Incidence, trends and risk factors for perineal injuries of low-risk pregnant women : experience from a midwife run obstetric unit, South Africa

Incidence, Trends and risk factors for perineal injuries of low-risk pregnant women: experience from a midwife run obstetric unit, South Africa

Running Title: Trends, incidence and risk factors of perineal injuries

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Abstract

Pregnant women experience perineal injuries during childbirths. Objectives of this cross-sectional retrospective study were to estimate the incidence, trends, and risk factors for perineal injuries of women who had childbirths from January 2013 to December of 2017. We used logistic regression to identify risk factors for all injuries, episiotomy and obstetric anal sphincter injury (OASI) measured by odds ratios (OR). A total of 5547 women showed gradual decreases of episiotomy from 17.6% in 2013 to 7.6% in 2017 ($p<0.05$). Perineal injuries were reduced from 33.3% in 2013 to 28.9% in 2017 ($p<0.05$). The risk factor for any perineal injury were younger ages, term pregnancy and nil parity (p,0.05). Advanced gestational age, nil parity, and previous vaginal births were risk factors for episiotomy. However, birth weight of baby was significantly associated with OASI. Episiotomy and overall perineal injury rates were commendable. Training to midwives is needed to improve the perineal care and maintain good practices during delivery.

Keywords: Episiotomy**,** labour management, obstetric anal sphincter injury.

Introduction

Pregnant women experience varying degrees of perineal injuries during childbirths. Perineal injuries are classified as (i) first degree: when the injury involves perineal skin, (ii) second degree: perineal muscles and skin are involved, (iii) third degree: injury involving anal sphincter complex and (iv) fourth degree: involving the anal sphincter complex, epithelium and rectal mucosa[1, 2]. The third- and fourth-degree perineal injuries are considered major or extensive and are collectively known as obstetric anal sphincter injuries (OASI). The overall rates of OASI are reported with great variations from different reports between 0.7% and 10.2% (Norway, Denmark, Sweden, Iceland, USA and UK) at different periods[3 -7]. A recent study of a systemic review of meta-analysis on "Birth-Related Trauma in Low-and middle-Income Countries (LMIC)" reported that the overall episiotomy, second degree injury and OASI rates were 46%, 24%, and 1.4% respectively[8]. However, this report excludes first degree injuries as a result of incomplete data from the published reports. The study further identifies other limitations such as definition, reporting and outcomes of perineal injuries, the use of episiotomy (routine versus selective) to prevent OASI and or to facilitate childbirths and suggestions made for improvement on monitoring and reporting of perineal injuries from different health facilities of LMIC[8]. High incidence of all perineal injuries were reported between 70 to 85% from high income countries where the monitoring and reporting systems are of high quality and included all injuries[9, 10]. A study from Sweden reported that the perineal injuries are lower among planned home childbirths than hospital births[11]. Higher incidences of overall perineal

injuries were reported from England (90.4%) and Iran (84.3%)[12-13]. The lowest incidence of 64% perineal injury was reported from Brazil among low-risk pregnancies[14].

It is reported that perineal injuries are related to pelvic floor disorders even after 10 years of delivery[15]. The incidence of episiotomy and OASI are also considered as obstetric care indicators[12, 16-17]. Detection and repair of extensive perineal injuries involving anal sphincter are thus important for maternity care. Therefore, it is universally recommended that the perineum is supported during the time of delivery of the foetal presenting part that causes stretching of the perineum as a standard obstetric care and found to prevent injuries[18, 19]. There are controversies on manual support to prevent perineal injuries. For example, report from a meta-analysis of randomised controlled trials (RCTs) find no protective effect but non-randomised studies find significantly protection for OASI[20]. Studies report from Norway that training of doctors and midwives on traditional method of manual support with significant reductions on the incidences of OASI, overall spontaneous and operative vaginal deliveries[21, 22]. A randomised control trial on primiparous women from Brazil reports that the left lateral position during childbirth resulted low risk of OASI[23]. Similar reduction of perineal injuries including episiotomy is found when women had childbirth on left lateral position compared to lithotomy position[24]. Therefore, left lateral position of women at the time childbirth is considered protective for perineal injuries.

