OUTCOME OF WOMEN WITH A B-LYNCH COMPRESSION SUTURE AT CHRIS HANI BARAGWANATH ACADEMIC HOSPITAL

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A research report submitted to the University of Witwatersrand, Johannesburg in fulfilment for the requirements of the degree of Master of Medicine, 2018

DECLARATION

I, Etang Malcolm Ayuk hereby declare that this research is my own work. I am submitting this research report for the degree Master of Medicine (Obstetrics and Gynaecology) in the submissible format to the University of the Witwatersrand, Johannesburg. This research report has not been submitted before for any degree or examination at this or any other university.

Signature ……

Done on this.....day of 2018

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To my wife Ayuk Ndiep Takor I cannot thank you enough for the unconditional love and support during this process. You always gave me hope

A huge thank you to my parents and the rest of the extended family, for your love and support. I would not have achieved any of this without you.

ABSTRACT

Background

Obstetric haemorrhage is the leading cause of maternal death particularly in Sub-Saharan Africa, and post-partum haemorrhage from uterine atony is the leading cause of deaths from obstetric haemorrhage.

Post-partum haemorrhage is therefore a major cause of maternal mortality, and the B-Lynch compression suture is a reliable and safe surgical method to manage post-partum haemorrhage...

This study aims to analyse the rate of use of B-Lynch sutures in a select South African setting, as well as its observed risk factors and the outcomes of women who had a B-Lynch suture for PPH.

Methods

The method used to carry out this study was a retrospective audit of women with a blood loss of 1000mls or more at Caesarean Section, and who required a B-Lynch suture. This was done at the Chris Hani Baragwanath Academic Hospital.

Results

According to the retrospective audit, fifty-seven women had a B-Lynch compression suture during Caesarean Section with a success rate of 98%. Ages of these women were within the range of 17 and 42 years, with a mean of 28 ± 5.7. Thirty-nine percent (39%) of the women

were obese, while 47% of the women were anaemic. One woman had pre-eclampsia, and none had gestational diabetes. Nine percent (9%) of the women were induced, while 18% received augmentation with uterotonics. The average blood loss was 1291±411ml. The shock index in theatre was in the range of 0.54 to1.26, while the shock index in recovery was in the range of 0.4 to 1.4. All women had a B-Lynch for uterine atony after failure of medical management. One woman required systemic devascularisation and a hysterectomy to arrest the haemorrhage. One death was recorded. Ninety-three percent (93%) of deliveries were singletons.

Conclusion

The B-Lynch compression suture in women who had PPH from uterine atony had a very high success rate, and was associated with few complications. B-Lynch can therefore be considered a life-saving technique that has improved maternal outcomes, even when employed in poorly resourced settings.

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CHAPTER 1: PROTOCOL AND EXTENDED LITERATURE REVIEW

1.1. INTRODUCTION AND BACKGROUND

Primary post-partum haemorrhage (PPH) is the leading direct cause of maternal mortality globally[1] and the second leading cause in South Africa[2]. PPH is defined as blood loss of more than 500ml in the first 24hrs after vaginal delivery, and blood loss of 1000ml or more after Caesarean delivery[3].

Cause-and-effect links have been established between PPH and certain adverse outcomes. If the window for timely intervention in cases of PPH is missed, outcomes can range from hypovolemic shock to acute kidney injury, disseminated intravascular coagulation, massive transfusions, and ultimately death.

Maternal mortality due to PPH is most commonly caused by uterine atony, which accounts for over 70% of cases.[4] Risk factors such as multiple gestation, foetal macrosomia, induction of labour, prolonged or precipitous labour, augmentation of labour, use of halogen anaesthetic gases, magnesium sulphate administration, obesity, and advanced maternal age contribute to causing uterine atony[5].

Nevertheless, this maternal mortality is preventable – preventing massive PPH starts from the active management of the third stage of labour, progressing to a stepwise approach of administering uterotonics and non-surgical interventions, and ending at minor and major surgical interventions.

Evidence-based guidelines have been published by international bodies on the management of PPH – however these guidelines while they may be useful, have not prevented PPH from

assuming the leading status among causes of maternal mortality and morbidity globally. Amid the cascade of interventions to arrest PPH, uterine compression sutures have become a well-established intervention.

The B-Lynch compression suture is the pioneer of uterine compression sutures, and was introduced in 1997.[6] Prior to the advent of the B-Lynch compression suture, intractable uterine bleeding post-delivery was salvaged with more radical interventions such as systematic devascularisation, and hysterectomies.

Placement of the B-lynch compression suture is technically less challenging compared to systematic devascularisation and hysterectomy, hence recommended even for the unskilled surgeon. While some studies have highlighted complications as a result of uterine compression sutures especially the Cho suture with sectional uterine necrosis[8], many studies have documented a success rate of B-Lynch ranging from 71% to 100%.[7], while other studies

Case series and case reports have confirmed the fertility-sparing capabilities of the B-Lynch compressive suture and its resultant long-term benefits, and have also highlighted the short-term complications in terms of uterine synechia, endometritis and even Asherman's syndrome. Studies done to assess the efficacy of the B-Lynch compression suture to curb PPH (as opposed to more radical surgical methods and even radiological interventions) have been limited to just observational studies for ethical reasons. Nevertheless, the B-Lynch compression suture has been well adopted by, and is implemented in, many countries.

