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ORIGINAL RESEARCH ARTICLE

Risk of obstetric anal sphincter injury associated with female genital mutilation/cutting and timing of deinfibulation

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Abstract

Introduction: A greater risk of obstetric anal sphincter injury has been reported among African migrants in several host countries compared with the general population. To what degree female genital mutilation/cutting affects this risk is not clear. In infibulated women, deinfibulation prevents anal sphincter injury. Whether the timing of deinfibulation affects the risk, is unknown. This study aimed to investigate the risks of anal sphincter injury associated with female genital mutilation/cutting and timing of deinfibulation in Norway, and to compare the rates of anal sphincter injury in Somali-born women and the general population.

Material and methods: In a historical cohort study, nulliparous Somali-born women who had a vaginal birth in the period 1990–2014 were identified by the Medical Birth Registry of Norway and data collected from medical records. Exposures were female genital mutilation/cutting status and deinfibulation before labor, during labor or no deinfibulation. The main outcome was obstetric anal sphincter injuries.

Results: Rates of obstetric anal sphincter injury did not differ significantly by female genital mutilation/cutting status (type 1–2: 10.2%, type 3: 11.3%, none: 15.2% $P = 0.17$). The total rate of anal sphincter injury was 10.3% compared to 5.0% among nulliparous women in the general Norwegian population. Women who underwent deinfibulation during labor had a lower risk than women who underwent deinfibulation before labor (odds ratio 0.48, 95% confidence interval 0.27–0.86, $P = 0.01$).

Conclusions: The high rate of anal sphincter injury in Somali nulliparous women was not related to type of female genital mutilation/cutting. Deinfibulation during labor protected against anal sphincter injury, whereas deinfibulation before labor was associated with a doubled risk. Deinfibulation before labor should not be routinely recommended during pregnancy.

KEYWORDS
country of birth, female genital mutilation/cutting, migration, nulliparity, obstetric anal sphincter injury, Somalia, timing of deinfibulation

Abbreviations: CI, confidence interval; FGM/C, female genital mutilation/cutting; OASI, obstetric anal sphincter injury; OR, odds ratio.

1 | INTRODUCTION

Female genital mutilation/cutting (FGM/C) alters the anatomy in the vulva to various extents[1] (Figure 1). The degree to which this practice affects obstetric anal sphincter injury (OASI) in high-income countries remains unclear. While most studies from African countries have found a greater risk of OASI associated with FGM/C, in high-income countries, several studies have reported that OASI rates do not differ between women with and without FGM/C.[2,3] Findings in systematic reviews differ as to whether significant differences were detected.[4–6] Type 3 FGM/C (infibulation) appears to affect the risk of OASI the most.[4]

OASI is a serious complication of vaginal birth that may cause anal incontinence and pain. Nulliparity, instrumental birth, midline episiotomy and large birthweight are major risk factors.[7] Other reported risk factors, often related to those above, are maternal age, fetal position, fetal head circumference, Asian or African origin, prolonged second stage, shoulder dystocia and epidural analgesia.[8,9] The incidence in European countries varies significantly (0.1%–4.9%)[10] and has shown variation over time.[10–12] This variation mainly reflects changes related to obstetric care and clinical recognition of OASI rather than changes in risk factors.[7,12] In low- and middle-income countries, reported incidences vary from 0.1% to 15%, but for most of these countries, data are not available.[13] In several host countries, African migrants have a greater risk of OASI than the general population.[14–16] Population-based studies suggest that FGM/C is a risk factor, particularly type 3.[9,14,15] However, in studies investigating FGM/C and OASI in high-income countries, the results diverge.[17,18]

To prevent OASI and other complications in infibulated women, deinfibulation is recommended.[19] Whether the timing of this procedure before pregnancy, during pregnancy or during labor affects the risk, is uncertain. Results in previous studies vary and meta-analyses have not detected significant differences.[20] Current guidelines therefore recommend that the decision about timing should be based on contextual factors, such as women's preference and access to skilled healthcare.[19] Analyses of knowledge gaps in the care of women with FGM/C highlight a need for research into the timing of deinfibulation and obstetric outcomes.[2,19]

In this study we examined the risk of OASI associated with types of FGM/C, and with timing of deinfibulation, in a cohort of nulliparous Somali-born women who underwent vaginal birth in Norway.

Key message

High risk of obstetric anal sphincter injury among nulliparous Somali-born women in Norway was not related to type of female genital mutilation/cutting. Deinfibulation during labor was associated with lower risk than deinfibulation before labor.

In addition, we compared proportions of OASI among the Somali women compared with nulliparous women in the general population.

2 | MATERIAL AND METHODS

The Medical Birth Registry of Norway identified nulliparous Somali-born women who gave birth in South-East Norway from 1990 to 2014 by linkage to the National Population Registry. This cohort was described in a previous study of risk of cesarean section.[21] In the present study we included a subset of women who underwent vaginal birth. Figure 2 shows the inclusion process and reasons for not participating. Methods are described in greater detail in the previous study.[21] Data were collected by manual search of hospital medical and obstetric records, including records from general practitioners and community midwives.

