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Infection and wound breakdown in spontaneous second-degree perineal tears: An exploratory mixed methods study.

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ABSTRACT

Background: Perineal trauma affects large numbers of women who have a vaginal birth. This study explores the incidence, etiology and women's experiences of wound infection/breakdown associated with spontaneous second degree tears.

Methods: This was an exploratory mixed methods study set in an urban tertiary National Health Service hospital in 2014-2015. The study included a prospective observational study of second degree tears using electronic patient records. Infection was defined using criteria adapted from Public Health England's Surgical Site Infection Surveillance Service. We also did a case-control study of maternity records to explore factors associated with perineal infection/wound breakdown, as well as semi-structured interviews with a purposeful sample of women who experienced wound infection/breakdown.

Results: Of 2892 vaginal births during the study period, 76.8% sustained perineal trauma, with second degree tears most commonly recorded (n=828/28.6%). Sixteen (1.9%) had a documented infection/wound breakdown which were associated with 'compromised wound status' (increased severity of wound/poor suturing) (p=.033) Women complained of a lack of information about their perineum and poor postnatal surveillance by midwives and physicians. Diagnosis and treatment were often delayed by clinicians' reliance on external signs of wound infection. Although the sample size was small, there were no differences in rates of infection between sutured and unsutured second degree tears.

Conclusions: Although second degree tears were common following vaginal birth, wound infection/breakdown was relatively uncommon. Women who report feeling unwell or develop pyrexia postnatally should be assessed urgently. A prospective longitudinal study exploring the long- term sequelae of second degree tears is needed.

INTRODUCTION

Perineal trauma is the most common obstetric complication of childbirth, occurring in 55-85% of vaginal births, with lower estimates coming from hospital episode statistics data which may reflect incomplete data capture nationally [1] [2]. Complications of perineal

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trauma include pain, infection and wound breakdown [3] [4] [5] [6] [7] [8]. Perineal trauma may be indirectly associated with long-term maternal morbidity (urinary incontinence, dyspareunia, psychological problems) but these are multi-factorial with no direct causal association [9] [10] [11] [12] [13].

Perineal trauma is classified by severity: 'first degree' describes injury to perineal skin only; 'second degree' involves injury to perineal muscles but not the anal sphincter, including both spontaneous tears and deliberate surgical incisions (episiotomies); 'third and fourth degree' describe injury to the perineum involving the anal sphincter complex [3]. Existing research into perineal trauma focuses on anal sphincter injuries and episiotomies. Little is known about the sequelae of spontaneous second degree tears, the most common type of perineal trauma, affecting 1:4 women who have a vaginal birth [1] [4]. Between 2000-2010, the UK National Health Service paid £8,740,915 in settlements for first and second degree perineal trauma [16]. A UK-based Delphi study found that infection was women's primary concern in the first few weeks after experiencing second degree perineal trauma [17] [18], but women's experiences of infection have rarely been studied. A literature search undertaken for this study in July 2015 exploring women's experiences of first and second degree perineal trauma identified only two interviews across six studies with women who experienced a perineal wound infection [19] [20] [21] [22] [23] [24].

Estimates for infection rates in second degree tears range from 2-11% [1] [25] [26] but defining and identifying clinically relevant infection is challenging [14] [15] [25]. Estimates for wound breakdown in sutured tears are 0.1-2% [8]. Many studies are complicated by the combination of different types of perineal trauma, confounding the association between the degree of trauma and outcomes of interest.

2. Infection/breakdown in 2nd degree perineal tears

The aims of this study were to investigate the incidence of clinically relevant infection/wound breakdown in a cohort of women who experienced a spontaneous second degree perineal tear following vaginal birth; explore potential contributory factors for perineal infection/breakdown; and interview women about their experiences of perineal infection/breakdown.

METHODS

An in-depth exploratory mixed-methods study was undertaken in one urban National Health Service tertiary hospital in the South of England (5,000-6,000 births per year). Qualitative data were included to provide insight into women's experiences of wound problems because 'maternal satisfaction' is included as a 'core outcome set' in the Core Outcome Measures in Effectiveness Trials initiative's consensus on minimum outcomes for maternity research [27].

The study included three discrete but interrelated elements:

(1) Prospective observational study

A prospective observational study was conducted over 9 months (July 1st, 2014-March 31st 2015) to explore the number and characteristics of women who sustained a spontaneous second degree tear during childbirth. Cases of second degree perineal tears were identified through electronic patient records, excluding women who had a caesarean delivery, intact perineum, first, third and fourth degree tear and episiotomy. Demographic data (age, parity, place of birth, ethnicity) and immediate management of the tear (sutured/not sutured) were collected.

