Homer CSE, Knight M, Kurinczuk JJ, Spark P, Brocklehurst P. (2010) Peripartum hysterectomy: A novel use of a classification system to audit safety in maternity care. *Midwifery* (Special Issue on Patient Safety) 26: 532–536.

A NOVEL USE OF A CLASSIFICATION SYSTEM TO AUDIT SEVERE MATERNAL MORBIDITY

ABSTRACT

Objective: Obstetric haemorrhage remains a significant cause of maternal morbidity and mortality worldwide and is significant in terms of patient safety and quality of care. One drastic outcome of haemorrhage is the need for peripartum hysterectomy. A classification system that can be used to audit severe events such as peripartum hysterectomy would be a useful adjunct to patient safety systems but it would need to account for pre-existing risk factors, such as previous caesarean section. One system that accounts for important risk factors is the Robson Ten Group Classification System (TGCS). The aim of this study was to examine whether the TGCS would be extended in a novel way to classify who required peripartum hysterectomy.

Setting: Population-based matched case control study data from the United Kingdom Obstetric Surveillance System (UKOSS) was used. All eligible UK hospitals participated.

Participants: Participants were women who underwent peripartum hysterectomy between February 2005 and February 2006 and their matched controls.

Methods: Cases and controls were categorised using the TGCS. The odds of having a peripartum hysterectomy in each classification group were calculated using logistic regression. An adjusted analysis was undertaken controlling for potential confounders.

Results: Three hundred and seven of the 315 who had a peripartum hysterectomy were classified into one of the ten groups; 606 of the 608 control women were classified. Women who underwent a peripartum hysterectomy were predominantly from the more complex classification groups. After adjusting for age, ethnicity and socio-economic status, the groups with an increased odds of peripartum hysterectomy were those who had a previous caesarean section.

Conclusions: The TGCS can be used in a novel way, that is, to examine an outcome other than caesarean section, and could be part of a new system to monitor patient safety. Population-based data was used as an example of how an existing classification system could be used in a different

way to which it was created and could make comparisons across institutions and countries while adjusting for case-mix in a simple manner. The TGCS may not necessarily be a useful way to monitor other events in childbirth. Further work is needed to develop other classification systems which could be used as a benchmarking tool to monitor patient safety in maternity care.

A NOVEL USE OF A CLASSIFICATION SYSTEM TO AUDIT SEVERE MATERNAL MORBIDITY

INTRODUCTION

Maternity care occupies a unique position within the patient safety field and within health services worldwide. The World Alliance for Patient Safety have recognised this uniqueness in their global set of research priorities in relation to maternal and newborn care (WHO Patient Safety, 2008). Maternal and newborn care is one of the top 20 research priorities. This includes developing a greater understanding of the burden of unsafe maternal and newborn care and being able to track trends and changes in maternal morbidity and mortality using simple solutions and approaches.

One of the major causes of maternal morbidity and mortality and a disruption to patient safety is obstetric haemorrhage. Major obstetric haemorrhage accounts for a significant proportion of cases of severe maternal morbidity, up to 50% in some studies (Brace, et al. 2004; Murphy, et al. 2009). Classifying and auditing severe maternal morbidity, such as major obstetric haemorrhage, provides a measure of the safety of maternity services, particularly where maternal mortality is rare, and is a useful way to track trends and changes in incidence and burden (Brace, et al. 2004; Brace, et al. 2007). The use of a simple classification system that accounts for some of the known contributing factors to major morbidity would be helpful for the audit and monitoring of patient safety.

