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Application of brace anchor at the fundal summit of b-lynch suture to prevent slippage of the brace sutures for managing atonic postpartum Haemorrhage; A case series

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Abstract
Preamble: The prevalence of postpartum haemorrhage varies widely from 2-10% globally. It is generally around 6% of all deliveries. Postpartum haemorrhage is defined as the loss of more than 500mls of blood after a vaginal delivery or more than 1,000mls after a caesarean section. The prevalence of PPH varies depending on geographic location, healthcare access and risk factors, such as multiple pregnancies, Postpartum haemorrhage (PPH) remains one of the leading causes of maternal morbidity and mortality worldwide. The B-Lynch suture technique developed to manage PPH due to uterine atony has gained prominence as a valuable surgical intervention over the years since its invention. The original procedure by B-Lynch had success rate of 80-100% in controlling PPH due to atony. Whenever B-Lynch suture fails, obstetricians tend to resort to hysterectomy therefore introducing modifications that can improve the success rate of B-Lynch suture is worthwhile.
The possibility of slippage of the B-Lynch suture has been well documented and published for example, by Marasinghe JP *et al*. The application of an anchor suture at the fundal summit of the B-Lynch suture is an innovation to prevent the slippage of the B-Lynch braces which is capable of reversing the effect of the compression. The main author particularly experienced this in a case of postpartum haemorrhage in which a B-Lynch suture was applied but unfortunately, the patient started bleeding again after surgery necessitating return to opening the patient up at which both brace sutures were found to have slipped down the sides of the uterus. The incidence stimulated the thought and search for what could be done as modification to the B-Lynch suture to prevent such occurrence.
Materials and Method: The case series is that of five patients managed for postpartum haemorrhage due to uterine atony during caesarean section despite administration of the usual uterotonics. All the patients developed atony of the uterus at caesarean section that was associated with bleeding necessitating insertion of B-Lynch suture. The possibility of failure of the B-Lynch suture was reduced by anchoring the 2 braces at their fundal summit. The original B-Lynch suture is first inserted using a vicryl 2 suture. A vicryl number 1 or 2 is then passed with small bite under the brace suture at the fundal summit of the brace on either side and tied with 2 or 3 knots in the middle. The patients were then closely followed up over 24 hours after surgery for any signs of abdominal distension and bleeding per vagina
Results: All the patients so managed and monitored (100.0%) did very well without any incidence of bleeding from the vaginal or abdominal distension over the 24 hours post operative period and till discharge on record time. None of them (0.0%) required any additional postpartum haemorrhage preventive of therapeutic intervention throughout their postoperative period stay in the hospital.
Conclusion: The original procedure by B-Lynch had success rate of 80-100% in controlling PPH due to atony. The addition of fundal brace anchor as described in this case series will definitely go a long way in reducing the percentages of failure associated with B-Lynch suture and therefore contribute to prevention of maternal mortality due to postpartum haemorrhage.

Keywords: Postpartum haemorrhage, B-lynch suture, uterine atony, maternal mortality, surgical intervention, fundal anchor, caesarean section; Modified B-Lynch.

Introduction
Over 100,000 women die of postpartum haemorrhage (PPH) each year, accounting for 35% of all maternal deaths. Postpartum haemorrhage can be primary or secondary. Primary when it occurs within 24 hours of delivery. For primary postpartum haemorrhage, about 70-80% of these cases happen when the uterus is unable to adequately contract after childbirth called uterine atony [1].

In 1997, Christopher Balogun-Lynch devised an innovative technique to treat uterine atony, where a continuous suture was used to envelope and mechanically compress the uterus, in an attempt to avoid hysterectomy. It was published in the British journal. Hysterectomy for whatever reason is not without its own attendant complications and especially when performed in an emergency situation. In addition to loss of fertility, contiguous organ injury, and even death can result. Postpartum haemorrhage (PPH) remains one of the leading causes of maternal morbidity and mortality worldwide. The B-Lynch suture technique developed to manage PPH due to uterine atony has gained prominence as a valuable surgical intervention over the years since its invention.

The application of an anchor suture at the fundal summit of the B-Lynch suture is an innovation to prevent the slippage of the B-Lynch braces which is capable of reversing the effect of the compression. The main author of this case series particularly experienced this in a case of postpartum haemorrhage in which a B-Lynch suture was applied but unfortunately, the patient started bleeding again after surgery necessitating return to opening the patient up at which both brace sutures were found to have slipped down the sides of the uterus. The incident stimulated the thought and search for what could be done as modification to the B-Lynch suture to prevent such occurrence. The possibility of slippage of the B-Lynch suture has been well documented and published for example, by Marasinghe JP *et al.* [2]

According to available research, the incidence of reoperation (re-laparotomy) for atonic post-partum haemorrhage following caesarean section is generally considered to be between 1-2% of all caesarean deliveries with some studies reporting rates as high as 8% in cases where significant bleeding occurs; meaning that for every 100 caesarean sections, 1-8% women might require a re-operation due to atonic postpartum haemorrhage. In a retrospective observational study by Ahmed Khan *et al.*, 2017 in which 20928 caesarean sections done over 5 years in an Indian tertiary hospital were analysed, 27 cases were found to have required relaparotomy of which Five, (5) 18.52% were due to atonic postpartum haemorrhage [3]. The prevalence of postpartum haemorrhage varies widely from 2-10% globally. It is generally around 6% of all deliveries. Postpartum haemorrhage is defined as the loss of more than 500mls of blood after a vaginal delivery or more than 1,000mls after a caesarean section [4]. The prevalence of PPH varies depending on geographic location, healthcare access and risk factors, such as multiple pregnancies, previous PPH history, the definition used and regional healthcare practices [5]. In some studies, the prevalence can be higher especially in low resource settings where access to skilled care and emergency services may be limited [6]. In high risk population such as women with previous caesarean section or high risk pregnancies, the prevalence of PPH can be significantly higher as stated by a study by Deneux-Tharaux *et al.* 2006 [7].