The known maternal risk factors for perineal injuries are age, parity, precipitated labour and very narrow introitus (foetal passage) lead to cephalo-pelvic disproportion (CPD) and foetal factors such as large foetus, occipito-posterior position of the vertex (foetal head) and or malpresentation. The known obstetric factors are uncontrolled or precipitated delivery (labour), assisted deliveries, episiotomy, vacuum extraction and extended episiotomy in emergency lead to perineal injuries[25]. A study from USA hospitals in 2011 on "third- and fourth-degree perineal tears prevalence and risk factors" reported that occipito-posterior position being the presenting part, , parity and excessive birth weight of the new-born)were significant predictors the cause of OASI[26]. Another study on "risk factors for OASI during vaginal delivery from a referral hospital" in Cape Town, South Africa (SA), identified primipara, assisted childbirths (use of forceps and vacuums), malpresentations, mothers negative HIV status and shoulder dystocia were significantly associated with perineal injuries[27]. In that hospital, midwives only conducted uncomplicated childbirths while complicated births were assisted and conducted by medical professionals under Obstetrician's supervision and used mediolateral episiotomies when necessary. Similarly, a report from two regional hospitals of Durban in SA found a rate of 16.2% spontaneous perineal injuries[28]. The same study found race, time required for childbirths, and the use of epidural analgesia were significantly associated with perineal injuries. Episiotomy was found to be a protective factor for OASI [28]. There is limited information from low-income countries and more so from midwife obstetric unit (MOU) where women give births. Therefore, it is important to understand the magnitude, classification, risk factors of perineal injuries from different settings. The objectives of this study are to estimate the incidence, trends, and risk factors for perineal injuries of women who gave childbirths at a MOU.

Research Method

Study design

A cross-sectional retrospective study was undertaken targeting all women who had spontaneous singleton vaginal childbirths at Kwadabeka community health center (KCHC) from January 2013 to December 2017.

Study setting and data collection:

The setting of the study has been explained elsewhere as this was part of a comprehensive study that investigated the problems and outcomes of pregnant women experienced during the time of delivery[28]. However, the study was undertaken at KCHC, a Primary Health Care (PHC) facility in Durban, SA, for the residence of Kwadabeka and Clermont communities with over 150,000 The maternity services at this MOU are available 24 hours a day and are run by trained midwives using SA National protocol[29]

Care and management of perineum during second stage of labor[29]

The second stage of labour is defined when the cervix is fully dilated and ends with delivery of the baby. Usually, two hours are allowed for the foetal head or the presenting part to descend onto the pelvic floor if there is no foetal distress and CPD. The bladder is emptied using a catheter, if necessary, as usual practice for easy decent of the presenting part of the foetus. Delivery of the foetus is usually undertaken in lithotomy position as a routine practice at the facility. Efforts to bear down of the foetus by the mothers are only encouraged when the foetal head starts to distend in the perineum with uterine contractions and the woman has an urge to push. When the woman is ready to bear down the baby, the woman is encouraged to bearing down only during contractions of the uterus (experience of pain by the mother). To protect the perineum, midwives use perineal guard when the foetal head crowns. An episiotomy is considered and undertaken on selective cases such as thick or rigid perineum that seems to prevent delivery and may prolong the second stage of labour. The other maternal and foetal conditions for episiotomy are signs of foetal distress in the second stage of labour, breech delivery, history of previous third- or fourth degree perineal injuries or preterm delivery where the perineum is tight. A standard right mediolateral episiotomy is undertaken using local anaesthetic. However, there is no induction of labour and instrumental deliveries using forceps or vacuum extractor at this MOU by the midwives. A rectal examination after suturing the episiotomy or second-degree injury is performed by the delivering midwife to check for any stitches placed in the rectum.

Referral criteria of pregnant women from KCHC to hospitals during labour [29]

Pregnant women attended KCHC in labour with the following conditions were referred to hospitals: primipara women aged ≥37 years, grandmultiparity (parity ≥5), had previous caesarean section or surgery of the uterus, cervix, vagina, bladder or pelvic floor, previous postpartum haemorrhage requiring blood transfusion, serious medical disorder (e.g. cardiac disease, current TB infection, currently symptomatic asthma, epilepsy), anaemia (Hb <10 g/dL), hypertension (≥140/90 mmHg), multiple pregnancies, breech presentation or transverse lie, estimated foetal weight <2 kg, rupture of the membranes before the onset of labour, maternal pyrexia ≥37.5 degrees Celsius, vulvovaginal blisters or ulcers, extensive vulvovaginal warts that may obstruct delivery, antepartum haemorrhage, suspected foetal distress, thick meconium staining liquor, offensive liquor, cord prolapse, prolonged latent phase (≥8 hours) of labour, poor progress in the active phase (first stage) of labour (> 8 hours) and prolonged second stage of labour (>2 hours)**.**