Haemorrhage-associated peripartum hysterectomy is an extreme procedure carried out for life threatening severe obstetric haemorrhage (Flood, et al. 2009). In the past decade, the rate of, and occurrences surrounding the management of severe obstetric haemorrhage and peripartum hysterectomy have been subject to at least two government inquiries in relation to concerns around the quality and safety of services (Douglas, et al. 2001; Government of Ireland, 2006) even though the event is rare. A population-based, matched case control study using the United Kingdom Obstetric Surveillance System (UKOSS) reported a peripartum hysterectomy incidence of 0.41 cases per 1,000 births (95% CI 0.36-0.45) (Knight, et al. 2008). However, the rate is increasing in some studies, probably due to the increased caesarean section rate in many developed nations (Daskalakis, et al. 2007; Kuklina, Meikle et al. 2009). In the United States, a population-based study reported incidence rates ranging from 0.25 in 1987 to 0.82 per 1,000 births in 2006 (Bodelon, et al. 2009). There are a number of factors that have been associated with an increased risk of peripartum

hysterectomy including previous caesarean section, maternal age over 35 years, parity of three or greater, previous placental removal, previous uterine surgery (myomectomy) and twin pregnancy (Knight, et al. 2008; Bodelon, et al. 2009; Flood, et al. 2009). Previous caesarean section was associated with a population attributable risk of 28% in the UK study,(Knight, et al. 2008) thus accounting for this factor in any classification system is important.

Systems to classify and audit events such as peripartum hysterectomy often do not consider the differing characteristics or complexities (casemix) of women from different hospitals. One system that considers different factors, including previous caesarean section, is the Robson Ten Group Classification System (TGCS) which was first proposed in 2001 as a means to classify and audit caesarean sections (Robson, 2001). The classification system uses five variables – previous obstetric history (parity and previous caesarean section), type of pregnancy (single or multiple), presentation (cephalic or otherwise), onset of labour and gestation at birth. A combination of these variables defines the ten groups (see Table 1 for a description of each group). The variables on which classification is made are often readily available in hospital databases or patient files (eg parity, previous caesarean section, plurality, presentation). The groups are mutually exclusive and totally inclusive, that is, each woman can, and must, be placed in one group. The grouping concepts are straightforward and clinicians and managers identify easily with the classification concepts and the groups.

While the TGCS is robust and clinically relevant, it has been used in a limited way in the published literature and only in relation to caesarean section (McCarthy, et al. 2007; National Maternity Hospital, 2008). We sought to investigate whether the TGCS might be a useful classification system to audit other obstetric outcomes, particularly cases of severe morbidity where previous caesarean section, parity, prematurity and multiple pregnancy are important factors. It could potentially provide a way for maternity units to monitor particular outcomes as it accounts for the casemix or complexity of the women attending the maternity service. As the classification groups are easy to explain, the system may also provide a framework to inform women about the risks of particular outcomes.

With these factors in mind, we undertook an exploratory analysis to determine whether the TGCS could be extended in a novel way to audit peripartum hysterectomy. The aim was to calculate the proportion of women in each TGCS group and estimate the odds and risks of peripartum

hysterectomy for each group. This was a secondary analysis using data from UKOSS (Knight, et al. 2008).

METHODS

We used data from a population-based frequency-matched case control study (Knight, et al. 2008). The cases were women who underwent peripartum hysterectomy between February 2005 and February 2006 and their frequency matched controls. A detailed description of UKOSS methods is presented elsewhere (Knight, et al. 2005; Knight, et al. 2008). All 229 eligible UK hospitals participated.

In brief, cases were defined as any woman giving birth and undergoing a hysterectomy in the same clinical episode. Controls were defined as any woman giving birth who did not undergo a hysterectomy, identified as the two women giving birth immediately before the case in the same hospital. Data collection forms were sent to clinicians reporting a case to collect details of risk factors, management, and outcomes from both case and control women. All data requested were anonymous and processes were in place to ensure that duplicate reports were identified and removed.

Cases and controls were categorised using the TGCS. The odds of having a peripartum hysterectomy in each group were calculated using logistic regression. Group 1 (nulliparous, single cephalic, $\geq$37 weeks, in spontaneous labour) was the Reference Category. An adjusted analysis was undertaken controlling for potential confounders – age, ethnicity and socio-economic status.