1.2. LITERATURE REVIEW

1.2.1. Risk factors for post-partum haemorrhage

Post-partum haemorrhage is a source of severe adverse maternal outcome, both globally and in the South African context. A list of risk factors for PPH have been outlined based on observational studies, and assessment tools have been validated and used to categorize pregnant

women into low medium and high risk –however, these validation tools only have a specificity of 60%[9]. As such, a third of women who end up having PPH do not present any of the risk factors associated with PPH[10]. Nevertheless, it is mandatory to profile the risk factors for PPH each pregnant woman presents, in order to better anticipate, prepare for and prevent the adverse outcomes that may ensue as a result of the delivery.

Kramer et al in an observational study analysed the trends of risk factors for PPH (notably atonic vs non-atonic) over a period of 10 years, and found that there was an increase over time of atonic PPH in a high-income setting. In their multivariate analysis they found strong associations between advanced maternal age, grand multiparity, previous Caesarean delivery, multiple pregnancy, pre-eclampsia and Caesarean delivery[11]. This finding was corroborated in the 6th South African enquiry into maternal deaths, which exposed an increase in bleeding during and after Caesarean sections (BDACS) [2]. Kramer's study also indicated a strong association between foetal macrosomia and atonic PPH.

A multinational study by Sheldon et al reflected similar findings to the study carried out by Kramer et al as mentioned above - strong associations were found to exist between age, parity, induction of labour and Caesarean sections on one hand, and PPH on the other. [12]

Anaemia in pregnancy has also been found to have a causal relationship with PPH if not corrected before the onset of labour. According to a study conducted by Al Zirqi et al, a strong relationship was found between emergency Caesarean sections, anaemia (Hb<9) and severe obstetric haemorrhage[13]. Frass in assessing anaemia as a risk factor for PPH, found an inverse relationship between blood loss and level of hemoglobin.[14]

There is strong evidence to show that prolonged labour is also a major risk factor for PPH[15]. Prolonged labour is defined as latent labour exceeding 14 hours (multiparous) or 20 hours (nulliparous). This has been associated with adverse obstetric outcomes and PPH.

Unfortunately, very few studies have been carried out in a South African setting to elucidate this.

Emergency Caesarean sections are equally associated with increased risk of PPH, and complications to both mother and child. According to a prospective study done in Sweden on intraoperative complications during Caesarean sections, more complications were associated with emergency Caesarean sections than elective ones (18.9% versus 4.2%).[16]

1.2.2. Risk factors for uterine atony

Uterine atony is the inability of the uterus to contract after delivery. This is a result of factors such as myometrial exhaustion, over-distension and even uterine infection prior to delivery. The significance of uterine atony has been highlighted by many studies – of note is an Irish study by Lutomski et al examining the trend of PPH over 11 years. This study found an increase in the trend of PPH, and a strong association between PPH and uterine atony as a major causative factor.[17]The results of this study were equally validated by a local enquiry by Maswime et al into causes of maternal deaths as a result of bleeding during and after Caesarean section, where it was recorded that trauma during Caesarean sections and uterine atony were also strong causative factors of PPH.[18]

Risk factors for uterine atony include multiple gestation, foetal macrosomia, induction of labour, prolonged or precipitous labour, augmentation of labour use of halogen anaesthetic gases, magnesium sulphate administration obesity and advanced maternal age[5]. Luisa et al in a randomized trial found eclampsia and chorioamnionitis to be independent risk factors for uterine atony. [10] Many studies have therefore reiterated uterine atony as the major cause of PPH, and its specific management is a prerequisite for care givers be they medical or surgical personnel.

1.2.3. Medical Management of uterine atony

Uterine atony is managed in a stepwise manner, beginning with medical management and ending with surgical management. [3]

Medical management involves the use of uterotonics, Oxytocin bolus and infusion, Oxytocin-Ergometrine fixed combination, Ergometrine, and Prostaglandin F2 alpha intramyometrially. Misoprostol and oral Prostaglandin have no advantage over the use of uterotonics in the treatment of PPH. The recommendation to start with Oxytocin is however based on its rapid onset of action and side effect profile. After administering Oxytocin, it is recommended to escalate to Prostaglandin F2 alpha intra-muscularly.[19] A randomized control trial comparing the effect of high- and low-dose Oxytocin in preventing uterine atony during Caesarean sections with subsequent prevention of PPH, showed that the group with the low-dose of Oxytocin required extra medical intervention to prevent PPH, while the high-dose group had their need for further intervention reduced by 60% and the need for curative management by 50%.[20]

1.2.4. B-Lynch compression suture and other uterine compression sutures

The B-Lynch compression suture is a brace suture placed around the uterus to assist in contraction. It is one of the fertility-sparing methods used to preserve the uterus during intractable bleeding following childbirth.

The B-Lynch compression suture was first introduced to the global obstetric community in 1997[6]. The authors described the suture as a useful tool to arrest uterine bleeding due to uterine atony. The B-Lynch compression suture works by mechanically compressing the uterus in

order to prevent engorgement of the vessels, and holding the uterine walls together long enough for intrinsic contraction of the uterus to resume.

Placing of the B-Lynch compression suture has been deemed a less technically challenging procedure when compared to systematic devascularisation and hysterectomy procedures. It is a continuous suture entering the uterus 2-3 cm below the uterine incision, and 3 cm away from the lateral border on the left or right corner (this is usually dependent on whether the surgeon is left or right handed). The suture used by the author as a chromic 2-suture mounted on a 70mm round-bodied needle. This suture goes through the uterine cavity to exit 2-3 cm above the uterine incision on the ipsilateral side. It then courses towards the fundus on the anterior wall. The suture is then taken over the fundus, courses the posterior wall where it goes through the posterior wall at the level of the wall adjacent to the incision, through the cavity over to the contralateral side and out the uterine wall. The suture then courses concurrently back to the incision and below the incision on the contralateral side, in the same trajectory as it was initially inserted. A knot is then placed below the uterine incision while pressure is placed on the uterus by an assistant, in order to maintain the state of compression while the suture is being secured. Emphasis is laid on the need for the uterus to be open at the time of placement of the suture, in order to rule out retention of products.