Definition of terms

APGAR score stands for "Appearance, Pulse, Grimace, Activity, and Respiration" for the new-born babies in 1 and 5 minutes. Five indicators were used to check the health of the baby. Each indicator was scored on a scale of 0 to 2, with 2 being the best score.
Preterm or premature babies were defined when babies were born < 37 weeks of gestation, or they can be small for their gestational age (37 weeks of gestation but baby weight < 2500 grams).
Preterm delivery was considered when mothers delivered a baby between 28 weeks and 36 weeks of gestational age and the baby weights above 1000 g.

The "term delivery" was considered between 37 and 41 weeks of gestation. Any delivery that occurred at 42 completed weeks or afterwards was considered as "post term delivery".

Data analysis

We entered data into Microsoft Excel for Windows and imported into Statistical Package for Social Sciences (IBM SPSS) version 22.0 software for coding and analysis. We analysed the following variables: (a) maternal factors: age in years, parity (nil, 1-4 & ≥5), and previous vaginal birth, antenatal care history; (b) obstetric factors: gestational age in weeks, episiotomy undertaken and (c) foetal factors: weight of the new-born (baby) in kilogram (Kg), gender of the new-born (male or female) and APGAR score at 1 and 5 minutes. Primary outcome measures of the current study were perineal injuries first categorized into a) induced injury (episiotomy) and b) spontaneous injuries. Spontaneous injuries were further categorized as i) first ii) second ii) third and iv) fourth degree injuries. The demographic, baseline dependent and outcome variables of women were summarized using descriptive summary measures: expressed as mean with standard deviation for continuous variables. We used percent for categorical variables. Cross table analysis of independent and dependent variables was undertaken using Chi square test (X^2) to identify the factors significantly associated with outcome variables. We used binary logistic regression analysis to determine possible predictors for outcome variables (separately for total, episiotomy and OASI) and the results were expressed with adjusted odds ratios (OR) with corresponding two-sided 95% confidence intervals (95% CI) and associated p-values. P-values <0.05 were considered significant.

Results

A total of 5547 pregnant women had delivered singleton babies during 2013-2017 and thus formed our study sample. The mean age was 24.67 (SD= 5.89) years ranging from 13 to 47 years. Most of them (60%) belonged to age group 20-29 years (Table 1). Nearly all of them were at term gestation (97%), majority (73.1%) had parity between 1 and 4, previous vaginal deliveries (73.3%) and received antenatal care (93.6%). The low-birth-weight delivery rate (≤ 2.5 kg) was 7.8% and most of the delivered babies (92.2%) had birth weight between 2.5 to 4.0 Kg. APGAR scores (over ≥ 7) of the babies in 1 and 5 minutes were 92.3% and 96.2% respectively.

The summary of all five years birth data showed (Table 1) that more than one fifth (21.1%) of the pregnant women had spontaneous perineal injuries while 11.3% had episiotomy making a total of 32.4%. Among spontaneous perineal injuries, the incidences of first- and second-degree injuries were 17.6% and 3.3% respectively. Only a few had third degree (0.2%) while none fourth-degree perineal injuries. Those who had undergone episiotomy did not have further third- or fourth-degree injuries. Table 1 also depicted the cross-table analysis with Chi Square (X^2) and p-values. There was a significantly higher (32.5%) rate of spontaneous perineal injuries among teenage ($p<0.01$) compared to older women. Significantly higher rate (24.2%) of perineal injury was found among those women who had term pregnancy (gestational age ≥ 37 weeks)) compared to preterm (12.6%) ($p=0.002$). Higher rate (25.8%) of perineal injury was found among those women that delivered babies weighing between 3-3.49 kg compared to lower birth weight categories ($p<0.05$).

Figure 1 showed the trends of perineal injury rates over the study period. At the base year (2013) the total (all types) injury rate was higher of 33.3% and found to decrease significantly to 28.9% ($p<0.05$) in 2017. The overall reduction of all perineal injuries was 13%. The episiotomy rates were also decreased from 17.6% in 2013 to 7.6% in 2017 ($p<0.05$) with a reduction of 57%. However, the spontaneous perineal injuries were increased significantly from 15.7% in 2013 to 21.3% ($p<0.05$) in 2017 with the highest rate of 25.2% in 2016.