To enable a comparison between outcomes in this cohort and the general population, we extracted nationwide aggregated data from all nulliparous women with a vaginal birth from the Medical Birth Registry of Norway in the same time period. The outcomes included were the occurrence of OASI, episiotomy, instrumental birth and postpartum hemorrhage. The registration to the birth registry is mandatory and is carried out by the attending midwives, who fill in tick-boxes after birth.

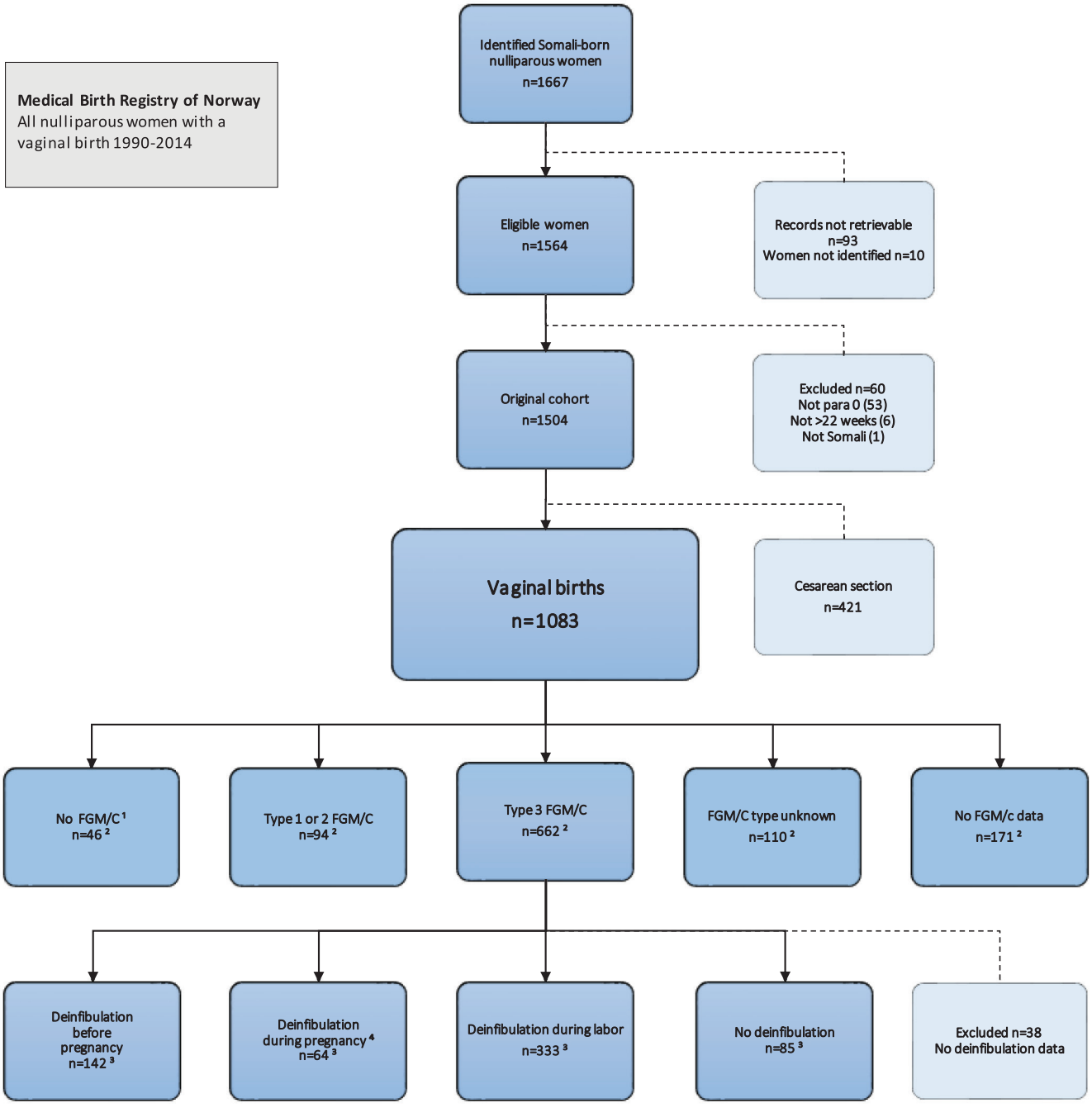
The primary outcome was third- or fourth-degree perineal tears defined as tears involving the anal sphincter and the anal sphincter and the anorectal mucosa, respectively. Secondary outcomes were blood loss during birth of ≥500 mL, infant Apgar score < 7 at 5 min, perinatal death and severe asphyxia. The severe asphyxia was defined as a composite variable and was computed from Apgar score 1–3 at 5 min and/or postnatal seizures and/or cerebral irritation or depression.