The causes of primary PPH can be broadly categorized into four main groups usually referred to as the 4T's in the obstetrics palance. Tone: Uterine atony is the most common cause of PPH occurring when the uterus fails to contract properly after delivery, leading to persistent bleeding from the placental site [8]. The failure of contraction of the uterus after delivery is associated with inability of the uterine muscles to contract and constrict the blood vessels at the placental site preventing closure of blood vessels which leads to substantial blood loss. Factors predisposing to uterine atony include prolonged labour, overdistension of the uterus (due to multiple gestations, polyhydramnios or large baby) use of uterine relaxants during labour such as magnesium sulfate [9] and retained placenta tissue that can cause ineffective contraction of the uterus around retained tissue [10]. Additionally, conditions such as obesity, multiple pregnancy and history of uterine atony in previous deliveries increase the risk of this complication [9] Infection particularly in the uterine lining like endometritis and chorioamnionitis can impair the uterus ability to contract and increase the risk of atony [12]. Overdistension of the uterus stretches the uterus excessively and beyond its normal capacity commonly due to multiplr gestation large size baby, polyhydramnios, excessive weight gain during pregnancy [13]. Prolonged labour or rapid labour can weaken the uterine muscles increasing the risk of atony. Conversely, rapid labour may not allow adequate uterine muscle recovery after delivery [14] maternal obesity has been associated with an increased risk of uterine atony due to both the physical impacts on the uterine tone and increased risk of other complications like diabetis mellitus [11]. Women with multiple previous births may be at high risk of uterine atony due to changes in the uterine muscle tone with age and repeated pregnancies [15]. Trauma: Birth canal trauma such as lacerations to the perineum, cervix, vagina or uterine rupture can result in significant blood loss. They can occur during difficult deliveries, such as those involving prolonged labour, instrumental assistance or fetal malposition leading to tears in the genital tract in the process of delivery. Perineal tears are the most common type of genital trauma and are classified into four degrees with the most severe involving the anal sphincter and rectum [16] Cervical and vaginal lacerations while less common can lead to significant blood loss particularly if they are not identified and repaired promptly. Uterine rupture although a rarer cause of genital trauma is a life-threathning condition that can cause massive bleeding. It often occurs in women with previous caesarean section or other uterine surgery [17]. The tear in the uterine wall leads to exposure of the maternal blood vessels resulting in a rapid loss of blood that can be fatal if not managed swiftly. Although uterine rupture is less common than perineal tear, its potential for haemorrhage is much greater. There are some factors that increase the risk of genital traumaduring delivery leading to postpartum haemorrhage. These include prolonged labour particularly in second stage of labour increases the risk of perineal laceration as the fetal head puts excessive pressure on the birth canal [18] Other risk factors include the use of forceps or vacuum-assisted delivery which are often employed when the fetus is not progressing through the birth canal adequately [19]. The size and presentation of the fetus also play role with larger babies, (macrosomia) or abnormal presentations such as breech contributing to higher rates of genital trauma (McDonald). In addition, the health and physical condition of the mother can influence the likelihood of genital trauma. For example, a history of pelvic trauma or scarring from previous deliveries can weaken the uterus predisposing it to rupture [20]. Older women and those who have had many pregnancies are at greater risk of pelvic floor weakness or previous trauma, making them more susceptible to lacerations during delivery [21]. Uterine inversion is a less common but life threatening condition, occurs when the uterus turns inside out during or after delivery resulting in severe bleeding. Once trauma is identified, treatment may involve surgical repair of lacerations manual removal of clots, or in severe cases, hysterectomy. The goal is to control bleeding while preserving the mother's fertility and health. In some instances, blood transfusion and other supportive measures such as fluid resuscitation are necessary to stabilize the patient [22]. Tissue retention: Often referred to as retained placenta is the failure to