Binary logistic output (Table 2) on all perineal injuries showed that the younger pregnant women had higher risk of perineal injuries. We found that teenage age (< 20 years) and ages between 20-29 years were 6 ($p<0.05$), and 3.8 times ($p<0.05$) respectively more likely to have perineal injuries than the older women. Primipara women and women with gestational age at term (≥ 37 weeks) were 3.9 ($p<0.05$) and 2 times ($p< 0.05$) more likely to have perineal injuries than their counterparts. Primipara women were almost 4 times (OR=3.97, $p<0.05$) more likely to have undergone episiotomy (Table 3) compared to multipara Pregnant women at term pregnancy (>37 weeks) were 6 times (OR=6.22, p< 001) more likely to have episiotomy than those had preterm childbirths. Similarly, women who had a previous vaginal delivery were 1.2 (OR= 1.2, $p<0.05$) times more likely to have an episiotomy than those that did not have previous vaginal deliveries. On the other hand, pregnant women who attended for antenatal care were 55% less likely to have undergone episiotomy (OR=.457, $p<0.05$) than those who did not. Lower birth weights of the babies were found to be a protective factor for OASI. Result (Table 4) showed that the birth weights of the babies < 3.0 Kg and between 3.0-3.99 Kg were 86% (OR=0.14, $p<0.05$) and 45% (OR=0.55, p <0.05) less likely respectively to have OASI compared to birth weight of ≥ 4kgs. No demographic, obstetrics variables and episiotomy were associated with OASI.

Discussion

This study collected data from a large number of vaginal deliveries from low-risk pregnant women between 2013 and 2017 and estimated the incidences and risk factors for different degrees of perineal injuries. Firstly, we found trends of all injuries over 5 years period (spontaneous, episiotomy and total) and secondly incidence of total injuries of different degrees and their risk factors. We found a decreasing trend of episiotomy from a higher rate of 17.6% in 2013 to a lower rate of 7.6% in 2017, a reduction of 57%. The episiotomy rate in 2017 had reached the rate recommended by WHO and is similar to other findings from Africa [16, 30, 31]. However, this trend must be seen with the increasing trend of spontaneous perineal injuries over the same period. There was an increase of spontaneous injury (21.3%) in 2017 compared to the rate of 15.7% in 2013 (Figure 1). It can be argued that it was due to reduction of episiotomy, there was an increase of spontaneous perineal injuries. However, there was a significant reduction (13%) of all perineal injuries from 2013 to 2017. These decreasing trends of total perineal injuries including episiotomy indicated that there were constant efforts to avoid unnecessary use of surgical intervention (episiotomy) and to prevent any spontaneous injuries for a physiological process of vaginal delivery. The reduction rates should be seen positively as midwives are constantly striving towards better services for the pregnant women and minimizing preventable perineal injuries at this MOU. However, good practices of perineal care during childbirths such as position of women for (lithotomy, standing, sitting, left lateral etc.), perineal support, bearing down of babies all contributed to reduction of episiotomy and overall perineal injuries.

Five years summary data showed that more than one fifth (21.1%) of these women had spontaneous and 11.3% had induced (episiotomy) perineal injuries. The incidence of spontaneous perineal injuries among the low-risk pregnant women appeared higher than other reports from similar resource constrained settings [11, 28, 32]. The rate was higher than the rate found from a hospital delivery in Durban (16.2%), SA [28]. This could be due to the support that midwives received from doctors in hospital. The incidence of perineal injuries was also found to be higher among black South African pregnant women than the other races in SA and elsewhere[28,33]. The rates of second degree and OASI were minimum in our setting compared to other studies in hospital settings in SA and abroad[14,27-28]. Regional hospitals in SA conduct deliveries of complicated pregnancies referred from MOUs and district hospitals thus higher rate of OASI is likely. The incidences of perineal injuries were found to markedly vary between different study settings with higher rates in hospitals compared to lower in community settings and those were found from Sweden and Nicaragua[11, 34]. The first degree perineal injury is

considered minor and it was 18% in our study. We found a low incidence of second degree and OASI (3.3% and 0.2% respectively). The spontaneous second-degree perineal injuries were much lower than the reported rate from a meta-analysis (23%)[8]. However, the rate of second-degree perineal injury in our study is comparable with other findings from Nicaragua (2.7%), Pakistan (3.2%), and Bangladesh (1.1%) [34-36]. The second degree perineal injury though considered minor injury still it needed special attention as it affects the perineal muscles. Though muscular injury is classified as a second-degree injury it is equal to and often becomes worse than a routine episiotomy. However, if the injury involves the levator ani muscle it leads to pelvic floor disorders in later life [10].