The exposures were FGM/C status and, among women with type 3 FGM/C, timing of deinfibulation. FGM/C status was classified as

Type 1	Partial or total removal of the clitoris and/or the prepuce (clitoridectomy)
Type 2	Partial or total removal of the clitoris labia minora, with or without excision of the labia majora (excision)
Type 3	Narrowing of the vaginal orifice with creation of a covering seal by cutting and appositioning the labia minora and/or the labia majora, with or without clitoridectomy (infibulation)
Type 4	All other harmful procedures to the female genitalia for non-medical purposes, for example: pricking, piercing, incising, scraping and cauterization

World Health Organization. Eliminating Female Genital Mutilation: An interagency statement (2008)

FIGURE 1 Classification of female genital mutilation/cutting.



[1] FGM/C=Female genital mutilation/cutting
[2] Percentage of the included women: No FGM/C 4.2%. Type 1 or 2 FGM/C 8.7%. Type 3 FGM/C 61.1%. Type unknown 10.2%. No FGM/C data 15.8%
[3] Percentage of women with type 3 FGM/C included in the subanalysis of deinfibulation: Before pregnancy: 22.8%. During pregnancy: 10.3%. During labor: 53.4% No deinfibulation: 13.6%
[4] Deinfibulation at week of pregnancy: Mean 28 weeks, range 13-42 weeks

FIGURE 2 Flowchart of participants. The original cohort of nulliparous Somali-born women 1990–2014 and the subset of women with vaginal births (blue). Aggregated data from the medical Birth Registry of Norway for all nulliparous women with a vaginal birth (gray box).

type 1 or 2, type 3 or no FGM/C. Cases of incomplete or inconsistent documentation of FGM/C were classified using the following criteria: The woman was registered as having type 3 FGM/C if there was a recording of tissue of any size covering the introitus, a narrowed introitus due to FGM/C or a deinfibulation. If having undergone FGM/C was stated in medical or antenatal records, but no description of the vulva was recorded and FGM/C was not mentioned in the obstetric records, she was registered as having FGM/C "other than infibulation," ie type 1 or 2. If there was no note of FGM/C in any records, and a normal anatomy was recorded, the woman was registered as not having undergone FGM/C. When the type of FGM/C could not be classified based on these criteria, the data were considered missing. Timing of deinfibuation was classified as deinfibulation before pregnancy, during pregnancy, during labor or no deinfibulation.

Based on previous literature, maternal age, education and year of delivery were regarded as potential confounders. Year of delivery was divided into two time periods, before and after 2006, when a national action plan to reduce OASI was launched.[22]

2.1 | Statistical analyses

Data were examined in cross-tables with chi-square tests. When chi-square test requirements were not met, we used Fisher's exact test. Risk of OASI was estimated as unadjusted and adjusted odds ratios with corresponding 95% confidence intervals in logistic regression analyses. Due to small cell numbers the categories of deinfibulation before pregnancy and during pregnancy were merged into one category (deinfibulation before labor) in the regression framework. Women with missing information of FGM/C were handled as a separate category and included in the statistical analyses (missing indicator method). Women with missing information of timing of deinfibulation were excluded from the analyses of this issue. Results were considered significant at $p<0.05$. Statistical analyses were performed using IBM SPSS Statistics for Windows Version 25.0 (Released 2017; IBM Corp., Armonk, NY, IBM Corp.).

2.2 | Ethics statement

The project was approved by the Regional Committee for Medical and Health Research Ethics South East D (Reference 2015/433/REK sør-øst D) on 3 December 2015. Individual consent was waivered. A user representative from the community of Somali women was elected member of the project group and contributed to the study design and interpretation of results.

3 | RESULTS

Of the original cohort, 72% (n = 1083) of the women underwent a vaginal birth (Figure 2). The majority had undergone FGM/C (69.9%), most of them type 3 (61.1%). The socioeconomic, medical and obstetric background factors are shown by FGM/C status in Table 1. Compared to women without FGM/C, women with type 3 FGM/C were more often married or cohabitant, had less formal education and shorter time of residence, attended the first antenatal visit later, and had more frequently a mediolateral episiotomy (midline episiotomy is not used in Norway).

Deinfibulation was most often performed during labor (53.4%) (Figure 2). Compared to those who underwent deinfibulation during labor, women who had undergone the procedure before or during pregnancy were more often employed or students, had been resident longer, had better language skills, more frequently epidural analgesia and less frequently episiotomy (Table 2).

Overall, 10.3% (CI 8.6–12.3) sustained OASI. (Table 3). Among women without FGM/C, the proportion was 15.2% and among those with type 1–2 and type 3 FGM/C it was 10.2% and 11.3%, respectively ($P = 0.17$).

In women with type 3 FGM/C, OASI was most frequent in those who had undergone deinfibulation before pregnancy (15.5%) and least frequent in those who underwent deinfibulation during labor (7.8%) ($P = 0.01$). Compared to deinfibulation before labor, deinfibulation during labor was associated with a lower risk (odds ratio [OR] 0.48, 95% confidence interval [CI] 0.27–0.86, $P = 0.01$) (Table 3). This estimate was stable when risk factors of OASI were added to the model.