The success of the procedure is not necessarily dependent on the type of suture provided it is an absorbable suture.[21] A series of case reports have reported the use of absorbable sutures ranging from monofilament (Monocryl) to braided sutures (Vicryl, Chromic), all with similar success rates. In principle, the choice of the suture is based on the tensile strength, rate of reabsorption, availability and cost.

There is a lack of randomized control trials comparing the efficacy of compression sutures against other surgical methods. Few studies also compare the efficacy of the various uterine

compression sutures against each other, -this has led to the usage of indirect parameters such as success vs failure rates of the different compression sutures, to assess their efficacy.

A comparison between the B-Lynch compression suture and other uterine compression sutures that compressed both walls (anterior and posterior wall) of the uterus was done. This review showed that the B-Lynch uterine compression sutures could be used both for therapeutic and prophylactic purposes. Also, the comparison highlighted the superiority of the B-Lynch compression suture over other compression sutures based on its wide usage, not restricted only to uterine atony.

For example, the Hayman suture (a variant of the B-Lynch suture) which apposes the anterior and posterior uterine wall, has advantages of being easier to place than the traditional B-Lynch compression suture, and could also be used after a vaginal delivery where a hysterotomy is not needed. However certain disadvantages have been recorded as a result of the inability to explore the uterine cavity which could lead to retention of tissue and even blood clots[22].

The Cho suture (described as a multitude of square sutures) on the other hand firmly obliterates the uterine cavity, avoiding any accumulation of clots thereafter. However some case reports have mentioned complications involving the placement of the Cho suture including pyometra[23]. Also Rathat et al in a retrospective study involving thirty-seven women demonstrated that despite a success rate of 81% in arresting PPH, there was an association between uterine synechia and the use of two or more surgical methods simultaneously to stop excessive uterine bleeding. This was noticed in women who received the Cho suture and B-Lynch compression suture simultaneously, or the B-Lynch, Cho sutures and other bilateral uterine artery ligation simultaneously – however this was not seen in cases where the B-lynch compression suture was used as an individual surgical method to salvage PPH during Caesarean section deliveries[24].

Even though the B-Lynch has been associated with a lot of success, there has been a case report involving a 33 year old gravida 3 patient in whom uterine necrosis was reported after placement of the B-Lynch suture, which was attributed to a likely poor placement of the suture[25]. Nonetheless, the use of the B-Lynch compression suture has an almost established safety profile, and has been proven to be relatively easy to place, (even where simultaneously with a wide variety of sutures) thereby constituting an effective method for the treatment of PPH in a resource-challenged setting.

1.2.5. Assessment of blood loss and state of shock

The diagnosis of PPH is clinical and subject to bias. Traditionally, the amount of blood loss is estimated visually for lack of appropriate methods to measure blood loss. In spite of continued clinical practice in this regard, many studies[26,27,28] have shown the shortcomings of visual assessment of blood loss during vaginal and abdominal deliveries.

The shock index, a ratio between the heart rate and systolic blood pressure, is used in trauma as a predictability tool in risk-stratifying patients with hypovolemia who need resuscitation.[29]In their retrospective study on the use of shock index to assess the need for massive transfusion in primary PPH, Sohn et al found that an increase in the shock index was associated with an increase in blood transfusions.[30]

Le Bas et al published a retrospective case control study where they sought to assess the need for blood transfusion in primary PPH patients,[31] in which they found the range of obstetric shock index in the control group to be 0.7 - 0.9. They also found an increase in the use of blood products to resuscitate patients whose obstetric shock index was equal to or greater than 1. Consequently, it may be said that the use of the shock index in determining hypovolemic shock

in primary PPH would be a more objective tool than visual assessment of blood loss. It is worth noting that the use of the shock index after an intervention to arrest intra-operative haemorrhage has not been explored - it may be useful to compare shock indices against outcomes after a B-Lynch compression suture.

1.2.6. Importance of continuous surgeon training

The South African confidential enquiry into maternal mortality and the Nielsen et al report on intraoperative complications both found a causal link between the level of experience of the operating doctors and a higher rate of complications during caesarean sections, and recommended continuous training of staff[32]. Bergholt et al opposed this finding in their observational study, where they found no statistical significance between the level of training of the surgeon and the incidence of complications in emergency caesarean section - nevertheless, they concurred that upgrading surgical skills of the surgeons is mandatory[33].

The aim of this study is to examine the outcomes of women who had a B-Lynch compression suture, in order to analyse antenatal predictors of PPH and intra-partum factors that contribute to the success or failure of the B-Lynch compression suture.

1.3. STUDY OBJECTIVES

- To describe prevalence and outcomes of the B-Lynch compression suture in women with an intra-operative blood loss of 1000ml or more during Caesarean sections.
- To examine the antenatal risk factors for uterine atony in women who had a B-Lynch compression suture.

- To determine intra-partum and post-operative factors associated with the failure and success of the B-Lynch compression suture.

1.4. METHODS

1.4.1. Study design

This study is designed as a retrospective cross-sectional study of outcomes over a 12-month period (January 2016 -December 2016).

Data will include: demographic details, risk factors for PPH, causes of PPH, type of suture material used for the procedure, interventions to arrest bleeding before and after B-Lynch, shock index after Caesarean section, maternal and foetal outcome, and rank of surgeon who started the Caesarean section.