Absolute risk ratios with 95% confidence intervals (CIs) were calculated by using the number of births in the UK in 2005 (Office for National Statistics, 2007a) and 2006 (Office for National Statistics, 2007b) to estimate the proportions in each of the ten groups in the control group. This study covered the entire cohort of UK births, and therefore risks with 95% CIs were calculated by using the population proportions derived from the control women.

All analyses were carried out using STATA version 10 (StataCorp, College Station, TX). The study was approved by the London Research Ethics Committee (ref. 04/MRE02/73).

RESULTS

There were eight women with incomplete data which meant classification was not possible. Three hundred and seven of the 315 who had a peripartum hysterectomy were classified into one of the ten groups; 606 of the 608 control women were classified (Table 1). Women who underwent a peripartum hysterectomy were predominantly from the more complex classification groups. Almost 60% (n=188) of women who had a peripartum hysterectomy had either had a previous CS (27%, n=85) or delivered preterm (33%, n=103). This latter group also included women with a previous CS. One third (31%, n=98) of women who had a peripartum hysterectomy were in the groups of women with relatively uncomplicated pregnancies (Groups 1-4). Multiple pregnancies and breech presentation accounted for a small proportion of women (7%, n=18).

In contrast, 75% (n=459) of control group women (those not undergoing peripartum hysterectomies) were predominately in the groups that represent relatively uncomplicated pregnancies (Groups 1-4). Women with a previous caesarean section and those who gave birth preterm made up 21% of the control group (n=121).

After adjusting for age, ethnicity and socio-economic status, the groups with a significantly increased odds of peripartum hysterectomy were those who had a previous caesarean section (Groups 5, 7, 8 and 10). Compared with nulliparous women with a single cephalic fetus in spontaneous labour at term, women with a previous caesarean section who had a single cephalic fetus at term were almost four times more likely to undergo a peripartum hysterectomy (OR 3.95; 95% CI 2.19-7.13). The odds increased if the baby was born preterm (OR 10.46; 95% CI 5.60-19.55) or if there was a multiple pregnancy (OR 11.57; 95% CI 2.71-49.34) or breech presentation (OR 15.73; 95% CI 2.82-87.70).

Estimated risks of needing a hysterectomy in the ten groups are shown in Table 2. The highest risks were in the groups of women who had a previous caesarean section (Groups 5, 7, 8 and 10). The lowest risks were seen in women having their first baby with a single baby in a cephalic presentation who had a spontaneous onset of labour at term (Group 1) and similar multiparous women (Group 3).

DISCUSSION

Severe maternal morbidity is fifty times more common than maternal death. Understanding and being able to monitor severe maternal morbidity could modify the safety and quality of care

(Callaghan, et al. 2008; WHO Patient Safety, 2008). The TGCS was created to explore and explain differences in caesarean section rates within, and between, institutions. We extended its use in this secondary analysis of data from UKOSS to investigate whether it could be a simple classification system to audit or monitor peripartum hysterectomy, as an example of severe maternal morbidity.

This analysis has shown that examining obstetric outcomes using the TGCS could be an effective approach to monitoring and audit. It is a simple classification system that accounts for some of the different characteristics of women giving birth. It would enable monitoring of outcomes over time while accounting for risk factors. Presenting data in this way can provide women and clinicians with important information about the potential risks of complications, such as peripartum hysterectomy. Information to women could be effectively directed using the TGCS as the antecedents enables classification. For example, low risk nulliparous women with a single cephalic presentation in spontaneous labour at term would see that their risk of peripartum hysterectomy is low.

In this analysis, reflecting previous work (Knight, et al. 2008), previous caesarean section was the largest contributor to peripartum hysterectomy. Women in the more complex groups (including previous caesarean section, breech, multiple pregnancy and premature birth) contributed almost two thirds (64%) of the women who had a peripartum hysterectomy. These results support other studies and provide evidence as to the potential harms associated with a prior caesarean section.

