B-Lynch suture for the treatment of uterine atony

Koh E, Devendra K, Tan L K

ABSTRACT

Introduction: Over 125,000 women die of postpartum haemorrhage (PPH) each year, with the commonest cause being uterine atony (75–90 percent). Failing conservative management, hysterectomy is usually the final resort. In 1997, Christopher B-Lynch devised an innovative technique to treat uterine atony, and it has been widely used around the world since its original report. However, there are hardly any reports of this technique being utilised in East Asian countries, including Singapore. Our study reviews the cases in which the B-Lynch suture was used to treat uterine atony, and the clinical outcomes of these cases.

Methods: A retrospective study of data of all women who delivered between May 2004 and June 2007 was collected from the department's database, to identify patients who had undergone the B-Lynch procedure. Primary PPH is defined as a blood loss of more than 500 ml at or within 24 hours of delivery.

Results: There were a total of 5,470 deliveries during this period, with primary PPH occurring in 100 cases. The B-Lynch procedure was performed in seven women, avoiding the need for a hysterectomy in five cases.

Conclusion: Our series of cases treated with the B-Lynch procedure showed that it is an effective method of containing PPH. It has the advantage of being applied easily and rapidly, and should be taught to all trainees and registrars in obstetrics. It should be attempted when conservative management of PPH fails and before any radical surgery is considered.

Keywords: B-Lynch suture, hysterectomy, postpartum haemorrhage, uterine atony

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Department of Obstetrics and Gynaecology, Singapore General Hospital, Outram Road, Singapore 169608

Koh E, MBBS, MRCOG
Registrar

Devendra K, MBBS, MRCOG
Consultant

Tan LK, MBBS, MMed, MRCOG
Senior Consultant

Correspondence to:
Dr Elisa Koh
Tel: (65) 6321 4667
Fax: (65) 6225 3464
Email: elisakoh@gmail.com

INTRODUCTION

It has been estimated that worldwide, over 125,000 women die of postpartum haemorrhage (PPH) each year.[1] In the most recent triennial Confidential Enquiry into Maternal Deaths in the United Kingdom (2003–2005), PPH remained one of the top three causes of direct maternal deaths, resulting in 14 deaths during this period.[2] Uterine atony accounts for 75%–90% of primary PPH. The traditional management of this condition begins with conservative methods such as bimanual uterine compression, medical therapy with uterotonic agents, uterine tamponade with balloons and occasionally, arterial embolisation,[3] the failure of which often mandates surgical intervention. Surgical measures such as ligation of the major pelvic vessels demand a rarely used skill possessed by few registrars. In the event of intractable haemorrhage despite the above measures, hysterectomy is usually the final resort.

In 1997, Christopher B-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.[3] Since then, the B-Lynch surgical technique has been widely used around the world. Anecdotal evidence suggests that around 1,300 cases have been performed successfully worldwide, in countries such as India, Africa, North and South America, and Europe.[4] However, there are hardly any reports of this technique being utilised in East Asian countries, including Singapore. Our study reviews the cases in which the B-Lynch suture was used in our institution to treat primary PPH and PPH secondary to uterine atony, and their clinical outcomes are discussed.

METHODS

A retrospective study of data of all women who delivered between May 2004 and June 2007 was collected from our department's database. Primary PPH is defined as a blood loss of more than 500 ml at or within 24 hours of delivery. There were a total of 5,470 deliveries during this period, with primary PPH occurring in 100 of these cases. The B-Lynch procedure was performed in seven women only after uterine atony did not respond to measures such as uterine massage, bimanual compression and the use of uterotonics, i.e. oxytoxin, ergometrine, carboprost and misoprostol. The need for a hysterectomy was avoided in five of the cases. No other surgical method of controlling

the bleeding, e.g. vessel ligation, was attempted before or together with the B-Lynch method in any of the cases.

The procedure was initially described using chromic catgut, but the consultants in our department used a variety of other sutures, such as PDS (polydioxanone) in one case and Vicryl (polyglactin 910) in the rest. The B-Lynch brace suture was first described as follows:[3]

(1) The patient was catheterised under general anaesthesia and placed in the Lloyd-Davis position for access to the vagina, to assess the control of bleeding objectively by swabbing.