expel the complete placenta or fragments of placenta tissue after childbirth. The retained tissue can prevent the uterus from contracting effectively which is necessary to stop bleeding by compression of the uterine vessels. Typically, the placenta should be delivered within 30min of baby's birth and any delay in this process increases the risk of retained placenta tissue. The pathophysiology of retained placenta tissue involves incomplete separation of the placenta from the uterine wall leading to the remaining tissue becoming embedded in the uterine lining [23]. Abnormality of placenta attachment is a common cause of retained placenta. There are 3 types of abnormal placenta attachment to the uterine wall. These are Placenta accrete in which the placenta attaches deeply into the uterine wall getting to less than 50% of the myometrial wall making it difficult to detach, placenta increta in which there is invasion of the myometrium up to 50% or more and placenta percreta in which the placenta invades there entire uterine wall and even gets to the serosa. In the severe cases such as increta and percreta, the placenta becomes difficult to deliver complicating delivery and increases the risk of haemorrhage [24]. Thrombine related cause refers to all cause that involve deficiencies of the ability of the blood to form clot otherwise known as coagulopathy. It is one of the significant causes of postpartum haemorrhage (PPH). This can be either pre-existing or acquired during the course of labour and delivery. Coagulopathies can result from various disorders including disseminated intravascular coagulation (DIC), Von Willebrand disease or acquired deficiencies of clotting factors due to conditions like liver disease or preeclampsia. Coagulopathy can arise from several mechanisms including platelet dysfunction, deficiency of clotting factors or an excessive consumption of coagulation factors. In the context of PPH, coagulopathy is often a consequence of excessive blood loss leading to the consumption of clotting factors [25] One of the most serious forms of coagulopathy in the postpartum period is disseminated intravascular coagulation (DIC) a pathological condition in which widespread clotting occurs in small blood vessels consuming clotting factors and platelets and leading to bleeding from multiple sites [26]. DIC is most commonly associated with severe obstetrics complications such as placental abruption, amniotic fluid embolism and sever pre-eclampsia [27]. In these conditions, tissue injury and hypoxia stimulate the release of pro-coagulants substances that overwhelmed the body's anticoagulant mechanisms leading to widespread clotting and bleeding. As a result, blood loss during labour or immediately after delivery can become uncontrollable making it one of the major contributors to maternal death worldwide [28].

The identification of coagulopathy as a cause of PPH relies on a combination of clinical features and laboratory investigations. Clinically, coagulopathy is suspected when there is persistent or worsening bleeding despite uterine massage and administration of uterotonics or surgical interventions [29]. In the case of DIC, signs such as petechiae, ecchymosis or spontaneous bleeding may be observed. Laboratory tests are crucial for confirming the presence and extent of coagulopathy. The most common tests include platelet count, prothrombin time (PT) activated partial thromboplstin time (aPTT), fibrinogen levels and D-dimer levels. A low platelet count, prolonged PT and aPTT, decreased fibrinogen and an elevated D-dimer are indicative of DIC [30]. It is important to note that while laboratory findings may help in diagnosing coagulopathy, clinical judgement remains central to identifying the underlying cause and guiding management strategies [31].

The management of coagulopathy as a cause of PPH focuses on both treating the underlying condition and controlling the bleeding. Immediate steps should include stabilization of the patient's haemodynamic status which may require intravenous fluids, blood transfusion and the administration of clotting factors or platelets concentrates. In the case of DIC, treatment of the underlying cause (e.g. delivery of the placenta in cases of placenta abruption or amniotic fluid embolism) is essential to halt the ongoing consumption of clotting factors [25]. Specific interventions may include the use of recombinant activated factor VII (rFVIIa) or freh frozen plasma (FFP) to replace depleted clotting factors. The goal is to restore a functional haemostatic balance while preventing further bleeding. Additionally, in cases where DIC is suspected, the use of heparin may be considered to prevent further clotting and microvascular occlussions [26]. For congenital clotting disorders, such as haemophilia or Von Wilebrands disease, targeted treatment based on specific factor deficiencies is required. Preventive strategies include the careful management of high-risk pregnancies such as those complicated by pre-eclampsia, gestational diabetes or a history of coagulopathies. Monitoring and early identification of coagulopathy along with proactive to managing PPH are crucial to reducing maternal morbidity and mortality [4].

While primary PPH is the more recognized and studied, secondary postpartum haemorrhage (SPH) is a less understood but significant condition. SPH refers to excessive bleeding that occurs between 24 hours and 6 weeks following childbirth it is often associated with various underlying causes and its timely diagnosis and management are crucial to reducing maternal complications. Causes of SPH can be divided into uterine or non-uterine causes. Uterine causes are more common and includeretained placental tissue, uterine infection (endometritis) and sub-involution of the uterus. Retained placental fragments are particularly significant as they can prevent the uterus from contracting properly leading to bleeding. The presence of infection can further exacerbate bleeding and if not promptly treated can lead to several maternal complications including sepsis [32]. Non-uterine causes of SPH include trauma to the genital tract, coagulopathies and abnormal uterine blood vessels. Although less common, conditions like uterine artery pseudo-aneurysms or arteriovenous malformations can also contribute to the condition [33]. These vascular abnormalities may go undetected until significant bleeding occurs posing a challenge to diagnosis and treatment.

Certain factors predispose women to development of SPH. These include a history of primary PPH, prolonged labour and use of instruments during delivery which can lead to genital tract trauma. Additionally conditions like placenta accrete, which is abnormal placenta attachment significantly increases the risk of SPH [34]. Women with previous caesarean section or uterine surgeries also have higher risk due to potential uterine scarring. Other risk factors of secondary postpartum haemorrhage are uterine over-distension as seen in multiple pregnancies or excessive amniotic fluid and maternal age with advanced maternal age being a known risk factor for complications during and after childbirth. The management of SPH requires a systematic approach to identify the underlying cause of bleeding. Initial management focuses on stabilizing the patient which involves fluid resuscitation, blood transfusion and medications to control bleeding such as oxytocin or misoprostol. If retained placenta tissue or uterine infection is suspected, imaging techniques like ultrasound can help in confirming the diagnosis. In cases of uterine infection broad spectrum antibiotics are started immediately and surgical intervention may be necessary in case of severe infection or necrosis. Surgical

management may include dilatation and curettage (D&C) to remove retained tissue or in more severe cases, hysterectomy. [34] In cases where vascular abnormalities are suspected, advanced imaging modalities like angiography may be used to locate and treat arteriovenous malformations or pseudo-aneurysms. With appropriate management instituted promptly, prognosis of secondary postpartum haemorrhage is generally good. However, delay in treatment can lead to significant morbidity including sepsis, shock and even death. (Kwon *et al.* 2019) [33]. Additionally, SPH can have long-term psychological effects including anxiety and post-traumatic stress disorder particularly for women who experience life-threatening complications.