In sensitivity analysis excluding infants with large birthweight, the results did not change. When the results were stratified by instrumental birth, the OASI rate in the spontaneous and instrumental birth groups was 6.5% and 26.3%, respectively. In the spontaneous birth group, deinfibulation during labor was associated with lower risk compared with deinfibulation before labor (OR 0.36, 95% CI 0.15–0.86, $P = 0.02$). In the instrumental birth group, the model showed no differences in estimates. Indications for instrumental birth were failure to progress in 54.1% and fetal distress in 43.3% of the cases. In total, 79.5% of those with instrumental birth had an episiotomy (data not shown).

In analyses stratified by episiotomy, the rate of OASI in the groups with and without episiotomy was 11.3% and 12.2%, respectively. In the episiotomy group, deinfibulation during labor was associated with lower risk compared with deinfibulation before labor (OR 0.37, 95% CI 0.18–0.76, $P = 0.01$). In the no episiotomy group, we found no significant differences in risk estimates.

Before and after 2006, when national measures against OASI were implemented, the incidence was 11.6% and 9.2%, respectively ($P = 0.19$). Changes in key exposures and OASI by time are shown in Figure 3.

Concerning other outcomes, we noted a lower risk of postpartum hemorrhage among women who underwent deinfibulation during labor compared with deinfibulation before labor (OR 0.66, 95% CI 0.44–1.00, $P = 0.05$). Neonatal outcomes showed no differences with respect to FGM/C status or timing of deinfibulation. The overall perinatal death rate was 1.7% (Table 4).

Comparing OASI in the cohort of Somali-born women with aggregated data from the Medical Birth Registry of Norway ($n = 510\,779$), the occurrence was twice as high in the cohort as in the general population (10.3%; 95% CI 8.6–12.3) vs (5.0%; 95% CI 5.0–5.1) (Figure 4).

4 | DISCUSSION

We found no association between FGM/C types and risk of OASI. We did find a 50% lower risk in women who underwent deinfibulation during labor than anmong those who had undergone deinfibulation before labor. The proportion of OASI was twice as high in the Somali cohort as in nulliparous women in the general population.

Our finding of no association between FGM/C and OASI risk is in line with findings in countries such as the UK and Switzerland.[3,18] It is

TABLE 1 Socioeconomic and obstetric characteristics by female genital mutilation/cutting status in nulliparous Somali-born women with vaginal birth in South East Norway 1990–2014 (n = 1083)

	Type 3 FGM/C		Type 1–2 FGM/C		No FGM/C		Missing[1]		Total		
	n	%	*n*	%	*n*	%	*n*	%	*n*	%	
	662	**61.1**	**94**	**8.7%**	**46**	**4.2%**	**281**	**25.9**	**1083**		*p*
Maternal age											
<20 years	53	8.0	11	11.7	6	13.0	34	12.1	104	9.6	0.14
20–34 years	588	88.8	82	87.2	40	80.7	240	85.0	950	87.7	0.51
>35 years	21	3.2	1	1.1	0		7	2.5	29	2.7	0.59
Completed primary or higher education	377	56.9	66	70.2	32	69.6	177	63.0	652	60.2	0.02
Married or cohabiting	441	66.6	49	52.1	22	47.8	206	73.3	718	66.3	0.00
Employed or student	247	44.8	46	52.9	27	61.4	127	49.8	474	47.5	0.08
Residence[2]											
0–2 years	137	33.3	17	27.0	8	29.6	59	42.1	221	34.5	0.12
3–10 years	225	54.7	36	57.1	10	37.0	52	37.1	323	50.4	0.00
>10 years	49	11.9	10	15.9	9	33.3	29	20.7	97	15.1	0.01
Basic language skills[3]	379	68.0	59	78.3	36	83.7	170	71.1	644	70.1	0.13
First visit before 13 weeks[4]	403	64.3	48	53.9	32	74.4	154	57.2	637	62.0	0.02
Antenatal visits ≥9[4]	455	72.5	62	69.7	33	76.7	168	62.5	718	69.8	0.02
Maternal comorbidity[5]	82	12.4	16	17.0	5	10.9	25	8.9	128	11.8	0.17
Pregnancy complications[6]	138	20.8	24	25.5	12	26.1	59	21.0	233	21.5	0.64
Gestational age											
<37 weeks	22	3.3	4	4.3	2	4.3	20	7.1	48	4.4	0.08
37–41 weeks	553	83.5	77	81.9	38	13.0	219	77.9	887	81.9	0.24
≥42 weeks	87	13.1	13	13.8	6	13.0	42	14.9	148	13.7	0.91
Epidural analgesia	237	35.8	29	30.9	16	34.8	91	32.4	373	34.4	0.67
Prolonged 2nd stage[7]	79	13.6	15	17.2	8	18.2	25	10.2	127	13.2	0.24
Instrumental birth	167	25.2	27	28.7	12	26.1	62	22.1	268	24.7	0.57
Episiotomy (mediolateral)	463	69,9	62	66,0	16	34,8	151	53,7	692	63,9	<0,00
Occiput anterior presentation[8]	634	95.8	93	98.9	43	93.5	261	93.5	1031	95.4	0.11
Other presentations	28	4.2	1	1.1	3	6.5	18	6.5	50	4.6	0.11
Fetal head circumference >37 cm[9]	22	3.5	1	1.1	1	2.3	9	3.4	33	3.2	0.77
Shoulder dystocia	5	0.8	3	3.2	2	4.3	1	0.4	11	1.0	0.01
Birthweight >4000 g[10]	36	5.5	7	7.4	5	10.9	19	6.8	67	6.2	0.37
Year of delivery											
≤2006	311	47.0	23	24.5	9	19.6	123	43.8	466	43.0	<0.00
>2006	351	53.0	71	75.5	37	80.4	158	56.2	617	57.0	