(2) The abdomen was opened by an appropriate-sized Pfannenstiel's incision, or if the patient had a caesarean section, following which she bled, the same incision was re-opened.

(3) On entering the abdomen, either a lower segment incision was made after dissecting off the bladder or sutures of the recent caesarean section were removed, and the cavity entered. The cavity was evacuated, examined and swabbed out.

(4) The uterus was exteriorised and rechecked to identify any bleeding point. If bleeding was diffuse, as in uterine atony, coagulopathy, or profuse placental bed bleeding where no obvious bleeding point is observed, then bimanual compression was first applied to assess the potential chance of success of the B-Lynch suturing technique. The vagina was swabbed to confirm adequate control of the bleeding.

(5) If vaginal bleeding was controlled, for a left-handed surgeon, or a surgeon electing to stand on the left side of the patient, a 70-mm round bodied needle, on which a number two chromic catgut suture was mounted, was used to puncture the uterus 3 cm from the right lower edge of the uterine incision and 3 cm from the right lateral border. The mounted number two chromic catgut suture was threaded through the uterine cavity to emerge at the upper incision margin 3 cm above and approximately 4 cm from the lateral border (because the uterus widens from below upwards). The chromic catgut suture, now visible, was looped over the uterine fundus 3–4 cm from the right cornual border, and fed posteriorly and vertically downwards to enter the posterior wall of the cavity at the same level as the upper anterior entry point. Now the chromic catgut was pulled under moderate tension, assisted by the first assistant. The suture, which was in the cavity, was passed back posteriorly on the left again through the same surface marking as for the right side, with the suture lying horizontally. The catgut was fed through posteriorly and looped over the fundus to lie anteriorly and vertically, compressing the fundus on the left side as on the right. The needle was passed through the uterine cavity and out 3 cm anteriorly and below the incision margin on the left.

(6) The two lengths of catgut were pulled taut, assisted by bimanual compression to minimise trauma and to achieve or aid compression. During such compression, the vagina was checked that the bleeding was controlled.

(7) As good haemostasis was secured, the uterus was compressed by an experienced assistant while the principal surgeon threw a knot (double throw) to secure tension.

(8) The uterine incision was now closed in the normal way, in two layers, with or without closure of the lower uterine segment peritoneum.

(9) For a major placenta praevia, it was suggested that an independent figure-of-eight suture be placed at the beginning anteriorly or posteriorly, or both, prior to the application of the B-Lynch suturing technique, as described above, if necessary.

RESULTS

The B-Lynch suture was attempted in a total of seven cases from May 2004 to July 2007. All seven cases were performed by two consultants familiar with the technique. The results are summarised in Table I. Apart from Case 1, which developed cardiomyopathy and pulmonary embolism, the rest of the patients had an uneventful postoperative recovery. The B-Lynch procedure failed to control bleeding in two out of the seven cases. In Case 2, a modified technique in which the uterine incision was not reopened, was used. However, it failed to control the bleeding and resulted in a hysterectomy. The B-Lynch suture also failed to control bleeding in Case 6, in whom the bleeding was largely due to a cervical tear, in addition to uterine atony. All the cases had evidence of uterine atony which responded poorly to conventional uterotonics. The estimated blood loss ranged from 400 ml to 5,000 ml. Case 7 had the least blood loss of 400 ml, and the B-Lynch suture was done partly as a prophylactic measure, in view of the patient's past history of severe PPH in her previous delivery.

DISCUSSION

Christopher B-Lynch's original case series of five patients underwent the B-Lynch procedure for massive PPH as conventional uterotonic agents proved ineffective.[3] The procedure was successful in preserving the uterus, and hence fertility, in all five cases, and there were no known immediate or long-term complications. Of the five cases, four had primary PPH and one had secondary PPH

Table I. Summary of patient characteristics and clinical outcomes of the use of the B-Lynch suture for the treatment of PPH.

