CPSP of 11.2% one year after CS. Considering the inadequate health services available, one would expect a higher risk of pain in Sierra Leone. It is already known that the women in the cohort had low expectations of the surgery and were afraid to die [16]. It is possible that the women were content with having survived the surgery, and therefore diminished their problems. With almost 10% of the women having a midline incision, one would suspect more CPSP than in countries with a lower rate, because the midline incision is associated with adhesions, which is associated with maternal morbidity [17].

Other studies have found varying risk factors to be significantly associated with CPSP [18] or have not been able to conclude at all [7], which aligns with the findings of this study. It suggests that there are no clear risk factors of CPSP at this moment.

There are several possible explanations for the superiority of MDs to ACs with regard to CPSP. It could be that a medical degree benefits the surgical performance. However, when the data collectors were included in the multivariate analysis, the superiority of the MDs was no longer statistically significant. One of the data collectors reported more pain, and also interviewed a higher proportion of patients of ACs compared to the other two data collectors.

It should be noted that MDs outperformed ACs even though more complicated deliveries, which may be associated with more trauma, are generally assigned to MDs at a higher rate than to ACs.

In Van Duinen 2019, the same women were visited 30 days after the CS, and there were no differences in rate of postoperative pain between ACs and MDs [14]. This discredits the findings in this study, suggesting that the discovery may be coincidental.

Implications

The possible superiority of MDs to ACs found in this study underscores the importance of quality in training of ACs. However, these findings are far from incontestable, and more research is necessary. In the 5-year follow up of the same women, it is advisable to investigate the rate of CPSP once more, and to further standardise the questions about pain in order to avoid confounding. Additionally, future studies should include preoperative data, and data on acute postoperative pain, especially because in Sierra Leone, there are shortages of pain medication and pain management, resulting in poor postoperative analgesia [19]. In Husby 2019, women in Sierra Leone recounted severe pain following the surgery [16].

Strengths and limitations

The prospective study design is the greatest strength of this study. Compared to other similar studies on the subject of CPSP after CS, this study includes relatively many patients [20-28]. This study investigates a topic that has been given meagre scrutiny in scientific literature; the long-term effects pertaining to the use of associate clinicians.

One major limitation of this study was the variation in reported CPSP between data-collectors. The best way to analyse differences between patients would be randomisation of surgeons, but this was not possible due to ethical and logistic concerns. Lack of randomisation leads to the possibility of selection bias; there were differences between the complexity and emergency level of the surgeries between the AC and MD patients. Because the data collectors were not fully blinded, they may have been biased.

Conclusion

CPSP after CS is, with 11.7%, as common in Sierra Leone as in other countries, even with inadequate availability of health services. There are no clear risk factors of CPSP after CS. Use of ACs no longer statistically significant when adjusted for data collectors, and a standardisation of questions in the 5-year follow up might clarify the relationship between use of ACs and CPSP. CPSP barely affects the perceived general health in SF-36.