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Within this cohort, infection and wound breakdown cases were identified through multiple sources to ensure as complete a data set as possible. These included: electronic patient records at final midwifery contact (10-28 days postnatal); Clinic daybooks (postnatal ward, maternal assessment unit, perineal clinic); Hospital and Emergency Department admissions of women who had perineal infection; 'Sepsis' cases identified by the coding department.

Based on a second degree tear prevalence rate of 25% [1], it was estimated that 721 second degree tears would be identified, which would provide sufficient cases of infection/wound breakdown for an exploratory study. The maternity records and (when available) microbiology results of all suspected cases of perineal infection/wound breakdown were reviewed. Rigorous inclusion criteria were adapted from Public Health England's Surgical Site Infection Surveillance Service [28] (Table 1). For the purpose of this study, 'wound breakdown' was defined as a dehisced sutured wound, not including second degree perineal tears where the woman had declined suturing. Final decisions about inclusion as a study case were made by a clinician in consultation with a microbiologist. Descriptive analysis of the electronic patient records data (frequencies and percentages) were undertaken using IBM SPSS version 22.

(2) Case-control study

To explore factors contributing to perineal wound infection/breakdown, a case-control study was undertaken. The maternity records of all potential perineal morbidity cases were ordered, along with two contemporaneous controls for each case. In addition, all the women who agreed to be interviewed for the qualitative study consented for their maternity records to be retrieved, and these were also included.

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A data-collection tool was devised to extract a detailed account of each perineal tear, including demographic information, potential antenatal and intrapartum risk factors, a description of each tear in the labour record, its management and details of the professionals undertaking perineal repair. Microbiology results and data from interviews were also included.

For purposes of analysis, individual risk factors were grouped into composites under the three key constituents of infection: compromised host defences, compromised wound status and potential exposure to pathogens (Table 2). Data were uploaded into IBM SPSS version 22 and logistic regression analysis was undertaken [29]. The logistic regression chi-square statistic testing the association between each composite risk factor (used as an ordinal/categorical variable) and case-control status, its degrees of freedom and probability (*p*) value calculated. As infection/wound breakdown numbers were small, statistical associations with individual risk factors for infection could not be tested.

(3) Qualitative study

A purposive sample of women who sustained a spontaneous second degree tear were interviewed, using the observational study as a sampling frame. Women who gave birth within the previous three months were approached to minimise possible recall bias [30]. The findings from participants who sustained an infection/wound breakdown are included in this study. Women interviewed who did not sustain an infection/wound breakdown will be reported separately. Women were excluded if they were <18 years old, had a documented learning disability, did not speak English, had experienced an obstetric/neonatal emergency which might confound their experience of perineal trauma

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or had received clinical care by the interviewer. Women were sent a letter and participant information sheet, followed up with a phone call inviting them to an interview at a venue of their choice. Semi-structured interviews enabled participants to report health problems and develop themes important to them. A patient involvement focus group contributed to the development of the participant information sheet and topic guide.

Interviews were audio-taped and transcribed verbatim using pragmatic naturalism [31]. Transcripts were coded using an iterative, inductive approach and analysed thematically using phenomenology [32]. Emerging meta-codes and themes were discussed by the authors to create richer insights and tabulated using Microsoft Excel. Memos and a reflexive diary provided an audit trail of the analysis process. Ethical approval was obtained from the Stanmore Health Research Authority (15/LO/0216). Data were anonymised and managed in accordance with the Data Protection Act 1998 [33], the Caldicott Principles [34] and the Research Governance Framework for Health and Social Care [35].

RESULTS

Observational study

A total of 2,892 women had a vaginal birth during the study, 2,220 of whom (76.8%) sustained perineal trauma (Table 3). Spontaneous second degree tears were recorded for 828 women, the most common perineal outcome associated with a vaginal birth (28.6%). Over one-half of the women were white (52%) and a third were black or Asian (33%) (Table 4). About 70% were aged 30 or over and one-half were primiparous. Most births (79%) took place in an obstetric unit and 87% of women had their perineal trauma sutured.

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Twenty-five potential cases of perineal infection/wound breakdown were identified among the 828 women and the records of these 25 women were analyzed. Following investigation, nine did not meet the inclusion criteria (in two cases, tears sustained were not second degree, four women presented with perineal pain but no signs of infection and three had unrelated infections) resulting in 16 confirmed perineal morbidity cases (1.9%).

Fourteen women suffered an infection (nine of which included wound breakdown) and two had wound breakdown without infection. The most common symptoms of infection other than wound breakdown was offensive discharge (9/14). The onset of infection/wound breakdown (where known n=14) ranged from 2-8 days postnatal (mean 5) with one outlier on day 16.