In controlling primary postpartum haemorrhage established to be due to uterine atony, and in attempt to avoid hysterectomy, Prof. Christopher Balogun-Lynch, a renowned UK Obstetrician born in Sierra Leone in 1947, [35] the son of Prof. Prince E. Balogun-Lynch and Mrs. Jane A. Balogun-Lynch, developed an innovative surgical technique to treat atonic PPH. Using this method, a continuous suture is used to envelop and mechanically compress the uterus. Since its invention in 1997, the method, later known as B-Lynch suture, has been used successfully and saved the lives of more than 2 million women worldwide by 2016 according to the World Health Organization.

B-Lynch's invention was revolutionary because it provided a simpler less invasive alternative to hysterectomy which was often considered the last resort in cases of uncontrolled bleeding. The technique was designed to be reversible, meaning that it could be removed once the haemorrhage was controlled allowing the uterus to remain intact and preserving the woman's fertility,[36] this breakthrough addressed an urgent need in obstetrics offering a solution that was both effective and less traumatic for the patient.

Following its introduction, the B-Lynch suture quickly gained popularity due to its success in controlling PPH and its relatively low complication rate. The method was particularly beneficial in settings where access to advanced medical resources and the capacity for hysterectomy were limited making it especially useful in resource-constrained environments [37] its widespread adoption was facilitated by reports of successful outcomes in various clinical studies and the growing recognition of the method as a safe and effective treatment for PPH [38]. The impact of B-Lynch suture on obstetrics practice has been profound. According to a review by Rizvi *et al.* (2012), the suture has significantly reduced maternal mortality rates from PPH, particularly in cases where traditional interventions fail. Additionally, the B-Lynch suture has become a cornerstone of maternal care, frequently included in training for obstetricians and emergency medicine professionals worldwide.

Materials and Method

The case series is that of fifteen patients managed for postpartum haemorrhage due to uterine atony during caesarean section. All the patients developed atony of the uterus at caesarean section that was associated with bleeding necessitating insertion of B-Lynch suture. The possibility of failure of the B-Lynch suture was reduced by anchoring the 2 braces at their fundal summit. The original B-Lynch suture is first inserted using a vicryl 2 suture. A vicryl number 1 or 2 is then passed with small bite under the brace suture at the fundal summit of the brace on either side and tied with 2 or 3 knots in the middle. The patients were then closely followed up over 24 hours after surgery for any signs of abdominal distension and bleeding per vagina