Note: FGM/C, female genital mutilation/cutting. [1]FGM/C type not classified 10.2%. No information of FGM 15.8%. [2]Missing information 40.8%. [3]Missing information 15.1%. [4]Missing information ≤ 5.1%. [5]Composite variable computed from infectious, autoimmune, renal and cardiac diseases, pregestational hypertension, epilepsy, diabetes, mental disorders, addiction and exposure to violence. [6]Composite variable computed from registered urinary tract infections, gestational diabetes, gestational hypertension, preeclampsia/eclampsia and intrauterine growth restriction. [7]Prolonged 2nd stage defined as active pushing >60 min. Missing information 11.4%. [8]Missing information 0.2%. [9]Missing information 4.7%. [10]Missing information 0.3%.

also consistent with findings in a systematic review that, in analyses stratified by European or African countries, detected no increased risk other than of episiotomy in women with FGM/C residing in Europe.[5] Some studies in African countries have also reported that when place of birth, socioeconomic factors and maternal morbidity were adjusted for, no association was found between FGM/C and OASI or other adverse obstetric outcomes.[23,24] Although the evidence generally suggests that obstetric risk associated with FGM/C is minimized

TABLE 2 Socioeconomic and obstetric characteristics by timing of deinfibulation in nulliparous Somali born women with vaginal birth and with type 3 female genital mutilation/cutting in South East Norway 1990–2014 ($n = 624$)

	Deinfibulation before pregnancy		Deinfibulation during pregnancy		Deinfibulation during labor		No deinfibulation		Total		
	n	%	*n*	%	*n*	%	*n*	%	*n*	%	
	142	**22.8**	**64**	**10.3**	**333**	**53.4**	**85**	**13.6**	***n* = 624**[a]		***p***
Maternal age											
<20 years	12	8.5	1	1.6	34	10.2	6	7.1	53	8.5	0.14
20–34 years	126	88.7	60	93.8	287	86.2	77	90.6	550	88.1	0.30
>35 years	4	2.8	3	4.7	12	3.6	2	2.4	21	3.4	0.85
Completed primary or higher education											
Yes	92	64.8	37	57.8	181	54.4	42	49.4	352	56.4	1.00
Married or cohabiting											
Yes	99	69.7	37	57.8	225	67.6	56	65.9	417	66.8	0.39
Employed or student											
Yes	74	55.6	31	52.2	125	40.8	28	36.4	258	44.9	0.01
Residence[2]											
0–2 years	17	17.7	10	17.9	85	46.4	16	35.6	128	33.7	<0.00
3–10 years	57	59.4	37	66.1	88	48.8	26	57.8	208	54.7	0.07
>10 years	22	22.9	9	16.1	10	5.5	3	6.7	44	11.6	<0.00
Basic language skills[3]											
Yes	107	82.3	46	78.0	166	62.4	37	52.9	356	67.8	<0.00
First visit before 13 weeks[4]											
Yes	86	65.6	44	72.1	201	63.0	46	58.2	377	63.9	0.37
Antenatal visits ≥9[4]											
Yes	96	73.3	44	72.1	235	73.3	58	72.5	433	73.3	0.99
Maternal comorbidity[5]											
Yes	23	16.2	8	12.5	37	11.1	8	9.4	76	12.2	0.37
Pregnancy complications[6]											
Yes	30	21.1	14	21.9	68	20.4	22	25.9	134	21.5	0.75
Gestational age											
<37 weeks	4	2.8	0	0	10	3.0	4	4.7	18	2.9	0.43
37–41 weeks	117	82.4	59	92.2	279	83.8	69	81.2	524	84.0	0.26
≥42 weeks	21	14.8	5	7.8	44	13.2	12	14.1	2	13.1	0.56
Epidural analgesia	66	46.5	28	43.8	106	31.8	20	23.5	220	35.3	0.01
Prolonged 2nd stage[7]	22	17.9	12	21.1	33	11.2	10	13.2	77	14.0	0.11
Instrumental birth	43	30.3	14	21.9	76	22.8	27	31.8	160	25.6	0.16
Episiotomy (mediolateral)	79	55.6	40	62.5	253	76.0	63	74.1	435	69.7	<0.00
Occiput anterior presentation	140	98.6	63	98.4	315	94.6	81	95.3	599	96.0	0.15
Other presentations	2	1.4	1	1.6	18	5.4	4	4.7	25	4.0	0.15
Fetal head circumference > 37 cm[8]	6	4.5	1	1.6	9	2.8	3	3.8	19	3.2	0.69
Shoulder dystocia	0	0	0	0	3	0.9	1	1.2	4	0.6	0.67
Birthweight >4000 g[9]	8	5.7	1	1.6	22	6.6	5	6.0	36	5.8	0.49
Year of delivery											
≤2006	59	41.5	9	14.1	182	54.7	40	47.1	290	46.5	<0.00
>2006	83	58.5	55	85.9	151	45.3	45	52.9	334	53.5	