Ten cases had a positive wound swab identifying eight distinct, mostly endogenous organisms which could be considered normal flora from the female reproductive tract [28]. Two cases of beta-haemolytic Streptococcus Group A infection were identified, one of which was invasive.

Infection/wound breakdown was more likely to be identified among white women, women aged 30+ and in women who gave birth outside the obstetric unit. Although thirteen percent (106) of women who sustained second degree perineal tears declined suturing, this was not associated with an increase in wound infection.

Case-control study

Of 89 maternity records ordered, 65 were available for review (73%), including all those with suspected infection/wound breakdown. Eighteen maternity records were excluded

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(four had been misclassified as second degree tears and 14 had no postnatal information), leaving 47 records available for analysis (16 cases and 31 controls, ratio 1:2).

Around half of the women's records documented the wound as '*second degree tear*' with no further details. Ten of 47 (21.3%) second degree tears were described as '*small*', '*well aligned*', '*not bleeding*', '*comes together well*', '*long but shallow*' (including all those left unsutured: 6/47). Fourteen (31%) were described as '*deep*', '*complex*' or '*bleeding+++*'.

There was a linear relationship between number of risk factors and an increased risk of morbidity ($p=.039$). Compromised wound status was the only composite risk factor significantly associated with morbidity ($p=.033$).

Qualitative study

Five confirmed morbidity cases did not meet the inclusion criteria for interview. Of the remaining eleven, the eight who gave birth in the last three months of the study were contacted and 5 consented to participate (63%). The women were 11-21 weeks postnatal at the time of interview (mean 16 weeks).

Two participants sustained an infection with wound breakdown, two only infection (one of whom had an unsutured tear) and one had wound breakdown without infection. Two participants were white British, two white 'other' and one black African; two spoke English as a second language. Place of birth included home (1), midwifery-led unit (3) and obstetric unit (1). All but one were multiparous. Excluded cases were more ethnically diverse, younger and more likely to have given birth in the obstetric unit.

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Women who developed infection described their symptoms as suddenly worsening after a few days of slow improvement. For some, the onset of infection was experienced as feeling initially feverish and/or physically or emotionally 'unwell' before developing acute perineal pain.

...I felt really unwell, and very teary, and very, very, it was just an awful, awful day. And I don't remember feeling more sore then? My perineum? But, um, I was just feeling really wrong....

In some cases delays in diagnosis occurred because women waited until their next midwifery appointment before seeking help, or because clinicians failed to diagnose infection in the absence of external signs:

I felt like I'd taken a couple of steps back... the pain was getting worse but she said, oh no, it looks absolutely fine.

[Wednesday] I said to her I'm getting this shivering and she said that's probably just your milk coming in... [Thursday] I said to the midwife, can you check me? Because I feel like it's infected... and she said, honestly, it looks absolutely fine... And then on the Friday it swelled... she went, OK that's really bad and she went, it doesn't smell right either.

Women expressed surprise that midwives and GPs did not always offer to check their perineum. The quality of examinations was also commented on:

I felt that it, I hadn't been examined properly... she was looking from underneath, probably where the stitches were, but my concern was a little bit more internally.

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I was like, what, you don't want to examine me? And she was like, I can have a look if you want me to, and I was like, well yes! I was really quite shocked... I've still not had an internal examination. It almost feels like you go to the dentist and, like, they just ask you to smile?

... [the GP] didn't check it? And I'd expected them to check it... I never went back.

But it never felt right.

Women felt marginalised when it came to knowledge about their perineal trauma and how to care for it. Uncertainty about 'what happened' was a source of ongoing psychological distress:

It's probably the thing I'm most unhappy about... I don't think I'll probably ever

really know what happened, like how I tore and exactly, like, was it a small tear?

Or a deep tear? Where was it?... I have absolutely no understanding.

Infection and wound breakdown in such an intimate, private place was experienced as especially distressing. In particular, offensive smells prompted the perception of poor hygiene, triggering shame and embarrassment.

...having an infection in your lower regions. It's just so gross... it's absolute hell...

having an infection [in a caesarean wound] seems nicer...

Women spoke of "down there", "lower regions", "the nameless place", "you know" or simply indicating "it" with a pause in the conversation. Women reported finding it difficult to talk openly about perineal problems with partners, friends and clinicians. This inability to have a "fluent conversation" about their tear, was seen as one reason women struggled to acquire the knowledge they needed to access help.

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The infections in this study were treated successfully with oral antibiotics and all the women described their perineum as 'healed', but only one was satisfied with the appearance and/or sensation of her vagina and perineum at the time of interview.

I've never felt completely comfortable with it again. I wouldn't really say it's pain... just not quite right.