Risk factors for spontaneous perineal injuries were well documented in previous reports. Teenagers (age < 20 years) and ages between 20-29 years), nulliparous (parity nil) pregnant women showed strong risk factors for spontaneous perineal injuries in our study which were well recognized in earlier reports[24, 37]. In our study, term pregnancy had twice the chance of having spontaneous injuries. Not many studies looked at gestational age as a risk factor for perineal injury. The case control study from Cape Town tertiary hospital (SA) looked into it and reported that gestational age was not a risk factor [27]. As the gestational age increases, the foetus grows bigger and gains weight. These two factors (higher gestational age and baby weight) are interrelated. We found both factors were indeed risk factors for perineal injuries like other study[26].

The episiotomy rate in our study was lower compared to other reports from Ethiopia where they found a rate of 35%, France (national average of 14.1% for all non-operative vaginal deliveries) and Vietnam (15.1%)[38-40]. However, the incidence of episiotomy is similar to the rate (10%) recommended by WHO when it is undertaken for selected cases [16]. However, the episiotomy rate in our study is higher than the rates reported from Brazil (8%) for low-risk pregnancies delivered at a hospital referred from PHC clinics and in Nigeria (9.3%)[14,30]. The possible reason for this low incidence of episiotomy in our study was possibly due to the fact that episiotomy was undertaken when it was indicated, and also to the fact that the low-risk pregnant women delivered at this MOU[29]. Routine episiotomy in reducing severe or major perineal injury (third or fourth degrees) became a controversial issue in modern obstetric practice. There was a systematic review report that supported that standard episiotomy (at mediolateral position) was found to reduce severe forms of perineal injury (third- and fourth-degree injuries)[31]. Similarly, episiotomy was found with an association of reducing perineal injuries in hospital deliveries from Durban, SA[28.] On the contrary, other reports from Cape Town and the Cochrane study found that there was no association to protect major perineal injuries using routine episiotomy[27, 41]. We also did not find any association of episiotomy and OASI. A report from Australia indicated that episiotomy was associated with minimising major injuries when assisted vaginal delivery was conducted using forceps[42]. In our set up there were no forceps assisted deliveries undertaken. The factors found associated with undertaking episiotomy in our study were gestational age $\geq$ 37 weeks, primipara and previous vaginal deliveries those are similar to other reports from Africa and elsewhere [38, 39, 43]. Pregnant women who had antenatal care during pregnancy was found to be protective (55%) against episiotomy. There is no report which highlighted that antenatal care during the antenatal period could reduce perineal injuries, especially episiotomy. However, it was reported that antenatal education prepare pregnant women for delivery and found to impact positively on wound-healing and compliance with wound care.[44]

The OASI in our study was low of 0.2%. This is lower than the rates found in Brazil (0.75% for low-risk pregnancies) and Mexico (0.8% for all vaginal deliveries) [14, 32]. The reason for the low rate of OASI in our study could well be due to low-risk pregnant women delivered our facility. The misdiagnosis and underreporting of major perineal injuries cannot be ruled out as suggested by others.[32]. However, underreporting is less likely as all OASI cases were needed

to be referred to hospital for surgical intervention like suturing of anal sphincter. Several studies suggested that heavier birth weight of babies at delivery was associated with severe perineal injuries. Our study found a similar trend of lower birth weight (<4Kg) was protective for OASI [11, 32, 33]. The earlier studies from Brazil and Mexico reported that women with a younger age (teenage women) had 1.3 and 2.9 times respectively more likely to have OASI [14, 32]. This was not the case in our study. In an earlier report it was found that the negative impact of OASI in subsequent pregnancies was five-fold to have severe perineal injuries thus strategies should be considered essential to prevent OASI [49].