1.4.2. Setting

The study was carried out in the Department of Obstetrics and Gynaecology at the Chris Hani Baragwanath Academic Hospital (CHBAH), situated in Soweto, Gauteng. CHBAH has approximately 18,000 deliveries a year, and a Caesarean section rate of 35 – 40%. CHBAH is a tertiary hospital.

1.4.3. Inclusion criteria

- Women who had a B-lynch compression suture at the time of Caesarean section, with a blood loss of 1000ml or more.

1.4.4. Exclusion criteria

- Women with history of congenital/acquired bleeding disorders prior to pregnancy;

- Women with bleeding which was not due to uterine atony;
- Women with an extra-uterine pregnancy;
- Women with a prophylactic B-Lynch or B-Lynch not related to PPH;'
- Women with a B-Lynch at exploratory laparotomy or at re-look laparotomy.

1.5. SAMPLE SIZE

A period sample was used, with no sampling strategy. Most of the published studies on the B-Lynch were case series with less than 20 cases. There are no estimates on an appropriate B-Lynch rate.

1.6. DATA ANALYSIS

Descriptive data analysis was used, using means and standard deviations for normally distributed data; medians and ranges for non-normally continuous data; proportions and percentages for categorical data. Precision was managed using 95% confidence intervals. Hypothesis testing explored Chi-squared, Mann-Whitney or Fischer's exact to explore associations.

1.7. ETHICS

Ethics approval was sought from the Wits HREC. Permission was sought from the CEO of the Hospital and the Head of Obstetrics and Gynaecology.

1.8. TIMING

The time of the study was from January to December 2016.

1.9. FUNDING

All costs was covered by the researcher.

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CHAPTER 2 : SUBMISSIBLE ARTICLE

TITLE: Outcome of women with a B-Lynch compression suture at Chris Hani Baragwanath Academic Hospital

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Short Title

The use of B-Lynch compression sutures at Chris Hani Baragwanath hospital

Conflict of interest

The authors declare no conflict of interest

Keywords

Compression sutures, B-Lynch, Post-Partum haemorrhage, surgical management of PPH, Uterine atony

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ABSTRACT

Background

Obstetric haemorrhage is the leading cause of maternal death globally particularly in Sub-Saharan Africa, and post-partum haemorrhage from uterine atony is the leading cause of deaths from obstetric haemorrhage. Post-partum haemorrhage is a major cause of maternal mortality, and the B-Lynch compression suture is a reliable and safe surgical method to manage post-partum haemorrhage.

This study aims to describe the rate of B-Lynch use in the identified setting, as well as risk factors of its use, and outcomes of women who had a B-Lynch suture for PPH.

Methods

The method used for this study was a retrospective audit of women with a blood loss of 1000mls or more at Caesarean section, who required a B-Lynch suture. The study was conducted at Chris Hani Baragwanath Academic Hospital.

Results

Fifty-seven women had a B-Lynch compression suture during Caesarean section, with a success rate of 98%. Their ages ranged between 17 and 42 years with a mean of 28 ±5.7. Thirty-nine percent (39%) of the women were obese, while 47% of the women were anaemic. One woman had Pre-eclampsia, and none had gestational diabetes. Nine percent (9%) of the women were induced, while 18% received augmentation with uterotonics. The average blood loss was 1291±411ml. The shock index in theatre ranged between 0.54 to1.26 while the shock index in recovery ranged from 0.4 to 1.4. All women had a B-Lynch for uterine atony after failure of medical management. One woman required systemic devascularisation and a hysterectomy to

arrest the haemorrhage. One death was recorded. Ninety-three percent (93%) of deliveries were singletons.

Conclusion

The B-Lynch compression suture in women who had PPH from uterine atony had a very high success rate, and was associated with few complications. B-Lynch is a life-saving technique that has improved maternal outcomes even in poorly resourced settings.

INTRODUCTION

Uterine compression sutures (UCS) have been adopted as an integral part of the surgical management of post-partum haemorrhage. UCS have been described as surgically less challenging compared to other measures to arrest haemorrhage, such as systematic devascularisation and hysterectomy. Life-saving and fertility-sparing techniques such as UCS are an essential skill for any surgeon who manages women who are at risk of developing Post-partum haemorrhage (PPH). Other interventions such as systematic devascularisation, hysterectomy and uterine artery embolization are successful in the management of PPH, though associated with increased morbidity and adverse consequences[1]. In trying to meet the recommendations of the United Nations Organisation with regard to the 3rd sustainable development goal[2] it has become imperative to find proper solutions to maternal death and obstetric haemorrhage, especially post-partum haemorrhage which is a leading cause of maternal death. The increasing morbidity and non-negligible mortality rates associated with PPH[3] have prompted constant reviews of management procedures, implementation of both medical and surgical procedures to arrest uterine bleeding after delivery, and categorisation and continuous evaluation of outcomes associated with PPH in order to identify failures in the management of PPH.

Despite the success rate of the uterine compression sutures that have been described in case reports to range from 70 to even 100%, it should be noted that surgical procedures have complications such as uterine necrosis, pyometria,[4] Asherman's syndrome,[5] and Sheehan syndrome.

The aim of this study is to analyse outcomes of women with PPH who had a B-Lynch suture procedure carried out.

MATERIALS AND METHODS

This study was a retrospective cross-sectional study carried out at Chris Hani Baragwanath Academic Hospital (CHBAH), one of the three teaching hospitals affiliated to the University of the Witwatersrand, Johannesburg. CHBAH is a tertiary hospital that covers a catchment area of about 1.4 million people. The hospital conducts approximately 20,000 deliveries annually, with a Caesarean section rate of about 35-40%. Ethical approval to conduct the study was obtained from the Human Research Ethics Council of the University of Witwatersrand (M170310), and permission was granted by the CEO.