Two women had serious on-going concerns (one suspected that she had an undiagnosed third degree tear and another was left with a visible 'hole' in her perineum) but neither had sought help because of their experience of painful suturing after delivery:

I don't want to have another surgery!

Because of what's happened, the first thing I'm afraid of is the stitches. I would be, like, terrified of being stitched again.

The kind of care women received during their labour and when their perineal trauma was being sutured impacted on how they assigned blame for their subsequent morbidity. Three women who described receiving disrespectful care associated their postnatal morbidity with sub-optimal clinical practice (i.e. poor suturing skills; lack of perineal hygiene advice). In contrast, the two women who reported feeling well cared for (treated respectfully; involved in decisions about their care) blamed 'bad luck' or took responsibility themselves.

DISCUSSION

The perineal infection/wound breakdown rate (1.9%) among women who had second degree perineal tears in the population studied was lower than reported in previous studies

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[1] [25] [26]. However, this may relate to the fact that data from earlier studies were obtained from planned prospective follow up of women and inclusion of third and fourth degree tears and episiotomies which are associated with higher infection rates.

The majority of cases of perineal infection in this study occurred before day 10 which suggests that midwives are well placed to identify women who develop signs and symptoms of infection. However, women's concerns that their perineal healing was not assessed at each clinical contact, or not assessed appropriately, suggests that postnatal care planning is lacking adherence to evidence-based guidelines [36]. The lack of priority accorded to monitoring women's postnatal recovery is consistent with findings that postnatal care is an under-resourced aspect of National Health Service maternity services [37] [38]. The Department of Health for England identified the need to improve postnatal care regardless of cost a decade ago [39].

Few women in this study were offered sufficient information about their perineal trauma or how to manage their recovery. Communication problems may be exacerbated by the lack of a shared vocabulary for discussing vaginal health, as suggested by this study. Feminist research has shown that the vagina is socially as well as anatomically hidden, [49] [9] [48] [50] perpetuating the perception that women's sexual health is unimportant and of low priority [23] [48].

That a wide variety of bacteria were found on wound swabs suggests no single source of perineal infection, which has been reported in previous studies [15]. The one woman identified with Invasive Group A Streptococcus, a potentially communicable disease [40] [41], is of concern. The 2009-2012 UK Confidential Enquiry into Maternal Deaths reported that twelve of the twenty deaths associated with genital tract sepsis were due to postnatal

Invasive Group A Streptococcus infections, with contributing factors including delayed diagnosis and incomplete assessment [40]. Delays in diagnosis reported in the current study occurred due to women not accessing timely help, and to a disconnect between symptoms reported by women and referral for further assessment by midwives.

The use of composite risk factors provided insights into areas for future study. 'Compromised wound status', which was associated with increased morbidity, included two main features: (1) increased severity of the wound (extensive tearing and/or oedematous tissue) and (2) poor clinical suturing skills. Previous studies have associated increased severity of tears with higher risk of morbidity [4] [7] [6] but this has not been identified within one classification of tear before now. The second element (poor suturing skills), is a modifiable factor which could be addressed through enhanced clinical training which has been described in several previous studies[3] [42] [43] [44].

Fewer perineal infections were identified among women who had unsutured perineal tears, which may reflect that these were all described as '*small*', i.e. less 'compromised', however findings must be interpreted with caution and further larger studies are needed. The UK National Institute for Health and Care Excellence [36] currently recommends that all second degree tears be sutured to reduce the risk of infection.

The quality of care women received during their intrapartum and immediate postpartum period impacted on how they managed their perineal morbidity, and on the perceived reasons for its onset. The importance of respectful care (enabling informed choice; attending to requests for pain relief) during childbirth is widely recognised [45] [46] [47].

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Strengths and Limitations

This study had several important strengths. These include the identification of a comprehensive data set and use of a mixed methods design which focused exclusively on spontaneous second degree tears. Standardised, nationally recognised criteria were used to identify clinically relevant morbidity cases. Purposive sampling for the qualitative study produced greater diversity of participants than previous studies which used convenience/snowball sampling [20] [21] [22] [23]. However, a number of limitations should also be considered. Study exclusion criteria reduced access to potentially more vulnerable women (teenagers and non-English speaking women). The small number of participants interviewed reflected the fact that perineal infection in spontaneous second degree tears is uncommon, and there was uncertainty at study commencement about how many women would choose to be interviewed on such a sensitive topic. The relatively high response rate in this study suggests that if women receive sensitive, timely information on the research there no reason to suspect that they would decline to participate in future studies.