[a]Women with missing deinfibulation data excluded ($n = 38$). [2]Missing information 37.9%. [3]Missing information 15.9%. [4]Missing information ≤5.3%. [5]Composite variable computed from infectious, autoimmune, renal and cardiac diseases, pregestational hypertension, epilepsy, diabetes, mental disorders, addiction and exposure to violence. [6]Composite variable computed from registered urinary tract infections, gestational diabetes, gestational hypertension, preeclampsia/eclampsia and intrauterine growth restriction. [7]Prolonged 2nd stage defined as active pushing >60 min. Missing information11.7%. [8]Missing information 4.2%. [9]Missing information 0.5%.

TABLE 3 Obstetric anal sphincter injury by female genital mutilation/cutting status and timing of deinfibulation in nulliparous Somali-born women with vaginal birth: outcomes, unadjusted and adjusted odds ratio

	OASI			No OASI				Unadjusted			Adjusted		
	n	%	95% CI	*n*	%	95% CI	*p*	OR	95% CI	*p*	OR[a]	95% CI	*p*
FGM/C status (*n* = 1083)							*p* = 0.17						
FGM/C type 3	75	11.3	9.0–14.0	587	88.7	86.0–91.0		0.71	0.31–1.65	0.43	0.65	0.28–1.53	0.32
FGM/C type1/2	10	10.6	5.2–18.7	84	89.4	81.3–94.8		0.66	0.24–1.87	0.44	0.65	0.23–1.84	0.41
No FGM/C	7	15.2	6.3–28.9	39	84.8	71.1–93.7		1 (ref)			1 (ref)		
Missing	20	7.1	4.4–10.8	261	92.9	89.2–95.6		0.43	0.17–1.08	0.08	0.40	0.16–1.02	0.06
Total	112	10.3	8.6–12.3	971	89.7	87.7–91.6							
Timing of deinfibulation (*n* = 624[2])							*p* = 0.01						
Before labor[3]	29	14.1	9.6–19.6	177	85.9	80.4–90.4		1 (ref)			1 (ref)		
During labor	26	7.8	5.2–11.2	307	92.2	88.8–94.8		0.52	0.30–0.91	0.02	0.48	0.27–0.86	0.01
No deinfibulation	17	20.0	12.1–30.1	68	80.0	69.9–87.9		1.53	0.79–2.30	0.21	1.53	0.78–2.98	0.21
Total	72	11.5	9.1–14.3	552	88.5	85.7–90.9							

Abbreviations: CI, confidence intervals; FGM/C, female genital mutilation/cutting; OASI, obstetric anal sphincter injury; OR, odds ratio.

[a]Adjusted for age, education and delivery year. [2]Women with missing deinfibulation data excluded (*n* = 38). [3]Deinfibulation before pregnancy and during pregnancy groups merged in the regression analysis.

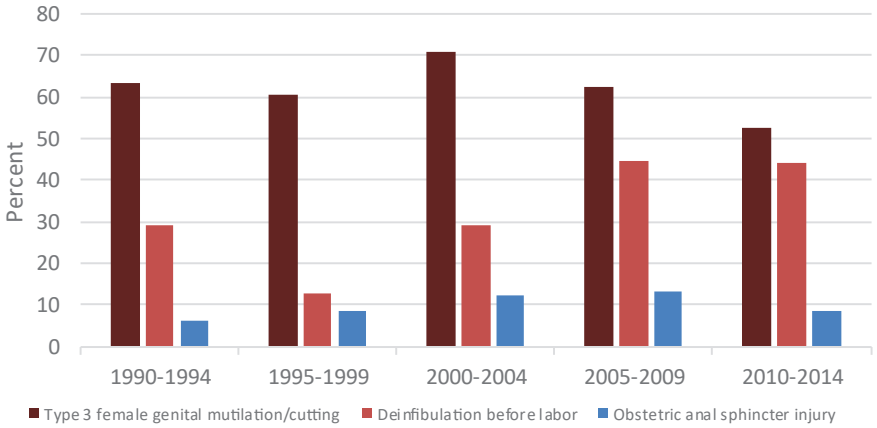


FIGURE 3 Type 3 female genital mutilation/cutting, deinfibulation before labor and obstetric anal sphincter injury by delivery year in nulliparous Somali-born women with vaginal birth in 1990–2014.