Data was collected from patient records of women who had a recorded blood loss of 1000ml or more, and who had a B-Lynch compression suture inserted post-Caesarean section as a result of PPH. Women with a background history of congenital bleeding disorder and prophylactic B-Lynch abdominal pregnancies were excluded from the study. The period sampled extended from January to December 2016.

Data collected in this study included age, race, body mass index, risk factors associated with uterine atony, labour and delivery details, as well as the different kinds of interventions that were used to arrest PPH, blood loss during surgery, the shock index of the patients at the end of surgery and in the recovery room was described and the outcomes (blood loss, transfusion, high care, ICU admission as a proxy for severity) of the patients who received a B-Lynch compression suture. The rank of the surgeon who performed the surgery and if assistance was needed with the surgery was also documented.

Data was analysed using Stata 14.0 software. The participant's characteristics were summarised as appropriate. Descriptive statistics was done using frequency tables, and

interquartile ranges were done where appropriate. Inferential statistics was done using Pearson Chi-square test and logistic regression. Where statistically significant associations were detected, further analyses were carried out using logistic regression analysis to determine the strength of these associations. Significance level was taken as 0.05.

RESULTS

There were 18935 deliveries conducted at the Chris Hani Baragwanath Academic Hospital from January to December 2016, and 7507 caesarean sections were done during the same period (caesarean section rate of 39%). The success rate of the B-Lynch suture was 98%.

A majority (n=51) of the participants were of black ethnicity. The age ranged between 17 and 42 years with a mean age of 28 SD±5.72 years. Five women (9%) were teenage pregnancies and seven women (12%) were advanced maternal age. Nineteen women (33%) were nulliparous. Out of 31 women with a recorded BMI, twelve women (39%) had a body mass index above 30kg/m^2. Twenty-six women (49%) were anaemic with a haemoglobin recorded below 11g/dl in the third trimester prior to Caesarean section. A majority of the women (n=49) were rhesus positive. Eighteen women (31%) were HIV positive while the majority (98%) screened negative for Syphilis. Only twelve women (21.1%) had a previous history of Caesarean section, hence most of the patients (n=45) were undergoing a Caesarean section for the first time in the index pregnancy. All the women (n=57) delivered by Caesarean section, with the majority (88.1%) having an emergency Caesarean section. One woman presented with a history of previous ante-partum haemorrhage.

No women had medical history of cardiac diseases, one woman (2%) had preeclampsia as an antenatal risk factor, and none had gestational diabetes. Five women (8.5%) had labour induced in the indexed pregnancy, and ten women (18%) had labour augmented with

uterotonics. The mean duration of labour was 4.69 SD±9.01 hours. Only three of the women were diagnosed with prolonged labour. Twenty-three women (40.7%) had a Caesarean section done under general anaesthesia, while thirty-three women (57.6%) had a Caesarean section done under spinal anaesthesia. Blood loss was between 1000ml and 3000ml with a mean blood loss of 1291ml. There were more women (n=24) with a high shock index at recovery post-surgery, compared to at the end of surgery (n=19). One woman needed further intervention to arrest uterine bleeding, which intervention consisted of a hysterectomy and systematic devascularisation. Only twenty-three women (39%) who had a B-Lynch compression suture placed were transfused, seven of which received three units and above. Twenty-six women were admitted to the Obstetrics High Care Unit, while two were admitted to the Intensive Care Unit, and one death was recorded. Out of sixty-two babies delivered there were fifty-four singleton deliveries and four twin deliveries, and six of these sixty-two deliveries were stillbirths. The birth-weight ranged between 1195g and 5105g. Six babies were above 4000g. A majority of the cases (n=31) were started by junior surgeons, twenty (33.9%) by senior registrars and seven (11.86%) were conducted by consultants.

DISCUSSION

The use of the B-Lynch compression sutures for the management of PPH from Caesarean section had a very high success rate of 98%. Similarly, B-Lynch et al[1] in their case series recorded a 100% success rate with 5 women diagnosed with PPH that received a B-Lynch compression suture. Two of the women delivered vaginally and one of the women had a B-Lynch suture for secondary PPH.

Kaya et al[2] in a Turkish study recorded a 94.4% success rate of B-Lynch compression sutures in 36 women in 2014, but this was influenced by the simultaneous use in some women, of bilateral uterine artery ligation and the B-Lynch compression suture.

Allahdin et al[3] published a case series on 11 women who had a B-Lynch, with a success rate of 72%.However, there was a need to simultaneously use a balloon catheter with the B-Lynch compression suture to arrest bleeding in one patient. B-Lynch failure in this study was defined as B-Lynch compression requiring further interventions to arrest haemorrhage. The woman in this study who had a failed B-Lynch compression suture had a Caesarean section for protracted labour, then received a B-Lynch compression suture for uterine atony, and subsequently had a hysterectomy after the B-Lynch compression suture failed to arrest the bleeding. Unlike many other studies on the B-Lynch compression suture, this study was done in a middle-income country with limited resources and emphasises that the B-Lynch compression suture can be done successfully in poorly resourced settings, where more invasive interventions are associated with worse adverse outcomes than in high-income countries.

The rate of the B-Lynch compression suture in our study was 30% for women who had PPH during a Caesarean section, calculated as the number of B-Lynch compression sutures placed with a denominator of the total number of Caesarean sections diagnosed with PPH. The rate of B-Lynch compression suture is a measure of the usability of this procedure irrespective of the indication, as the B-Lynch suture is usually described to be used for uterine atony[2], but has been used for other indications by different authors[1]. One would therefore expect a higher usage of B-Lynch compression sutures since it is easy to place and has an acceptable risk profile, considering that uterine atony is the main cause of PPH.