The use of a single study site limits generalisability, and although multiple sources of data were accessed to identify morbidity cases, some women may have been missed (i.e. women discharged out of area; infection onset occurred after midwifery contacts had stopped) so morbidity may be underestimated. A high number (27%) of records could not be obtained for the case-control study and this could introduce bias. The use of composite risk factors is another limitation since the omission of variables could potentially bias the results, however, as there is no current consensus on which potential

risk factors are most relevant or how they should be categorised, the use of composite risk factors was a pragmatic decision.

Conclusions

This single centre study found a low incidence of infection/wound breakdown in spontaneous second degree perineal tears regardless of immediate clinical management. When infection was identified, onset was most likely to be associated with compromised wound status. Delays in diagnosis of infection occurred due to women not seeking timely help, perceived poor postnatal surveillance of the injury by midwives and physicians and clinicians' reliance on external signs when diagnosing wound infection. Clinicians should ask women about perineal healing at every postnatal encounter. Women who report feeling unwell, develop pyrexia following birth, report offensive vaginal discharge or worsening pain, should be assessed urgently and referred for medical consultation if appropriate. National standards for training in perineal assessment and suturing should be developed and audited. Respectful care and good information-sharing may minimise adverse outcomes and support women's recovery. Prospective longitudinal observational studies exploring modifiable risks for infection/wound breakdown and long-term sequelae of second degree tears are needed. One outcome might be a typology of second degree tears to inform different management pathways.

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CONFLICT OF INTEREST

OW is a qualified midwife who works part-time for the Trust which was the site for this study but the Trust was not involved in the design, analysis or reporting of findings. No other relationships or activities that could appear to have influenced the submitted work have been identified by the authors.

ETHICS APPROVAL

The procedures of the study received ethics approval from the relevant institutional ethics committee responsible for human experimentation: The Stanmore Research Ethics Committee (REC): 15/LO/0216 (Appendix 3.8), the sponsor (King's College London) and the site's R&D department.

AUTHORS' CONTRIBUTIONS

OW conceptualized and designed the study, undertook data collection and analysis, and prepared the manuscript for publication. DB and AMR contributed to study design and oversight and were involved in theme development for the qualitative data. TM and JS contributed to the design and analysis of the quantitative data. All authors contributed to ongoing discussions about the study, commented on drafts of the paper and accept responsibility for the content as published.

TRANSPARENCY DECLARATION

This manuscript is an honest, accurate, and transparent account of the study being reported, no important aspects of the study have been omitted and any discrepancies from the study as planned have been explained.

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Bibliography

- [1] R. McCandlish, U. Bowler, H. van Asten, G. Berridge, C. Winger, I. Sames, J. Garcia, M. Renfrew and D. Elbourne, "A randomised controlled trial of care of the perineum during second stage of normal labour," *BJOG*, vol. 105, no. 12, pp. 1262-1272, 1998.
- [2] Health and Social Care Information Centre, "Hospital Episode Statistics: NHS Maternity Statistics England 2013-2014," Health and Social Care Information Centre, 2015.
- [3] A. Sultan, "Obstetrical perineal injury and anal incontinence.," *Clin Risk*, vol. 5, no. 6, pp. 193-196, 1999.
- [4] L. Albers, J. Garcia, M. Renfrew, R. McCandlish and D. Elbourne, "Distribution of genital tract trauma in childbirth and related postnatal pain," *Birth*, vol. 26, no. 1, pp. 11-15, 1999.
- [5] C. Glazener, "Sexual function after childbirth: women's experiences, persistent morbidity and lack of professional recognition," *Br J Obstet Gynaecol*, vol. 104, no. 3, pp. 330-335, 1997.
- [6] V. Andrews, R. Thakar, A. Sultan and P. Jones, "Evaluation of postpartum perineal pain and dyspareunia: a prospective study," *Eur J Obstet Gynecol Reprod Biol*, vol. 13, pp. 152-156, 2008.
- [7] A. Macarthur and C. Macarthur, "Incidence, severity and determinants of perineal pain after vaginal delivery: A prospective cohort study," *Am J Obstet Gynecol*, vol. 191, pp. 1199-1204, 2004.
- [8] M. Williams and M. Chames, "Risk factors for the breakdown of perineal laceration repair after vaginal delivery," *Am J Obstet Gynecol*, vol. 193, no. 3, pp. 755-759, 2006.
- [9] V. Braun, *The vagina: an analysis [dissertation]*, London: Loughborough University, 2000.
- [10] C. Kettle and D. E. Fenner, "Repair of episiotomy, first and second degree tears," in *Perineal and anal sphincter trauma*, A. H. Sultan, R. Thakar and D. E. Fenner, Eds., London, Springer Verlag, 2009, pp. 20-32.
- [11] H. Woolhouse, D. Gartland, S. Perlen, S. Donath and S. Brown, "Physical health after childbirth and maternal depression in the first 12 months post partum: results of an Australian nulliparous pregnancy cohort study," *Midwifery*, vol. 30, no. 3, pp. 378-384, 2014.
- [12] L. Mason, S. Glenn, I. Walton and C. Appleton, "The experience of stress incontinence after childbirth," *Birth*, vol. 26, no. 3, pp. 164-171, 1999.