TABLE 4 Neonatal outcomes and maternal blood loss by female genital mutilation/cutting status and timing of deinfibulation in nulliparous Somali-born women with vaginal birth

Female genital mutilation/cutting status											
	Type 3 FGM/C		**Type 1 or 2 FGM/C**		**No FGM/C**		**Missing**		**Total**		
	n	**%**	***n***	**%**	***n***	**%**	***n***	**%**	***n***	**%**	
	662	**61.1**	**94**	**8.7**	**46**	**4.2**	**281**	**25.9**	**1083**		***p***
Blood loss ≥ 500 ml	148	22,4	31	33,0	10	21,7	63	22,4	252	23,3	0,14
Apgar < 7 at 5 min[a]	17	2,6	1	1,1	2	4,4	7	2,5	27	2,5	0,65
Severe asphyxia	1	0,2	0	0	0	0	3	1,1	4	0,4	0,20
Perinatal death	10	1,5	0	0	1	2,2	7	2,5	18	1,7	0,33
Timing of deinfibulation											
	Before labor		**During labor**		**No deinfibulation**		**Total**				
	n	**%**	***n***	**%**	***n***	**%**	***n***	**%**			
	206	**33.0**	**333**	**53.4**	**85**	**53.4**	**624[b]**				***p***
Blood loss ≥ 500 ml	57	27.7	65	19.5	24	28.2	146	23.4			0.05
Apgar < 7 at 5 min[c]	7	3.4	6	1.8	2	2.4	15	2.4			0.50
Severe asphyxia	0	0	1	0.3	0	0	1	0.2			1.00
Perinatal death	3	1.5	5	1.5	1	1.2	9	1.4			1.00

Abbreviation: FGM/C, female genital mutilation/cutting.

[a]Missing information 1.3%.

[b]Women with missing deinfibulation data excluded ($n = 38$).

[c]Missing information 1.1%.

by access to high standard obstetric care in high-income countries,[2] some studies have reported that the OASI risk remains high.[17,25] These discrepancies are reflected in meta-analyses that have reached different conclusions concerning whether risk estimates of OASI differ significantly.[4–6]

The greater risk of OASI among Somali women compared with the general population is consistent with findings in population-based studies.[9,14,15] Growing evidence indicates that migration factors might explain these findings, as recent studies have identified time of residence and language skills as independent risk factors of OASI.[16,26] We found a very high OASI rate in women with an instrumental birth. In a situation such as an instrumental birth, optimal protection of the perineum requires good communication between the woman and the birth attendant.

In line with previous research in high-income countries, neonatal outcomes showed no relation to FGM/C.[3,27] The high perinatal death rate among the Somali women compared with the Norwegian national average of 0.7%[28] has been found in population-based studies and is consistent with findings in other host countries.[29]

The greater risk of OASI we found associated with deinfibulation before labor was unexpected, despite the heterogeneity in results in previous studies.[20] FGM/C is thought to leave the perineum prone to obstetric tears due to scar tissue with reduced tensile strength.[17] While we noted no greater OASI risk associated with FGM/C, the

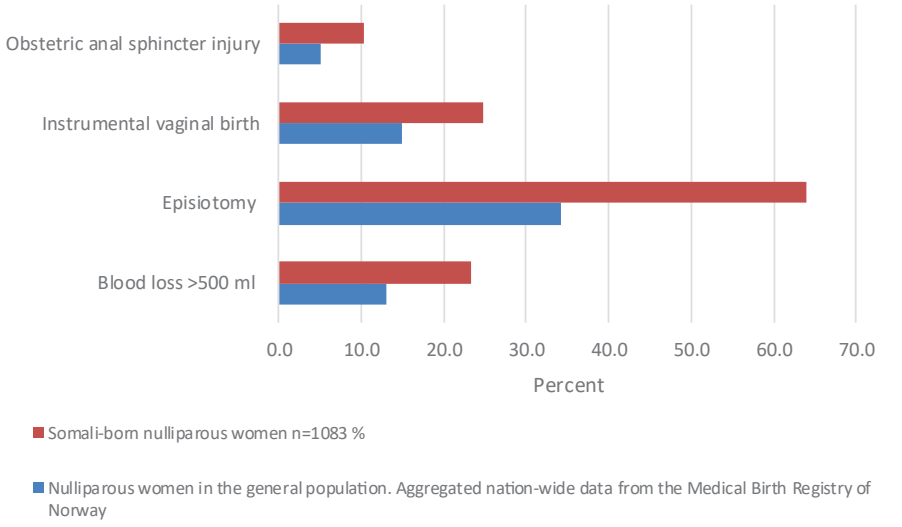


FIGURE 4 Obstetric anal sphincter injury, instrumental vaginal birth, episiotomy and blood loss in nulliparous Somali-born women in South East Norway and women in the general population with vaginal birth in 1990–2014.

risk associated with deinfibulation before labor might suggest that new scar tissue formation by the deinfibulation itself may increase the vulnerability of the perineum.