Strengths and Limitations

The strength of this study was its fairly large homogenous type of sample. The limitations of this study were its retrospective nature and review of records limited the study variables and made us reliant on the quality of data recorded. Finally, more prospective studies are necessary, in order to assess more risk factors associated with mild and severe perineal injuries. It is important to identify women who are at risk of OASI during childbirths, in order to minimize the risks of perineal injury during this period. Midwives from PHC facilities need to have advanced knowledge of pelvic and perineal anatomy, so as to prevent injuries during childbirths.

Conclusion

This large sample of women from a MOU had shown declining trends of perineal injuries. Risk factors identified for these injuries are similar to those previously reported in other studies carried out in different settings. Identification of those parturient women who are at higher risk groups may result in timely and appropriate interventions that minimize perineal injuries and complications thus preventing postpartum and the long-term sequelae that may develop later in life. Further studies are recommended to identify the effect of antenatal care on perineal health at the time of delivery and to monitor the trends of perineal injuries.

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Ethical Approval

We obtained ethical approval from Umgungundlovu Health Ethics Research Board (Reference no. UHERB 015/2020). We sought permission from the management of KCHC for utilizing the delivery register to conduct the study. We did not use identification of patient or staff during analysis and presentation of the results.

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Conflict of Interest

There is no competing interest of authors to this report and study.

Contributions of Authors

AMH – Conceptualisation, study design, monitoring and participation in data collection, collation and analysis, preparation, and finalization of the manuscript.
MEH– Conceptualisation, data analysis, editing and finalization of the manuscript

GVH – Conceptualisation, editing and finalization of the manuscript. All authors have read and approved the manuscript.

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Table 1: Baseline variables with cross table analysis with outcome variables of the study population

Variables	Frequency	%	Spontaneous Injury (%)	P value	Episiotomy (%)	P value	OASI (%)	P value
Age (n=5542)								
<20 years	1068	19.2	5.5	0.000	4.3	0.000	0.1	0.010
20-29 years	3332	59.9	14.7		6.1		0.1	
30- 39 years	1082	19.4	3.5		0.9		0.0	
>40 years	51	0.9	0.0		0.1		0.0	
Gestation age (n= 5508)								
Term (37 -40 weeks)	5338	96.9	23.4	0.001	11.2	0.000	0.2	0.298
Preterm (≤36 weeks)	170	3.1	0.4		0.1		0.0	
Parity (n= 5471)								
Nil parity	1386	25.3	7.6	0.000	5.6	0.000	0.1	0.845
1-4 parity	3996	73.1	16.1		5.6		0.2	
>5 parity	89	1.6	0.2		0.1		0.0	
Previous vaginal deliveries (n=5547)								
Yes	4073	73.3	6.1	0.449	3.6	0.001	0.1	0.919
No	1474	26.7	17.7		7.7		0.2	
Antenatal booking (n=5547)								
Yes	5181	93.6	1.3	0.011	0.3	0.000	0.0	0.367
No	357	6.4	22.6		10.9		0.2	
Sex of baby (n=5500)								
Male	2759	49.6	12.4	0.014	5.8	0.043	0.1	0.999
Female	2741	49.4	11.4		5.4		0.1	
Birth weight (n= 4874)								
< 3 Kgs	1748	31.4	6.2	0.00	3.3	0.189	0.0	0.000
3- 3.99 Kgs	3711	66.8	17.3		7.8		0.1	
≥ 4.00 Kgs	99	1.8	0.4		0.1		0.1	
Length (n=5210)								
≤50 cm	4167	80	19.7	0.542	9.3	0.120		
≥51 cm	1043	20	4.8		2.0			
APGAR score (n=5547)								
<7 in 1 minutes	425	7.7	0.8	0.003	0.7	0.162	0.0	0.440
≥ 7 in 1 minutes	5122	92.3	23.3		10.7		0.2	
< 7 in 5 min	212	3.8	0.0	0.001	0.1	0.462	0.0	0.740
≥ 7 in 5 min	5351	96.2	24.1		11.4		0.2	
Perineal injuries (n= 5545)								
Intact perineum	3747	67.6						
1-degree injury	978	17.6						
2-degree injury	184	3.3						
3-degree injury	11	0.2						
Episiotomy	625	11.3						