Anaemia and obesity were the leading risk factors for uterine atony in our study. About half of the women in our study were anaemic in the third trimester prior to Caesarean section. Anaemia and low socioeconomic status have been previously linked[4], and this could be a contributing factor for the findings in our study, considering the setting. Anaemia has also been associated with increased blood loss during delivery, given that the lower the haemoglobin levels, the more blood loss recorded.[5] Nair et al in a retrospective study on the association between anaemia and pregnancy outcomes found women with severe anaemia to have higher odds for PPH.[6] These findings support the need for antenatal correction of anaemia.

Obesity as a recurring risk factor for post-partum haemorrhage in this study was found in39% of the patients' records. Interestingly, obesity is seen to be on the increase in the South African population,[7] and adjustments have to be made to accommodate this sub-group of patients. The global rise in the prevalence of obesity has been met simultaneously with an increase in the incidence of co-morbidities seen in pregnancy in this sub-group, as well as abnormal labour and uterine atony leading to primary post-partum haemorrhage. Puoane et al[7] highlighted the increasing prevalence of obesity in South Africa especially in women, a trend which is also observed worldwide[8]. Obesity is a direct as well as indirect risk factor for uterine atony, and as such maintains a relationship with PPH. The mechanism by which obesity leads to atonic PPH is diverse, ranging from an inclination to bear forth constitutionally bigger babies hence abnormally distending the uterus, to difficulties with labour necessitating the use of uterotonics[9]. Different factors have been examined for the increasing prevalence of obesity, nonetheless the fact remains that obesity is now considered a serious public health problem which requires in this case, the adaptability of health services to cater for this sub-group of women.

The use of uterotonics to induce or augment labour was done in approximately one-third of patients. Usage of uterotonics to either initiate or augment labour has been known to be a risk factor for uterine atony[10,11]. The findings were not convincing enough for to determine if there was a direct causal link between induction (10%) and augmentation (21%) as independent factors with uterine atony, but it is believed these risk factors would have an effect when cumulated with other risk factors.

ICU admission, peripartum hysterectomy and death were not common in this study. A hysterectomy rate of 17 per 1000 deliveries was recorded, as well as a 4% frequency of ICU admissions in this study. These findings could be explained by the fact that most women had multiple risk factors, and a considerable proportion were anaemic.

An American audit over 5 years of 32,834 deliveries ended in 2003 comparing morbidity amongst women with different modes of delivery (vaginal spontaneous, vaginal instrumental, caesarean with and without trial of labour) showed that there was a higher chance of morbidity in the arm of Caesarean deliveries with trial of labour - specifically, the auditors found that a 4.2% chance of being transfused.[12] Concurrently another observational study of 30,132 women in which morbidity in primary versus repeat Caesarean section was compared, showed an increase in morbidity with increasing order of repeat caesarean sections[13], to the tune of 0.65% of hysterectomies and 1.85% of Intensive Care admissions for primary Caesarean sections, and 8.99% of hysterectomies and 5.62% Intensive Care admissions for repeat Caesarean section respectively. The index study with a similar sample profile to the above studies exhibits relatively lower rates of hysterectomy and Intensive Care admissions -this could however be attributed to a smaller sample size, and also to the usage of the B-Lynch suture. The numbers produced by our findings may have been more if the study included women who delivered

vaginally and had a PPH. Findings in the current study appear to be as a result of the successful placement of the B-Lynch suture, but may be less representative of the general population.

The shock index is defined as a ratio between the heart rate and systolic blood pressure. 30% of the women involved in the study had a shock index above 1 in theatre, and 33% had a shock index above 1 after the Caesarean section.

La Bas et al in a case control study recommended the use of a shock index of more than 1 in obstetrics to signify the need for transfusion, considering the physiologic changes imparted to the pregnant woman by the pregnancy[14]. The shock index was used in this study as a tool to assess circulatory compromise occasioning the need for transfusion, considering that all women included were diagnosed with PPH. The shock index was calculated at two instances based on the worst recorded blood pressure and pulse in theatre by the anaesthetist, and that recorded in recovery by the recovery nurse. Contrarily, it was noticed that more women (40%) were transfused than categorised necessary by the shock index. The expectation was for all the women in the cohort to have a high shock index, since they were all diagnosed with PPH. The significance of this finding is not necessarily conclusive, given that there are other factors to be considered in deciding to transfuse a woman who is undergoing the physiologic changes of pregnancy. Nevertheless, the average blood loss in our study (1291ml) highlights the advantage of using the B-Lynch compression suture, which conclusion is similar to findings by Kalkal et al who recorded a success rate of 100%.[15]

Even though the first B-Lynch compression suture was described in the year 1997, it has only become a common procedure in the recent past. It is increasingly taught in South Africa to all surgical interns – it is therefore not surprising that junior doctors are more accustomed to carrying out the procedure, than senior doctors – this is evidenced in this study, where 89% of the primary surgeons who placed the B-Lynch sutures were registrars. However, it is possible

that a majority of the Caesarean sections were done by registrars and medical officers, who probably moved on to the B-Lynch as an urgent option whilst calling for help to manage PPH. Various studies have recommended rolling out of the skills needed to place the B-Lynch suture, based on the fact that it is technically less challenging compared to other more radical surgical procedures used in managing intractable PPH.[16,21,5]Also, this skill is important in resource-limited settings that may be ill-equipped with handling morbidity associated with more radical interventions.