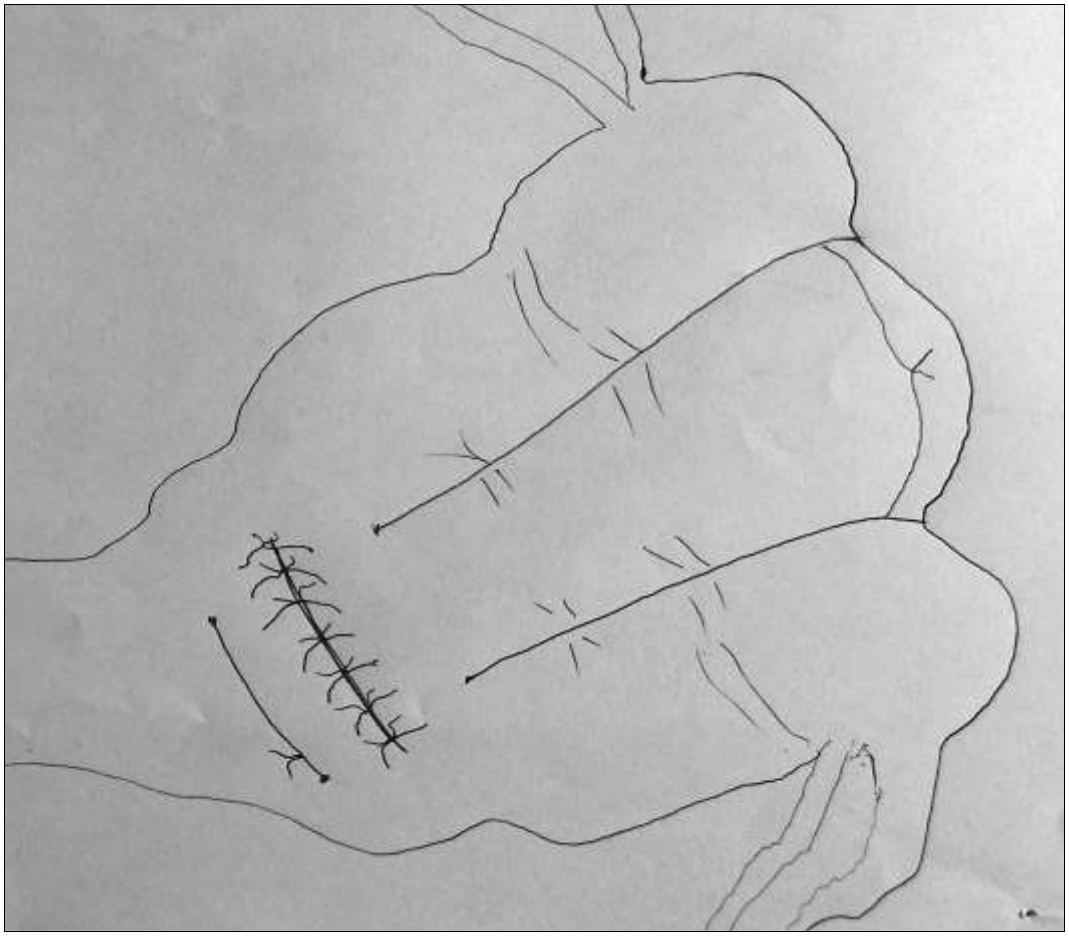


Fig 1: Diagram showing B-Lynch suture and an anchor at the fundal summit area to prevent slippage

Case 1

She was a 40year old booked G5P4 (4 Alive) woman at gestational age of 37 weeks who presented with painless vaginal bleeding of 4 hours duration. Bleeding was unprovoked and painless with estimated blood loss before presentation of about 100mls. No history of medical condition or past surgery. Not on any chronic drug use. She had decided to complete her family size with the index pregnancy.

On examination, she was conscious and alert, not pale with Pulse rate of 90 b/m, Blood pressure of 100/70mmHg. Abdomen was uniformly enlarged with Symphisiofundal height (SFH) of 38cm, singleton fetus in longitudinal lie cephalic presentation. No uterine contractions. Vaginal examination revealed perineal pad that was moderately soaked with fresh blood. Digital vaginal examination was avoided. Urgent Obstetrics ultrasound done revealed placenta praevia anterior Type II.

An assessement of Symptomatic placenta praevia type II in a G5P4 was made. She was counselled for emergency caesarean section + Bilateral Tubal ligation (BTL) which she subsequently had under spinal anaesthesia. Baseline pre-op investigations were normal. She consented for the surgery.

Intraoperative findings include: anterior placenta praevia type II, Live male fetus in longitudinal lie cephalic presentation APGAR score 8 at 1min 10 at 5 min. Baby's birth weight was 2.6kg. She had uterine atony after delivery apart from the bleeding from the placenta beds in the lower segment. She therefore had a B-Lynch suture inserted combined with a transverse B-Lynch suture. A fundal anchor was used to stabilize the 2 braces of the longitudinal B-Lynch suture. These effectively contracted the uterus to stop the bleeding. Estimated blood loss was 1000mls.

Patient did well postoperatively without any episode of bleeding throughout the post operative period. She was discharged home on POD 3 with Packed cell Volume (PCV) of 28%.

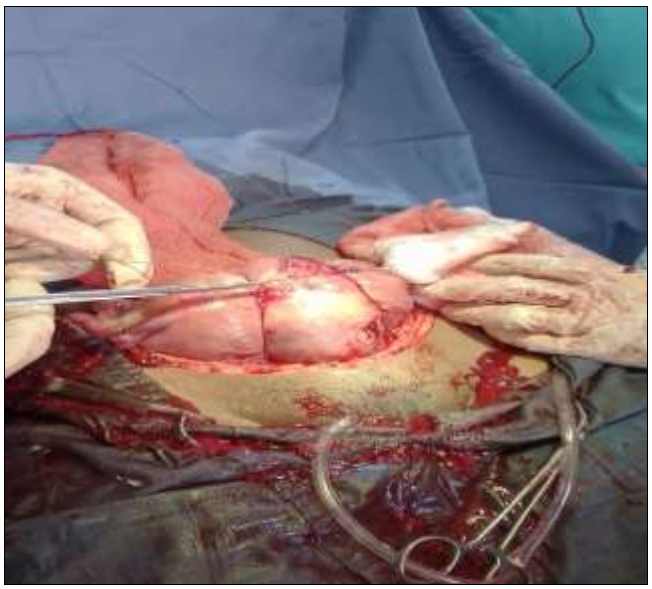


Fig 2: Picture of B-Lynch with fundal anchor. Case 1

Case 2

Patient is H. M, a 29year old booked G2P1 (1A) who presented at 38 weeks with contracted pelvis secondary to short stature and a history of 1 previous caesarean section. No history of drainage of liquor or bleeding per vagina. No history of medical condition. She was regular on Antenatal Care, not on any chronic drug use.

Examination revealed a short statured woman with height of 1.45m. Not pale afebrile anicteric vital signs. Pulse rate=80b/m, blood pressure= 110/70mmHg. Abdomen was uniformly enlarged, there was a well healed pfannenstiel scar, symphysiofundal height was 38cm, singleton fetus in longitudinal lie cephalic presentation, no uterine contractions. There was a normal female external genitalia, cervix was firm, and 2cm long, posterior and cervical os was closed. A diagnosis of Short statured G2P1 with previous caesarean section scar at 38 weeks gestation was made.