Table 2: Logistic regression output of all perineal injuries

Variables	Sig.	Odds Ratio (OR)	95% C.I. for OR	
			Lower	Upper
Age coded	.000			
Age < 20 years	.001	5.927	2.084	16.861
Age 20-29 years	.011	3.866	1.369	10.920
Age 30-39 years	.085	2.506	.882	7.120
Gestational age ≥37 weeks	.003	2.046	1.286	3.256
Parity	.000			
Parity nil	.000	3.919	2.021	7.600
Parity 1-2	.072	1.817	.948	3.484
Birth weight of the baby	.000			
Birth weight < 3 kgs	.868	.960	.592	1.555
Birth weight 3-3.99 Kgs	.242	1.327	.826	2.130
ANC booking (Yes)	.008	.689	.524	.905
Constant	.000	.024		

Table 3: Logistic regression output for episiotomy

Variables	Sig.	Odds Ratio (OR)	95% C.I. for OR	
			Lower	Upper
Age coded	.000			
Age < 20 years	.176	2.303	.689	7.701
Age 20-29 years	.711	1.254	.378	4.159
Age 30-39 years	.534	.679	.200	2.301
Gestational age ≥ 37 weeks	.000	6.226	2.250	17.232
Parity coded	.000			
Parity Nil	.024	3.973	1.202	13.130
Parity 1-4	.448	1.583	.484	5.180
Had previous vaginal delivery	.016	1.262	1.045	1.525
Had antenatal booking	.002	.457	.279	.749
APGAR scores > 7 after 5 minutes of delivery	.078	1.397	.963	2.026
Constant	.000	.007		

Table 4: Logistic regression output for OASI

Variables	Sig.	Odds ratio (OR)	95% C.I. for OR	
			Lower	Upper
Birth weight	.000			
Birth weight < 3 Kgs	.000	.14	.011	.142
Birth weight 3-3.99 Kgs	.000	.55	.133	.223
Gestational age < 37 weeks	.066	.115	.011	1.157
Constant	.997	.000		

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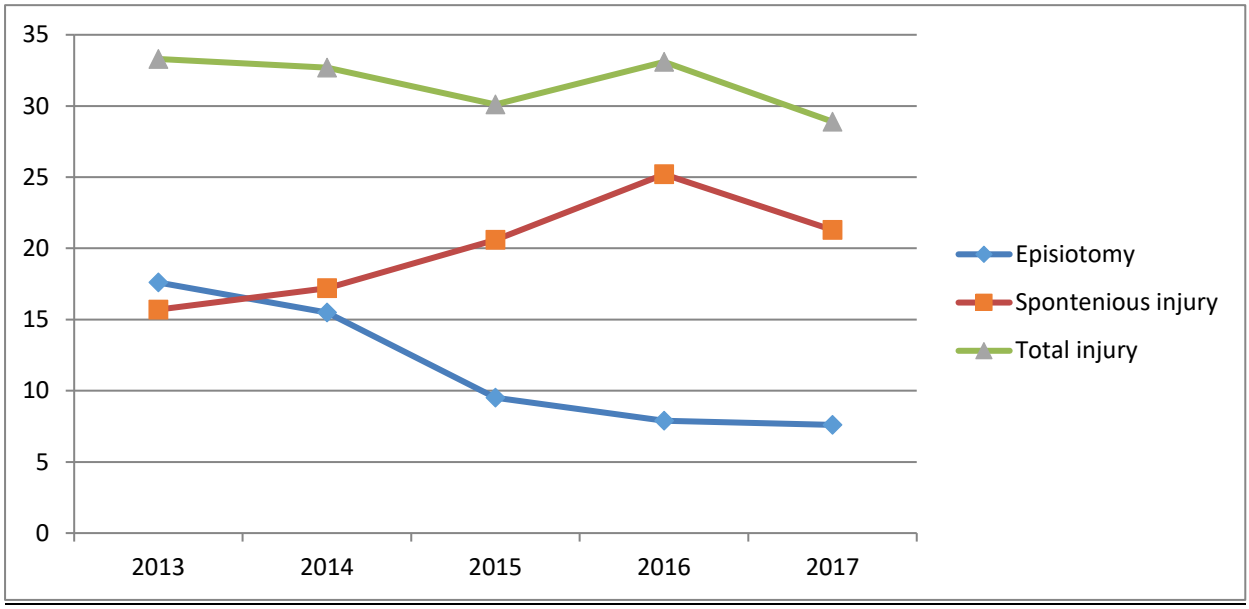

Figure 1: Trends of different types of perineal injuries from 2013 to 2017 at KCHC.