The current study classified 7% of its participants as being advanced maternal age, while 9% of the participants were classified as teenage pregnancy. This same pattern of age distribution was seen by Waheed et al in a descriptive study assessing the effectiveness of B-Lynch in controlling atonic PPH,[17] though that study included women who delivered vaginally. Kalkal et al in a prospective observational study to assess the effectiveness of B-Lynch suture during Caesarean section, had a similar age distribution of their participants.[15]Age in the extremes is considered a risk factor for obstetric haemorrhage and other obstetrical complications.[18 19] In the current study most of the patients were within 20 – 35 years of age, and as such there was a non-frequent representation of the extremes of ages (extremes being advanced maternal age or teenage pregnancy). No studies have been done to assess the relationship between B-Lynch and maternal age, maybe because PPH is not age specific and hence its interventions will exhibit the same relationship irrespective of age.

Pre-eclampsia though documented by certain authors as a risk factor for uterine atony[20], was not significant in our study.

Feerasta et al[21] in a case control study to elucidate risk factors for uterine atony, found gestational diabetes to have significance. Contrarily our study recorded no woman with gestational diabetes, as risk factors. Hence, we did not find strong evidence to retain maternal

medical comorbidities as risk factors for uterine atony. The limitations of this study were the lack of control groups to compare with, both from women who delivered vaginally, and also from other women who underwent a Caesarean section, who suffered PPH as a result of other causes and did not have a B-Lynch suture placed. Though the study setting is considered to be well-resourced, it faces challenges similar to those faced by under-resourced settings such as blood bank shortages, drug shortages, staff shortages and overcrowding.

The generalizability of the findings from this study is limited. It was conducted in a tertiary centre where all surgeons have been taught how to perform a B-Lynch. Though this study shows that South Africa is abreast with international recommendations in the management of PPH, an immense array of information concerning uterine compression sutures in general and the B-Lynch suture in particular, have not been exploited in our setting. We recommend that more efforts in low-resourced settings are put into training and supporting the use of B-Lynch in the management of PPH. The strength of this study is two-fold – from a clinical perspective, it has shown the importance of the B-Lynch compression suture and its usefulness to stop bleeding due to uterine atony during Caesarean section. In addition, this study also adds data to the inadequate local data on B-Lynch uterine compression sutures, and could help to further motivate for the adoption of this safe and simple procedure on a national scale.

CONCLUSION

The B-Lynch suture is a simple and effective suture to arrest haemorrhage during a Caesarean section, and helps to reduce adverse outcomes associated with PPH. Anaemia is a modifiable risk factor for uterine atony, and B-Lynch can be used successfully in a poorly-resourced setting for the management of PPH related to Caesarean sections.

TABLES AND FIGURES

Table 1 characteristics of B-Lynch Women

	NUMBER	PERCENTAGE (%)
BMI≥30	12	39
Hb≤ 11	26	49
HIV Positive	18	38
Induction of labour	5	9
Augmentation of labour	10	17
Emergency Caesarean section	51	89
General anaesthesia	23	40
ICU admission	2	4

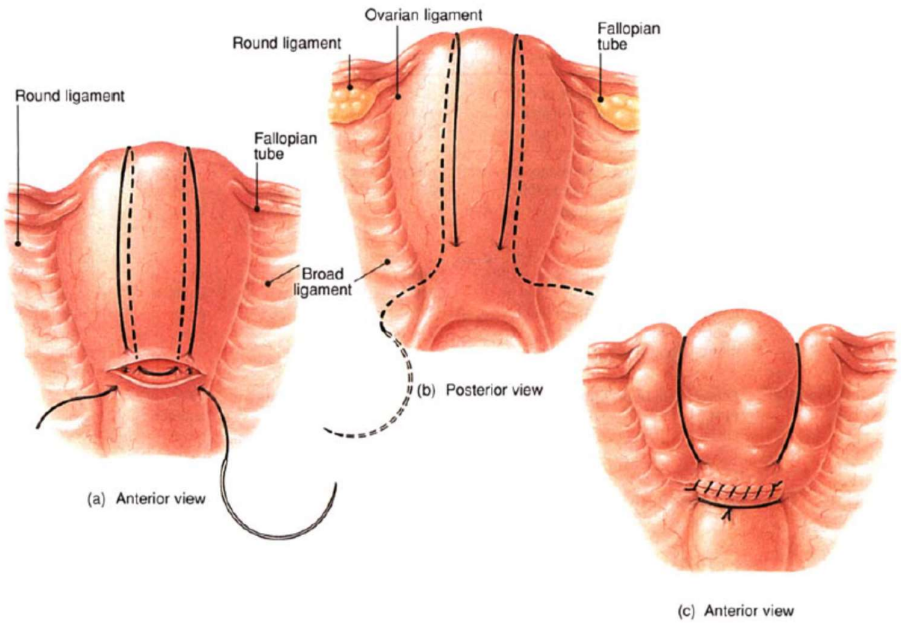

Figure 1: The views of the uterus showing the application of the B-Lynch brace suture (Adapted from Br J Obstet ***Gynaecol*** **104,** 372-375)