An alternative explanation is that these women may have had more extensive infibulations that might represent a persisting greater OASI risk. The greater effect of type 3 FGM/C on obstetric outcomes is thought to be caused by removal of more genital tissue and more scar tissue formation than in types 1 and 2.[1] However, the size of the covering seal does not necessarily reflect the amount of removed tissue.[30] Beneath an extensive infibulation that may have caused a range of urogenital and sexual problems for the woman, the anatomy may appear moderately, even minimally, altered.[31] Thus, it seems plausible that rather than being caused by the extensive infibulation per se, the greater OASI risk might be caused by scar tissue from the deinfibulation. The revised WHO classification of FGM/C reflects the considerable empirical variation in tissue removal within each type.[1,19]

When risk factors of OASI were analyzed, we found a greater risk of prolonged second stage associated with deinfibulation before labor. Prolonged labor is thought to be associated with FGM/C by inelastic scar tissue hindering the progress and may underlie other adverse outcomes. While we found no such association to FGM/C, the association with deinfibulation before labor might suggest that new scar tissue formation by the procedure itself might prolong the second stage and, thereby, increase the OASI risk. Of other risk factors, epidural analgesia was more frequent among women who had undergone deinfibulation before labor, and instrumental birth was nonsignificantly more frequent. However, none of the risk factors changed the risk estimate when added to the regression model.

Systematic reviews have concluded that in nulliparous women in general, episiotomy protects against OASI both in spontaneous and instrumental births.[32,33] The greater likelihood of episiotomy we found in women with FGM/C is consistent with previous research.[4,5] However, women who had undergone deinfibulation before labor had episiotomy less frequently and might have had less protection. Because they were no longer infibulated, these women might have been perceived as being of lower risk. One study that investigated the effect of episiotomy and deinfibulation on OASI in women with FGM/C found that in a population of mixed parity and type of vaginal birth, deinfibulation had greater protective effect than episiotomy and the combination.[34] Our sensitivity analysis suggests that in nulliparous women who underwent spontaneous labor and deinfibulation during labor, episiotomy protected against OASI.

The greater risk of postpartum hemorrhage associated with deinfibulation before labor is most likely secondary to the risk of OASI. Consistent with previous findings, we detected no unfavorable effects of deinfibulation during labor compared with before labor.[35]

In Norway, a national action plan and training program to reduce OASI was introduced in 2006. Key elements were perineal support technique and good communication between the woman and the birth attendant during the last part of labor.[7] The overall incidence declined from 3.8% in 2005 to 1.9% in 2014[28] and, among nulliparous women, from 6.2% to 3.1%.[36] Our findings indicate that Somali-born women have not benefited as much from these measures as women in the general population and remain a high-risk group. Special attention during the second stage of labor, regardless of the FGM/C or deinfibulation status, is warranted to prevent the serious short- and long-term sequelae and morbidity associated with OASI.

The present study points in the same direction as previously published data from our group, suggesting that deinfibulation might affect obstetric outcomes unfavorably in nulliparous Somali-born women when performed before labor.[21]

The strengths of the present study were the combination of a population-based cohort design and the use of clinical data that included descriptions of FGM/C and deinfibulation as well as general medical and obstetric information. The women were of the same parity and country of birth and had access to antenatal and intrapartum care within the public healthcare system, free of charge. The sample size was large for a clinical study of FGM/C in a western country, particularly for a study of timing of deinfibulation.[20]

The retrospective study design was a major limitation. During the study period, no ICD-10 diagnosis was uniformly in use for

FGM/C and the issue was not documented routinely. We therefore expected a large fraction of missing FGM/C data and assumed that the data would be lacking both at random and not at random. We chose to handle this by including a separate category of missing FGM/C data in the analyses. Compared with methods such as multiple imputation, the missing indicator method is simple, with few assumptions.[37] As would be expected, the estimate size for OASI in the missing data group was between the estimates for the groups with FGM/C and without. Conversely, as missing data on timing of deinfibulation were limited (1.9%), missing cases were excluded for these analyses. The preponderance of type 3 FGM/C in the study population implies that smaller effect estimates might not have been detected. For the analysis of timing of deinfibulation, however, group sizes were robust.

The information about socioeconomic factors other than maternal education and employment was limited. In particular, migrant-specific characteristics were poorly documented and were not included in the regression analyses. Access to deinfibulation before labor may have varied among regions and periods of time.

Finally, we compared clinical data for the Somali women with nationwide registry data. The validity of the diagnosis of OASI in the birth registry has been examined and found to be high.[38]

5 | CONCLUSION

A high risk of OASI in Somali-born nulliparous women in Norway was not related to the type of FGM/C in this study. Factors related to migration and the obstetric care are likely to be involved in this excess risk.

Deinfibulation during labor protected against OASI, whereas deinfibulation before labor was associated with a doubled risk. Deinfibulation before labor should not be routinely recommended during pregnancy. Obstetric care providers need to be alert to the fact that nulliparous Somali-born women constitute a high-risk group. Women who have undergone deinfibulation before or during pregnancy may need special attention during labor. There is a need for prospective studies of timing of deinfibulation, episiotomy practices and risk of OASI.

AUTHOR CONTRIBUTION

ST and SV conceptualized the study. ST wrote the protocol, collected data, analyzed the data and wrote the manuscript. SV contributed to the protocol and commented on the manuscript. PØ contributed to the protocol and data analysis and commented on the manuscript. IS contributed to the protocol, collected data, contributed to the data analysis and commented on the manuscript.

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CONFLICT OF INTEREST

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