- [13] D. Morof, G. Barrett, J. Peacock, C. R. Victor and I. Mayonda, "Postnatal depression and sexual health after childbirth," *American Journal of Obstetrics and Gynecology*, vol. 102, no. 6, pp. 1318-1325, 2003.
- [14] R. Ganpathy, N. S. Bardis and R. F. Lamont, "Secondary repair of the perineum following childbirth," *J Obstet Gynecol*, vol. 28, pp. 608-613, 2008.
- [15] N. Tharpe, "Post pregnancy genital tract and wound infections," *J Midwifery Womens Health*, vol. 53, no. 3, pp. 236-46, 2008.
- [16] NHS Litigation Authority, "Information Sheet 13: Perineal Trauma. Extract from ten years of maternity claims: An analysis of NHSLA data," 2012.
- [17] D. Bick, C. Kettle, S. Macdonald, P. Thomas, R. Hills and K. Ismail, "PErineal Assessment and Repair Longitudinal Study (PEARLS): protocol for a matched pair cluster trial.," *BMC Pregnancy Childbirth*, vol. 10, no. 10, pp. 1-8, 2010.
- [18] E. Perkins, S. Tolhill, C. Kettle, D. Bick and K. Ismail, "Women's views of important outcomes following perineal repair," *BJOG*, vol. 115, no. Sup 1, p. 1.179, 2003.
- [19] L. Briscoe, T. Lavender, E. O'Brien, M. Campbell and L. McGowan, "A mixed methods study to explore women and clinicians' response to pain associated with suturing second degree perineal tears and episiotomies [PRAISE]," *Midwifery*, vol. 31, pp. 464-472, 2015.
- [20] S. Way, "A qualitative study exploring women's personal experiences of their perineum after childbirth: expectations, reality and returning to normality," *Midwifery*, vol. 28, no. 5, pp. e712-719, 2012.
- [21] R. O'Reilly, K. Peters, B. Beale and D. Jackson, "Women's experiences of recovery from childbirth: Focus on pelvic problems that extend beyond the puerperium," *J Clin Nurs*, vol. 18, pp. 2013-2019, 2009.
- [22] S. Herron-Marx, A. Williams and C. Hicks, "A Q-methodology study of women's experiences of enduring postnatal perineal and pelvic floor morbidity," *Midwifery*, vol. 23, pp. 332-334, 2007.
- [23] D. Salmon, "A feminist analysis of women's experiences of perineal trauma in the immediate post-delivery period," *Midwifery*, vol. 15, pp. 247-256, 1999.
- [24] S. Clement and B. Reed, "To stitch or not to stitch? A long-term follow-up study of women with unsutured perineal repair," *The Practicing Midwife*, vol. 2, no. 4, pp. 20-28, 1999.
- [25] P. Ahnfeldt-Mollerup, L. Petersen, J. Kragstrup, R. Christensent and B. Sorensen, "Postpartum infections: occurrence, healthcare contacts and association with breastfeeding," *Acta Obstet Gynecol Scand*, vol. 19, pp. 1440-1444, 2012.

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- [26] A. Johnson, R. Thakar and A. Sultan, "Obstetric perineal wound infection: is there underreporting?," *Br J Nurs*, vol. 21, no. 5, pp. S28, S30,S32-5, 2012.
- [27] D. Devane, C. M. Begley, M. Clarke, D. Horey and C. OBoyle, "Evaluating Maternity Care: A Core Set of Outcome Measures," *Birth*, vol. 34, no. 2, pp. 164-172, 2007.
- [28] Public Health England, "Protocol for the Surveillance of Surgical Site Infections (V6)," Public Health England, London, 2013.
- [29] N. Pearce, "Analysis of matched case-control studies," *BMJ*, pp. 352-j969, 2016.
- [30] J. Green and N. Thorogood, *Qualitative methods for health research*, London: Sage, 2004.
- [31] D. G. Oliver, J. M. Serovich and T. L. Mason, "Constraints and opportunities with interview transcription: towards reflection n qualitative research," *Social Forces*, vol. 84, no. 2, pp. 1273-1289, 2005.
- [32] L. Ayres, K. Kavanaugh and K. Knafl, "Within-case and across-case approaches to qualitative data analysis," *Qual Health Res*, vol. 13, no. 6, pp. 871-883, 2003.
- [33] UK Parliament, "Data Protection Act," The Stationary Office, Norwich, 1998.
- [34] Department of Health, Caldicott Committee, "Report on the Review of Patient-Identifiable Information," Department of Health, London, 1997.
- [35] Department of Health, "Research Governance Framework for Health and Social Care," Department of Health, 2005.
- [36] National Institute for Care and Health Excellence (NICE), "Postnatal care. NICE Guideline CG37," 2014.
- [37] D. Bick, C. MacArthur and H. Winter, *Postnatal care: evidence and guidelines for management*, 2 ed., Edinburgh: Churchill Livingstone Elsevier, 2009.
- [38] National Childbirth Trust (NCT), "Postnatal care: still a Cinderella story," NCT, London, 2010.
- [39] Department of Health (DH), "National Service Framework for children, young people and maternitiy services: Maternitiy care," DH, London, 2004.
- [40] M. Knight, S. Kenyon, P. Brocklehurst, J. Neilson, J. Shakespeare, J. Kurinczuk and on behalf of MBACE-UK, "Saving lives, improving mother's care - lessons learned to inform future maternity care from the UK and Ireland confidential enquiries into maternal deaths and morbidity 2009-2012," National Perinatal Epidemiology Unit, Univeristy of Oxford, Oxford, 2014.