She counseled for delivery by caesarean section. All pre-operative investigations were essentially normal. She consented and had elective caesarean section under spinal anaesthesia. Intraoperative findings were that of mild adhesions between the lower uterine segment and the anterior abdominal wall. A live female fetus was delivered with APGAR score 8 at 1 minute, 10 at 5 minutes, weighted 3.5kg. She had uterine atony despite adequate oxytocics prophylaxis with blood loss estimated to be 1,150mls and a B-Lynch suture with fundal anchor was inserted which effectively contracted the uterus stopping haemorrhage. She had 1 unit of blood transfused.

She remained stable throughout post-operative period without any episode of bleeding. Post-operative PCV was 35%. She was discharged home on POD 3.

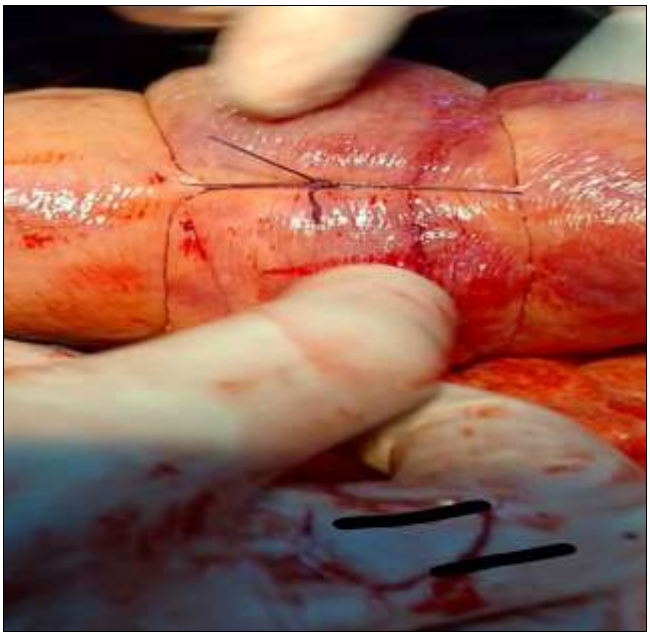


Fig 3: Picture of B-Lynch with fundal anchor. Case 2

Case 3

Patient was a 35year old booked G5P2+2 (2A) at EGA 39 weeks 5 days with pregnancy induced hypertension. No history of abdominal pains. No drainage of liquor or bleeding Per Vagina. She was regular on her antihypertensives. No past surgery. Ultrasound scan done revealed severe oligo hydramnios Amniotic Fluid Index (AFI)=4 and low lying placenta. Urinalysis was negative for protein. Examination revealed conscious and alert patient, not pale, afebrile, acyanosed, not dehydrated, no pedal edema. Pulse rate was 96 b/minute and blood pressure was 180/110mmHg. Abdomen was uniformly enlarged with gravid uterus, symphysiofundal height was 37cm. Singleton fetus in longitudinal lie cephalic presentation. No uterine contractions. Fetal heart rate (FHR) was 140 b/min. Vaginal examination shows normal female external genitalia, cervix was central, soft, 1cm long, Os is 6cm dilated station -1, membrane intact.

Diagnosis was that of a 35year old booked G5P2 +2 (2A) at 39

weeks 5 days with pregnancy induced hypertension and severe oligohydramnios. She was counselled and worked up for emergency caesarean section under spinal anaesthesia. All pre-operative investigations were normal.

Intraoperative findings were that of a gravid uterus and normal tubes bilaterally. Live female fetus was delivered with APGAR 8 at 1min, 10 at 5 min. Birth weight 2.9kg.

The uterus remained uncontracted after delivery despite adequate oxytocics with associated bleeding necessitating insertion of a B-Lynch suture with a fundal anchor which effectively controlled the bleeding. Blood loss at surgery was estimated to be >1000mls for which she was transfused with 1 unit of blood.

She did not have any bleeding episode post-operatively and was discharged together with the baby on post op day 3. Packed Cell volume at discharge was 30%.

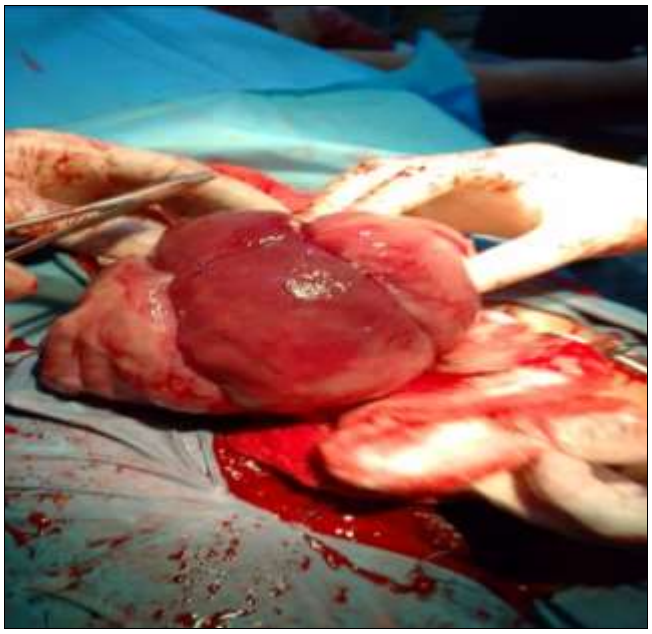


Fig 4: Picture of B-Lynch with fundal anchor. Case 3

Case 4

Patient was a 32year old unbooked G5P4 (5 alive) with index pregnancy of twin gestation at gestational age of 39 weeks 1 day. There was history of previous twin delivery. She had Antenatal Care (ANC) at a comprehensive health center and was regular at antenatal clinic. Ultrasound scan had earlier diagnosed monochorionic monoamniotic twin gestation. She had decided to complete her family size with current pregnancy.