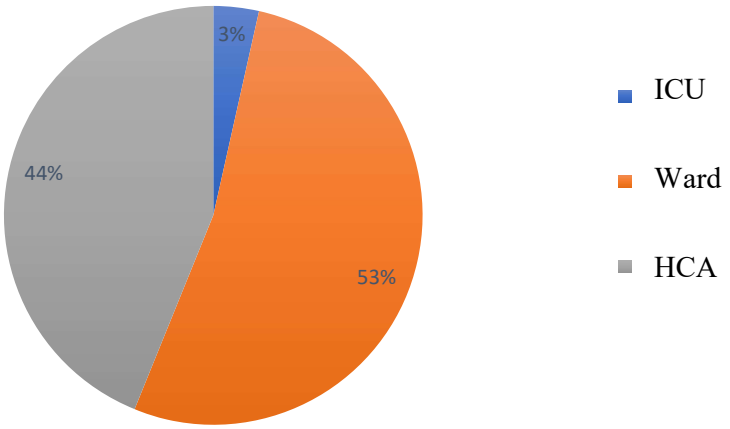

Figure 2: Admission after placement of the B-Lynch suture

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CHAPTER 3: APPENDICES

Data Collection Sheet

OUTCOME OF WOMEN WITH A B-LYNCH COMPRESSION SUTURE AT CHRIS HANI BARAGWANATH ACADEMIC HOSPITAL

Data sheet number:……

DEMOGRAPHIC

AGE:

RACE: Black White Coloured

PARITY: G1 >G1

WEIGHT HEIGHT BMI

MEDICAL AND SURGICAL HISTORY

Hb: RPR: positive negative

Previous C/S: YES NO

Previous abdominal surgery: YES NO

Chronic hypertension: YES NO

Gestational hypertension: YES NO

Preeclampsia: YES NO

Pregestational diabetes: YES NO

Gestational diabetes: YES NO

Placenta praevia: YES NO

Ante-partum haemorrhage: YES NO

Cardiac: YES NO

HIV: YES NO

Twin pregnancy: YES NO

Other:

LABOUR AND DELIVERY

IOL: YES NO

AOL: YES NO

Onset of labour:…….

Time of delivery:……

Duration of labour:…….

Dilatation before c/s:……

TYPE OF C/S

Elective Emergency

ANAESTHESIA

Spinal: YES NO

Epidural: YES NO

General: YES NO

SURGERY

Estimated blood loss:…….

Last heart rate at surgery:…….

Last systolic blood pressure at surgery:…….

Shock index……..

Heart rate at recovery:……..

Systolic blood pressure at recovery:……..

Shock index…….

OUTCOMES

Medical management: YES NO

B-Lynch : YES NO

Devascularisation; YES NO

Hysterectomy: YES NO

How many units of blood given……..

Admission to ICU HCA WARD

Foetal outcome

Alive FSB MSB

Apgar……..

Weight……..

Singleton: YES NO

Twins: YES NO

Admitted to TICU: YES NO

Rank of surgeon who started the CS : MO junior reg senior reg consultant

Number of surgeons called for help 1 2 3

Ethics clearance certificate

R14/49 Dr Etang Malcolm Ayuk

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)

CLEARANCE CERTIFICATE NO. M170310

NAME: (Principal Investigator)	Dr Etang Malcolm Ayuk
DEPARTMENT:	Obstetrics and Gynaecology Charlotte Maxeke Johannesburg Academic Hospital
PROJECT TITLE:	Outcome of Women with a B-Lynch Compression Suture in Chris Hani Baragwanath Academic Hospital
DATE CONSIDERED:	31/03/2017
DECISION:	Approved unconditionally
CONDITIONS:	
SUPERVISOR:	Dr Salome Maswime
APPROVED BY:	Professor CB. Penny Co-Chairperson, HREC (Medical)
DATE OF APPROVAL:	22/09/2017

This clearance certificate is valid for 5 years from date of approval. Extension may be applied for.

DECLARATION OF INVESTIGATORS

To be completed in duplicate and **ONE COPY** returned to the Research Office Secretary in Room 10004,10th floor, Senate House/3rd floor, Phillip Tobias Building, Parktown, University of the Witwatersrand. I/We fully understand the conditions under which I am/we are authorised to carry out the above-mentioned research and I/we undertake to ensure compliance with these conditions. Should any departure be contemplated, from the research protocol as approved, I/we undertake to resubmit to the Committee. **I agree to submit a yearly progress report**. The date for annual re-certification will be one year after the date of convened meeting where the study was initially reviewed. in this case, the study was initially review March and will therefore be due in the month of March each year. Unreported changes to the application may invalidate the clearance given by the HREC (Medical).

Principal Investigator Signature Date

PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES

Hospital clearance letter

GAUTENG PROVINCE
HEALTH
REPUBLIC OF SOUTH AFRICA

MEDICAL ADVISORY COMMITTEE
CHRIS HANI BARAGWANATH ACADEMIC HOSPITAL

PERMISSION TO CONDUCT RESEARCH

Date: 19 April 2017

TITLE OF PROJECT: Outcome of women with a B-lynch compression suture at Chris Hani Baragwanath Academic Hospital

UNIVERSITY: Witwatersrand

Principal Investigator: Ayuk Malcolm

Department: Obstetrics and Gynaecology

Supervisor (If relevant): S Maswime

Permission Head Department (where research conducted): Yes

Date of start of proposed study: April 2017
Date of completion of data collection: Dec 2018

The Medical Advisory Committee recommends that the said research be conducted at Chris Hani Baragwanath Hospital. The CEO /management of Chris Hani Baragwanath Hospital is accordingly informed and the study is subject to:-

- Permission having been granted by the Human Research Ethics Committee of the University of the Witwatersrand.
- the Hospital will not incur extra costs as a result of the research being conducted on its patients within the hospital
- the MAC will be informed of any serious adverse events as soon as they occur
- permission is granted for the duration of the Ethics Committee approval.

.....
Recommended
(On behalf of the MAC)
Date: 19 April 2017

.....
Approved/Not Approved
Hospital Management
Date: 24/04/17