Case	Age (years)	Parity	Gestation (weeks)	Mode of delivery	Initial measures	Method/ suture type	Outcome	EBL (ml)	Blood products
1	35	G1P0	39	Normal vaginal delivery	IV ergometrine; IV oxytocin infusion 30 units; Supp misoprostol 1,000 mg	B-Lynch / PDS	Uterus conserved. Developed postpartum cardiomyopathy and pulmonary embolism. Discharged well on 14th POD.	5,000	14 units PCT 6 units FFP 4 units platelets
2	43	G3P1	40	Emergency LSCS for non-reassuring foetal status	IV ergometrine; intramyometrial carboprost × 500 ug; Supp misoprostol 400 mg	Modified B-Lynch / Vicryl	Persistent bleeding leading to hysterectomy. Recovered well and discharged sixth POD.	4,000	8 units PCT 6 units FFP
3	36	G1P0	35	Emergency LSCS for preeclampsia	IV oxytocin infusion 30 units; IV ergometrine, IM carboprost × 1 mg	B-Lynch / Vicryl	Uterus conserved. Uneventful postoperative recovery. Discharged well on fifth POD.	800	Nil
4	34	G5P2	35	Emergency LSCS for placenta praevia	IV oxytocin infusion 30 units; hot packs; IV ergometrine 1ml; IV duratocin; intramyometrium carboprost 1.25 mg in total	B-Lynch / Vicryl	Uterus conserved. Uneventful postoperative recovery. Discharged well on third POD.	2,000	4 units PCT 2 units FFP
5	30	G2P1	35	Emergency LSCS for triplets	IV oxytocin infusion 30 units; IV ergometrine 1 ml; Intramyometrial carboprost; IV duratocin	B-Lynch / Vicryl	Uterus conserved. Uneventful postoperative course. Discharged home on third POD.	600	Nil
6	31	G2P1	41	Normal vaginal delivery	IV ergometrine 1 ml; IV duratocin; intramyometrial carboprost, Sengstaken-Blackmore tube	B-Lynch / Vicryl	Persistent bleeding – source of bleeding from upper cervix. Hysterectomy done. Uneventful postop recovery. Discharged well on fourth POD.	3,000	6 units PCT 4 units FFP 1 unit platelets 80 ml cryoprecipitate
7	34	G3P2	33	Emergency LSCS for antepartum haemorrhage and two previous LSCS	IV oxytocin infusion 30 units, IV duratocin	B-Lynch / Vicryl	Uterus conserved. Uneventful postop recovery. Discharged well on third POD.	400	1 unit whole blood

EBL: estimated blood loss; LSCS: lower segment caesarean section; POD: postoperative day; PCT: packed cell transfusion; FFP: fresh frozen plasma

nine days after an elective caesarean section. Although uterine atony is often the indication for the use of the B-Lynch procedure, it has been shown in many case reports that the suture is also useful in controlling bleeding in cases of placenta praevia and placenta accreta.[5] Apart from the treatment of massive PPH, the procedure has also been used successfully in controlling recurrent severe bleeding outside the context of the immediate puerperium, e.g. following massive bleeding after mid-trimester miscarriages,[6] or prophylactically in patients thought to be more susceptible to massive PPH, e.g. cases of morbidly-adherent placenta, placenta praevia major, clotting factor deficiency, etc.[7] It is also useful as a prophylactic measure in women who are at high risk of PPH but decline blood transfusion for ethical or religious reasons.[8] Many patients subsequently proceed to have successful pregnancies and uneventful deliveries.

The B-Lynch suture has also been used successfully in combination with other methods such as the placement of intrauterine balloons.[9] In our case series, a Sengstaken-Blackmore tube was used in Case 6. It was inserted into the uterine cavity and filled with 150 ml of saline before the B-Lynch suture was attempted. Other surgical methods used in combination with the B-Lynch suture, with variable

results, have also been described, including uterine artery ligation, ovarian vessel ligation and oversewing of the placental bed.[10] However, in our case series, no other surgical method was used in conjunction with the B-Lynch procedure. The surgeons proceeded to hysterectomy once the B-Lynch procedure failed to control bleeding.