Examination revealed patient that was conscious and alert, not pale anicteric, acyanosed no edema. Pulse rate was 88b/min, blood pressure 110/80mmHg. Abdomen was uniformly enlarged with gravid uterus, SFH was 44cm and multiple fetal parts felt. Leading twin was presenting cephalic. No uterine contractions. Twin 1 (T^1) Fetal Heart Rate (FHR)=148b/min, Twin 2 (T^2) FHR=160b/min. Cervix 2cm long and cervical Os was closed. Her Packed Cell Volume (PCV) was 30%. Ultrasound scan done revealed monochorionic monoamniotic twin gestation at 39 weeks.

A diagnosis of 32 year old unbooked G5P4 (5A) at 39 weeks with monochorionic monoamniotic twin gestation with fetal tachycardia of the leading twin was made.

She was counselled for emergency caesarean section and tubal ligation which she had under spinal anaesthesia which she consented for and had. Intraoperative findings were that of gravid uterus normal tubes and ovaries bilaterally. She was delivered of live twin neonates, Twin 1 was a life male neonate with APGAR 8 at 1 min weight 3.1kg, 10 at 5 min. twin 2 was live male neonate APGAR 8 at 1 min, 10 at 5 min weight 2.9kg.

The uterus was persistently atonic after delivery of the babies despite the administration of the necessary oxytocics. Therefore, a B-Lynch suture with fundal anchor was inserted which effectively contracted the uterus. She remained stable in the postoperative period without bleeding. Post-operative Packed Cell Volume (PCV) was 29%. The babies were also stable and she was discharged on P

Fig 5: Picture of B-Lynch with fundal anchor. Case 4

Case 5

She was a 29 year old booked G2P0 who presented at gestational age of 40 weeks 5 days with suspected fetal macrosomia. No any adverse complaints in pregnancy. No any medical condition, no past surgery. Examination revealed a conscious and alert patient that was not pale and not dehydrated. Vital signs were Pulse rate of 74b/m, Blood Pressure of 110/70mmHg. Abdominal examination revealed Symphysofundal height of 44cm, singleton fetus in longitudinal lie cephalic presentation with fetal heart rate of 148 b/m. vaginal examination revealed normal vulva and vagina, cervical Os was closed. A diagnosis of suspected fetal macrosomia in a nullipara with postdated pregnancy was made.

Patient was counselled for elective caesarean section under spinal anaesthesia which she subsequently consented and had with intraoperative findings of single live female fetus. Baby's birth weight was 4.2 kg and APGAR score 8 at 1 min, 10 at 5 min. Uterus remained persistently atonic during the operation despite adequate oxytocics with associated bleeding from the point of placenta insertion. Blood loss was estimated to be 900mls.

She was adjudged to be having uterine atony and a B-Lynch

suture with fundal anchor was inserted which effectively contracted the uterus and stopped the bleeding. She had other appropriate post- operative care and remained stable throughout the period of admission without any bleeding in the immediate 24 hours post op and beyond.
The patient and her baby were discharged home on post-operative day (POD) 3. PCV at discharge was
30%.

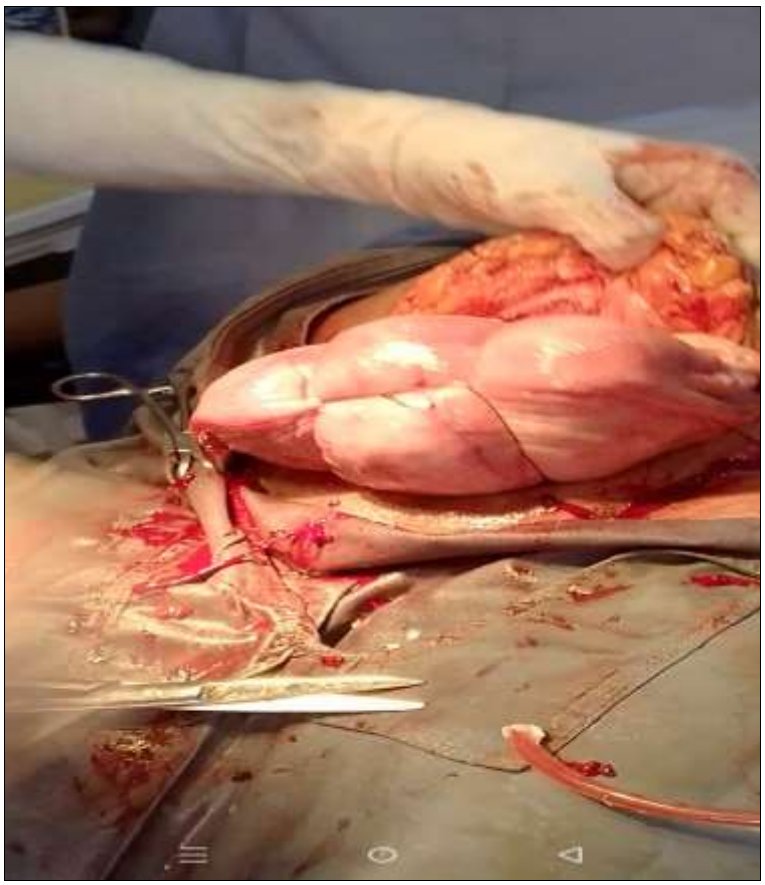


Fig 6: Picture of B-Lynch with fundal anchor. Case 5

Results

All the patients so managed and monitored (100%) did very well without any incidence of bleeding from the vaginal or abdominal distension over the 24 hours post-operative period and beyond. None of them (0%) required any additional post-partum haemorrhage preventive of therapeutic intervention. They were all discharged at post operative day 3 which is the usual time of discharge good packed cell volume.