Being able to monitor the rates of both caesarean section and severe morbidity such as peripartum hysterectomy is an important aim of health services. The TGCS could be used as part of a process of audit and feedback as a means to improve patient safety. The audit cycle includes monitoring rates of maternal morbidity and mortality, feedback of results, formulating recommendations, implementing change and re-evaluating practice (Drife, 2006). On its own, the effects of audit and feedback are generally small to moderate (Jamtvedt, et al. 2007), however, as part of an overall package of quality improvement and clinical risk management, it is an essential component. A simple system of monitoring and audit using a classification system such as the TGCS could be part of a risk management framework for maternity care that includes learning and sharing safety lessons; and implementing solutions to prevent harm (Scholefield, 2008). Our analysis has demonstrated, however, that, due to the inclusion of previous caesarean section as one of the classification factors, the TGCS may not be sufficiently generalisable to use as a tool to audit severe maternal morbidity as a whole. A system including factors such as maternal age, parity and ethnicity may be required

although it is possible that this could be more complex and hence defeat the point of having a simple system. Further work is needed to explore the utility of, and possibly develop, such a system.

Severe maternal morbidly is a rare event and it is unlikely that one institution will have enough cases to use a condition-specific classification system. Nonetheless, examining even small numbers of cases using such a classification system may be helpful to develop local strategies to address prevention. At a broader level, routinely collected population health datasets can be used to identify women who suffer a major adverse outcome and have potential for monitoring the quality of obstetric care in a uniform and cost-effective way (Roberts, et al. 2008). Many population health datasets identify readily accessible demographic and pregnancy factors that could be used in a classification system. Another use of a generalisable classification system could be to monitor other, less rare outcomes such as postpartum haemorrhage, the main antecedent event to a peripartum hysterectomy. In a recent study, severe adverse maternal outcomes associated with childbirth were shown to have increased with the increase being entirely among women who experienced a postpartum haemorrhage (Roberts, et al. 2009). Being able to effectively monitor and audit obstetric haemorrhage while accounting for the casemix or complexity of the women attending a particular service and relevant population health variables may help understand trends in patient safety outcomes.

One of the limitations of this study is that we have used the TGCS, which was developed for one purpose, (monitoring the caesarean section rate) for another (auditing severe maternal morbidity). Nonetheless, as the TGCS is a simple classification system it provided a useful framework for this exploratory analysis. We are not aware of other suitable classification systems that do not require complex analyses and account for the most common risk factors. This analysis includes women who had a peripartum hysterectomy for uterine atony as well as for other reasons such as morbidly adherent placenta. We did not separate these groups as the numbers in each group would have been too small to make valid conclusions. In addition, some of the TGCS groups have small numbers (for example, Group 7) with very wide confidence intervals which makes generalisation difficult.

CONCLUSION

This exploratory analysis demonstrated that the TGCS could be used in a novel way, that is, to monitor an outcome other than caesarean section and could be an adjunct to monitoring patient safety. Population-based data on peripartum hysterectomy was used as an example of how an

existing classification system could be used in a different way to which it was created. The TGCS may, however, not be sufficiently generalisable to use as a tool to audit severe maternal morbidity as a whole and further research is needed to develop such a system.

REFERENCES

Bodelon, C., Bernabe-Ortiz, A., Schiff, M., Reed, S. 2009. Factors associated with peripartum hysterectomy. Obstetrics & Gynecology 114, 115-23.

Brace, V., Kernaghan, D., Penney, G. 2007. Learning from adverse clinical outcomes: major obstetric haemorrhage in Scotland, 2003-05. BJOG: An International Journal of Obstetrics & Gynaecology 114, 1388-96.

Brace, V., Penney, G., Hall, M., Brace, V., Penney, G., Hall, M. 2004. Quantifying severe maternal morbidity: a Scottish population study. BJOG: An International Journal of Obstetrics & Gynaecology 111, 481-4.

Callaghan, W., MacKay, A., Berg, C. 2008. Identification of severe maternal morbidity during delivery. American Journal of Obstetrics & Gynecology 199, 133.e1-8.