- [41] Centre for Maternal and Child Enquiries, "Saving Mother's Lives: Reviewing maternal deaths to make motherhood safer: 2006-2008," *BJOG*, vol. 118, no. Sup. 1, pp. 1-203, 2011.
- [42] A. Sultan, "'Have I missed a third-degree tear?' The identification, treatment and follow-up of women who experience perineal trauma," *RMC Midwives*, vol. 5, no. 9, p. 301, 2002.
- [43] D. Bick, K. Ismail, S. Macdonald, P. Thomas, S. Tohill and C. Kettle, "How good are we at implementing evidence to support the management of birth related to perineal trauma? A UK-wide survey of midwifery practice," *BMC Pregnancy Childbirth*, vol. 12, no. 57, pp. 1-10, 2012.
- [44] A. H. Sultan, M. A. Kamm and C. N. Hudson, "Obstetric perineal trauma: an audit of training," *Journal of Obstetric and Gynaecology*, vol. 15, no. 1, pp. 19-23, 1995.
- [45] J. Sandall, H. Soltani, S. Gates, A. Shennan and D. Devane, "Midwife-led continuity models versus other models of care for childbearing women," *Cochrane Database of Systematic Reviews*. Issue 8, 2013.
- [46] White Ribbon Alliance, "Respectful maternity care: the universal rights of childbearing women," White Ribbon Alliance, Washington DC, 2011.
- [47] Birthrights Dignity in Childbirth Forum, "Dignity in childbirth: the dignity survey 2013," Birthrights, London, 2013.
- [48] T. Arias, 'Hidden': Women's perceptions of their vaginas in the year after childbirth [dissertation], London: King's College London, 2007.
- [49] A. Oakley, *Essays on women, medicine and health*, Edinburgh: Edinburgh University Press, 1993.
- [50] D. Walsh, "Perineal care should be a feminist issue," *Br J Midwifery*, vol. 8, no. 12, pp. 731-736, 2000.
- [51] National Institute of Care and Health Excellence (NICE), "Intrapartum care: care for healthy women and their babies during childbirth. NICE Guideline CG190," National Institute of Care and Health Excellence, 2014.
- [52] R. Engemann, A. Holzheimer and A. Thiede, *Immunology and its impact on infections in surgery*, Berlin: Springer Verlag, 1995.
- [53] C. Kettle, R. Hills and K. Ismail, "Continuous versus interrupted sutures for repair of episiotomy or second degree tears," *Cochrane Database of Systematic Reviews*, no. 11, 2012.

21. Infection/breakdown in 2nd degree perineal tears

Table 1 Inclusion criteria for morbidity cases in a prospective observational study of women who sustained a spontaneous second degree perineal tear at an urban tertiary National Health Service hospital in the UK (infection/wound breakdown), 2014-2015

CRITERIA			RATIONALE
Criterion 1	Spontaneous dehiscence	Sufficient on its own	SSISS ¹ criterion.
Criterion 2	Prescribed antibiotics by physician for an identified perineal infection	Sufficient on its own	Adapted from SSISS. We removed the requirement for this to be combined with Criterion 5 as clinical records were not always available (i.e. family doctor/GP)
Criterion 3	Swab culture yields organism which may be associated with infection	Sufficient in combination with one other criterion	Adapted from SSISS. SSISS allows a swab yielding an organism is sufficient on its own if pus cells are also present but pus cells are not always reported in perineal and vaginal wound swabs. Many organisms are endogenous (normal flora from the female reproductive tract)
Criterion 4	Offensive discharge/smell	Sufficient in combination with one other criterion	Adapted from SSISS (not sufficient on its own as it may originate from an unrelated uterine infection).
Criterion 5	Two clinical symptoms <ul style="list-style-type: none"> • Pain • Redness • Swelling • Heat 	Sufficient in combination with one other criterion	Adapted from SSISS