Discussion

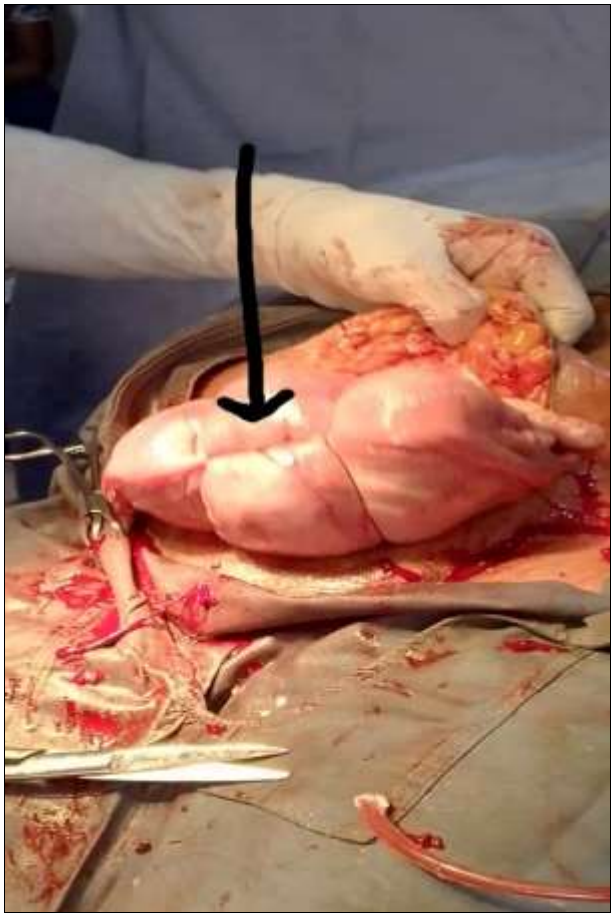
The first publication of any form of compression suture on the uterus to control haemorrhage was a single case report published in German in 1996 in which compression sutures was applied only to the fundus to successfully treat haemorrhage from atonic uterus [39]. This has however been followed by several other discoveries of techniques at improving the extent of uterine compression, effectiveness and reducing side effects of such compression which essentially justifies this study

A famous report of 5 consecutive cases successfully treated with B-Lynch suture followed in 1997. Since the invention of B-Lynch suture, several modifications have been developed to address different clinical situations and improve outcomes. Moreover, the success rate of the original B-Lynch suture has been quoted to be 70-80% this may be due to slippage of the braces reversing its effectiveness, however, with the addition of fundal anchor to the B-Lynch suture as done in this case series, the effectiveness improves significantly to about 100%. Similarly, several other modified B-Lynch techniques aim to refine the original procedure enhancing safety, ease of application and efficacy. Some of the prominent modifications include: the "Cross" B-Lynch Suture which is a common modification of the B-Lynch suture, the cross stich involves a crisscross pattern that improves uterine compression and minimizes the risk of suture failure. Involves passing separate suture around the lower uterine segment above and below the incision line anchoring the B-Lynch braces and improve compression [40] Marasinghe *et al.* described a method of avoiding brace slippage in which 2 separate brace sutures were placed with each brace wound round about 4 cm of the fundus before tying anteriorly. This anchorage method however involves increased number of entering into the endometrial cavity. Other modifications of the B-Lynch suture include Cho, [41] Hayman [42], Ohuabah's, [43] Khairy [44].

The original procedure by B-Lynch had success rate of 80-100% in controlling PPH due to atony with uterine preservation. The suture technique of Hayman *et al.* had a success rate of 90% and Cho's and Ouahba's techniques had success rates of 100% and 95% respectively

Usual uterotonics administration which is the first component for PPH prophylaxis was administered in all the cases presented in this study amongst several other caesarean sections done in which uteronics administration sufficed, but these cases still required insertion of B-Lynch suture. This occurrence is supported by previous publications that have reported that uterotonics reduces chances of PPH by only about 50% [45]. A

south Korean study by Kim *et al.* had earlier described a form of modified B-Lynch in which 2 separate brace sutures were used to compress the uterus anteroposteriorly with the sutures penetrating through the cavity apposing the walls and each brace tied at the fundus followed by tying of the suture stumps together at the fundus to prevent slippage [46]. However, Kim's modification is different from our proposed modification which uses the conventional B-Lynch and the uterine walls are not apposed.



Conclusion

The search for methods and innovations that can help in preventing maternal mortality is endless and any of such discovered is worthwhile. The addition of fundal brace anchor as described in this case series will definitely go a long way in reducing the percentages of failure associated with B-Lynch suture, reduce the rate of re-laparotomy for atonic postpartum haemorrhage after caesarean section and therefore contribute in prevention of maternal mortality due to postpartum haemorrhage especially those caused by uterine atony.

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