Daskalakis, G., Anastasakis, E., Papantoniou, N., Mesogitis, S., Theodora, M., & Antsaklis, A. 2007. Emergency obstetric hysterectomy. Acta Obstet Gynecol Scand 86, 223-7.

Douglas, N., Robinson, J., & Fahy, K. 2001. Inquiry into obstetric and gynaecological services at King Edward Memorial Hospital 1990 - 2000: Final Report. Perth, Government of Western Australia.

Drife, J. 2006. Perinatal audit in low- and high-income countries. Seminars in Fetal and Neonatal Medicine 11, 29-36.

Flood, K. M., Said, S., Geary, M., Robson, M., Fitzpatrick, C., Malone, F. D., et al. 2009. Changing trends in peripartum hysterectomy over the last 4 decades. American Journal of Obstetrics & Gynecology 200, 632.e1-6.

Government of Ireland. 2006. The Lourdes Hospital Inquiry: An inquiry into peripartum hysterectomy at Our Lady of Lourdes Hospital, Drogheda. (By Judge Harding Clark). Dublin, Stationery Office.

Jamtvedt, G., Young, J. M., Kristoffersen, D. T., O'Brien, M. A., & Oxman, A. D. 2007. Audit and feedback: effects on professional practice and health care outcomes [Systematic Review]." Cochrane Database of Systematic Reviews Issue 4.

Knight, M., Kurinczuk, J., Tuffnell, D., & Brocklehurst, P. 2005. The UK Obstetric Surveillance System for rare disorders of pregnancy. BJOG: An International Journal of Obstetrics & Gynaecology 112, 263-5.

Knight, M., Kurinczuk, J. J., Spark, P., Brocklehurst, P. 2008. Cesarean delivery and peripartum hysterectomy. Obstetrics & Gynecology 111, 97-105.

Kuklina, E., Meikle, S., Jamieson, D., Whiteman, M., Barfield, W., Hillis, S., et al. 2009. Severe Obstetric Morbidity in the United States: 1998-2005. Obsterics & Gynecology 113, 293-299.

McCarthy, F., Rigg, L., Cady, L., & Cullinane, F. 2007. A new way of looking at Caesarean section births. Australian and New Zealand Journal of Obstetrics and Gynaecology 47, 316-320.

Murphy, C., Murad, K., Deane, R., Byrne, B., Geary, M., & McAuliffe, F. 2009. Severe maternal morbidity for 2004-2005 in the three Dublin maternity hospitals. European Journal of Obstetrics, Gynaecology and Reproductive Biology 143, 34-7.

National Maternity Hospital. 2008. How should we audit and classify Caesarean Sections. MS Robson. Retrieved 28 October, 2009, from http://www.nmh.ie/iopen24/defaultarticle.php?cArticlePath=46_93.

Office for National Statistics. 2007a. Key Population and Vital Statistics. Population and vital statistics by area of usual residence in the United Kingdom, 2005. London, Palgrave MacMillan.

Office for National Statistics, 2007b. Key Population and Vital Statistics. Population and vital statistics by area of usual residence in the United Kingdom, 2006. London, Palgrave Macmillan.

Roberts, C., Cameron, C., Bell, J., Algert, C., & Morris, J. 2008. Measuring maternal morbidity in routinely collected health data: development and validation of a maternal morbidity outcome indicator. Medical Care 46, 786-94.

Roberts, C., Ford, J., Algert, C., Bell, J., Simpson, J., & Morris, J. 2009. Trends in adverse maternal outcomes during childbirth: a population-based study of severe maternal morbidity. BMC Pregnancy and Childbirth 25, 7.

Robson, M. 2001. Classification of caesarean sections. Fetal and Maternal Medicine Review 12, 23-39.

Scholefield, H. 2008. Safety in obstetric critical care. Best Practice & Research Clinical Obstetrics and Gynaecology 22, 965-982.

WHO Patient Safety. 2008. Global Priorities for Research in Patient Safety (first edition). Geneva, World Health Organization.