References

1. Boerma, T., et al., *Global epidemiology of use of and disparities in caesarean sections.* Lancet, 2018. **392**(10155): p. 1341-1348.
2. Molina, G., et al., *Relationship between cesarean delivery rate and maternal and neonatal mortality.* JAMA - Journal of the American Medical Association, 2015. **314**(21): p. 2263-2270.
3. Berghella, V., *Cesarean delivery: Postoperative issues*, C.J. Lockwood, Editor. 2020, UpToDate: Waltham, MA.
4. Geil, D., et al., *Chronified Pain Following Operative Procedures.* Dtsch Arztebl Int, 2019. **116**(15): p. 261-266.
5. Weibel, S., et al., *Incidence and severity of chronic pain after caesarean section: A systematic review with meta-analysis.* Eur J Anaesthesiol, 2016. **33**(11): p. 853-865.
6. Sun, K.W. and P.H. Pan, *Persistent pain after cesarean delivery.* International Journal of Obstetric Anesthesia, 2019. **40**: p. 78-90.
7. Yimer, H. and H. Woldie, *Incidence and Associated Factors of Chronic Pain After Caesarean Section: A Systematic Review.* J Obstet Gynaecol Can, 2019. **41**(6): p. 840-854.
8. The World Bank. *Mortality rate, neonatal (per 1,000 live births) - Sierra Leone*. 2019 [cited 2020 14.12.2020]; Available from: https://data.worldbank.org/indicator/SH.DYN.NMRT?locations=SL.
9. The World Bank. *Maternal mortality ratio (modeled estimate, per 100,000 live births) - Sierra Leone*. 2020 02.11.2020]; Available from: https://data.worldbank.org/indicator/SH.STA.MMRT?locations=SL.
10. Holmer, H., et al., *The rate and perioperative mortality of caesarean section in Sierra Leone.* BMJ Glob Health, 2019. **4**(5): p. e001605.
11. Betran, A.P., et al., *WHO Statement on Caesarean Section Rates.* BJOG, 2016. **123**(5): p. 667-70.
12. Bolkan, H.A., et al., *Safety, productivity and predicted contribution of a surgical task-sharing programme in Sierra Leone.* Br J Surg, 2017. **104**(10): p. 1315-1326.
13. Bolkan, H.A. *CapaCare Annual Activity Report - Surgical Training Programme*. 2018 [cited 2020 05.11.2020]; Available from: https://capacare.org/wp-content/uploads/2016/12/Annual-report-surgery-sierra-leone_2018_LR-1.pdf.
14. van Duinen, A.J., et al., *Caesarean section performed by medical doctors and associate clinicians in Sierra Leone.* Br J Surg, 2019. **106**(2): p. e129-e137.
15. RAND Medical Outcomes Study, *36-Item Short Form Survey Instrument (SF-36)*, in *RAND Medical Outcomes Study: Measures of Quality of Life Core Survey from RAND Health Care*, RAND Health Care, Editor. 2020, RAND Corporation,: 1776 Main Street, Santa Monica, California 90401-3208.
16. Husby, A.E., A.J. van Duinen, and I. Aune, *Caesarean birth experiences. A qualitative study from Sierra Leone.* Sex Reprod Healthc, 2019. **21**: p. 87-94.

17. Mooij, R., et al., *Association between surgical technique, adhesions and morbidity in women with repeat caesarean section: a retrospective study in a rural hospital in Western Tanzania.* BMC Pregnancy Childbirth, 2020. **20**(1): p. 582.
18. Sun, K.W. and P.H. Pan, *Persistent pain after cesarean delivery.* Int J Obstet Anesth, 2019. **40**: p. 78-90.
19. Lonnee, H.A., et al., *A survey of anaesthesia practices at all hospitals performing caesarean sections in Sierra Leone.* Acta Anaesthesiol Scand, 2020.
20. Jin, J., et al., *Prevalence and risk factors for chronic pain following cesarean section: A prospective study.* BMC Anesthesiology, 2016. **16**(1).
21. Kainu, J.P., et al., *Persistent Pain After Cesarean Delivery and Vaginal Delivery: A Prospective Cohort Study.* Anesth Analg, 2016. **123**(6): p. 1535-1545.
22. Koelewyn, A., et al., *Chronic pain after caesarean section.* International Journal of Obstetric Anesthesia, 2015. **24**: p. S7.
23. Liu, T.T., et al., *Chronic pain after caesarean delivery: an Australian cohort.* Anaesthesia and intensive care, 2013. **41**(4): p. 496-500.
24. Niklasson, B., et al., *Risk factors for persistent pain and its influence on maternal wellbeing after cesarean section.* Acta Obstet Gynecol Scand, 2015. **94**(6): p. 622-8.
25. Nikolajsen, L., et al., *Chronic pain following Caesarean section.* Acta Anaesthesiol Scand, 2004. **48**(1): p. 111-6.
26. Ortner, C., et al., *The short-formmcgill pain questionnaire-revised to evaluate persistent pain and surgery-related symptoms in healthy women undergoing a planned cesarean delivery.* Regional Anesthesia and Pain Medicine, 2014. **39**(6): p. 478-486.
27. Richez, B., et al., *The Role of Psychological Factors in Persistent Pain After Cesarean Delivery.* J Pain, 2015. **16**(11): p. 1136-46.
28. Wang, L.Z., et al., *Incidence and risk factors for chronic pain after elective caesarean delivery under spinal anaesthesia in a Chinese cohort: a prospective study.* Int J Obstet Anesth, 2018. **34**: p. 21-27.

NTNU
Norwegian University of
Science and Technology

CapaCare