¹ SSISS - Surgical Site Infection Surveillance Service [28]

Table 2 Definition of composite risk factors for infection / wound breakdown used in a case-control study of women who sustained a spontaneous second degree perineal tear at an urban tertiary National Health Service hospital in the UK, 2014-2015

COMPOSITE RISK FACTORS	CONTRIBUTORY FACTORS	RATIONALE
<p>Compromised host defences (factors which might reduce the body's ability to fight infection)</p>	<p>1/ Mental health - Anxiety during pregnancy, and/or history of depression plus medication</p> <p>2/ Social risk - non-English speaker, deprivation, poor attender</p> <p>3/ BMI >=35</p> <p>4/ Medical : diabetic, pre-eclampsia</p> <p>5/ Smoker</p> <p>6/ Post-partum haemorrhage >1L and/or blood transfusion</p>	<p>Widely reported conditions which can impact on wound healing.</p> <p>We did not include 'underlying sepsis', since all cases of suspected sepsis during labour were treated with antibiotics, a potentially protective factor.</p>
<p>Potential exposure to pathogens</p>	<p>1/ >4 vaginal examinations during labour</p> <p>2/ Instrumental delivery</p> <p>3/ Delay in suturing >1 hr or not sutured</p> <p>4/ Meconium at delivery</p> <p>5/ Prolonged rupture of membranes (PROM) >24 hours before onset of labour</p> <p>6/ Ragged membranes (i.e. possible retained products could be a source of infection)</p>	<p>Invasive procedures increase the risk of nosocomial infection, potentially transmitting organisms into the wound.</p> <p>The National Institute for Health and Care Excellence (NICE) recommends undertaking repair 'as soon as possible to minimise the risk of infection' [51]</p> <p>Meconium at delivery, PROM and ragged membranes are risk factors associated with infection in the literature</p>
<p>Compromised wound status (The wound is an entry portal and complexity / compromise (i.e. poor repair) may increase the risk of infection [52])</p>	<p>1/ Prolonged second stage (pushing), defined by NICE as >2 hours for primiparous women and >1 hours for multiparous women.</p> <p>2/ Tear described as 'deep', '?3rd degree', 'complex', or 'bleeding +++'.</p> <p>3/ Clinician doing the suturing requiring supervision (low skill level).</p> <p>4/ Suturing without using continuous non-lock technique (i.e. the use of interrupted sutures)</p>	<p>Can lead to oedematous tissue which is associated with dehiscence and poor wound healing. [51]</p> <p>Risk of infection is associated with the severity of the wound.</p> <p>Could contribute to wound breakdown or leave reservoirs for infection</p> <p>Interrupted sutures may signify poor practice, excessive bleeding or a complex tear [51] [53]</p>

Table 3 Perineal outcomes of women who had a vaginal birth at an urban tertiary National Health Service hospital in the UK by morbidity status, 2014-2015 (grouped by the most serious element of trauma)

Outcome	n(%)
Second degree tear	828 (28.6)
Intact	672 (23.2)
Episiotomy	597 (20.6)
First degree tear	435 (15.0)
Other (lacerations/cervical tear etc.)	272 (9.4)
OASIS (3 rd & 4 th degree tear)	88 (3.0)
Total vaginal births	2892 (100)

Table 4 Sociodemographic and delivery characteristics of women who sustained a spontaneous second degree perineal tear at an urban tertiary National Health Service hospital in the UK by morbidity status (infection/wound breakdown), 2014-2015

Demographic information		Spontaneous second degree perineal tears	Morbidity (infection / wound breakdown)
		n (%)	n
Ethnicity	White British	271 (33%)	7
	White other	162 (20%)	4
	Asian	68 (8%)	1
	Black other	106 (13%)	1
	Black African / Caribbean	99 (12%)	1
	Other/not known	122 (15%)	2
Age	<20	10 (1%)	1
	20-29	229 (28%)	2
	30-39	545 (66%)	11
	40+	44 (5%)	2
Parity	Primipara	411 (50%)	9
	Multipara	417 (50%)	7
Place of birth	Home	46 (6%)	2
	Midwifery-led Unit	101 (12%)	3
	Obstetric Unit	657 (79%)	11
	Other	24 (3%)	0
Management of perineal tear	Sutured	722 (87%)	15
	Unstured	106 (13%)	1
TOTAL		828 (100%)	16