In our own series, the B-Lynch procedure failed to adequately achieve haemostasis in two out of seven patients, both of whom eventually underwent a hysterectomy. Case 2 was the only patient in which a modified B-Lynch procedure was performed, where the uterine incision was not re-opened after the caesarean section. A simple looping of the sutures vertically over either side of the fundus was done as the patient was having ongoing brisk bleeding and was haemodynamically-unstable. Although this technique is easier and quicker to perform, Christopher B-Lynch himself feels it is important to explore the cavity to exclude retained products as the cause of PPH, as well as remove any retained clots which can lead to subsequent infection.[4,11] In this case, the patient had already suffered massive blood loss at the time of the procedure and had evidence of disseminated intravascular coagulation, which could have accounted, in part, for its failure. B-Lynch brace suturing should, therefore, be applied as soon as uterine atony resistant to standard pharmacological interventions is evident. Due to the small number of patients in this case series, it is not possible to attribute the failure to the difference in technique alone.

The other patient (Case 6) who required a hysterectomy, initially had a successful bimanual compression test before application of the B-Lynch suture, but started to bleed again shortly after the application. The source of the bleeding was later discovered to be from a tear at the region of the upper cervix and lower uterine segment, which was not easily accessible for repair. The patient was already in severe coagulopathy as the B-Lynch procedure was attempted only after massive blood loss, as in Case 2. B-Lynch used catgut suture in all of his cases in his initial case series. Subsequently, there has been a total of 16 publications on the technique from 2000 to 2005, reporting an 80%–100% success rate of the B-Lynch procedure in controlling PPH with uterine preservation. Since 1997, more than 1,000 procedures have been performed worldwide.

Various suture materials have also been tried, including Vicryl (polyglactin 910), Dexon (polyglycolic acid), PDS (polydioxanone), Prolene (monofilament polypropylene) and nylon. It is believed that the ideal suture should be strong, monofilamental (to minimise possible trauma to the friable tissue of the atonic uterus), quickly absorbed, and mounted on a large curved needle for ease of placement of the suture. Non-absorbable or slowly-absorbable sutures may result in bowel entrapment, should they become loose, and can also stimulate the formation of adhesions. Ideally, the suture needs to maintain tensile strength for 48–72 hours, and then be absorbed rapidly. On this basis, Monocryl (polyglecaprone 25) has been suggested by Price and B-Lynch as the most suitable material for the B-Lynch brace suture. Ethicon has specifically developed a prototype soluble suture for the B-Lynch procedure, using the material number one Monocryl (polyglecaprone 25) monofilament with an absorption profile of 60% of original strength at seven days and 0% at 21 days. Absorption is complete at 90–120 days. It consists of a 90-cm-long soluble Monocryl suture attached to a 70-mm-long Ethiguard blunt semicircular hand-held needle.[4] However, this was not available in our institution. In our series of seven cases, Vicryl was used in all but Case 1, in which PDS was used. Although this is not recommended for the reasons stated above, there were no subsequent long-term complications encountered in this patient.

There have been isolated reports of adverse consequences after B-Lynch application. In 2004, Grotegut et al reported one case of erosion of a B-Lynch suture through the uterine wall, in a 19-year-old primigravida, who underwent suture placement at caesarean section for haemorrhage secondary to uterine atony.[12] The suture used was Maxon (monofilament polyglyconate), a slowly-absorbable suture; hence, the importance of using a rapidly-absorbable suture. At six weeks postpartum, the suture was noted to be protruding through the cervical os and was removed without difficulty. Ultrasonohysterography performed six months after the operation showed a small defect at the anterior wall of the lower uterine segment.[12] The effect of the erosion on future fertility and labour remains unknown. Despite this, many patients on long-term follow-up have demonstrated resumption of periods and normal reproductive health.[10]

Partial ischaemic necrosis of the uterus occurring 24 hours after the procedure has also been reported in a 26-year-old primigravida who underwent an emergency caesarean section for foetal distress.[13] A B-Lynch suture was placed for atonic PPH which failed to respond to uterotonic agents. Haemostasis was secured before abdominal closure. However, postoperatively, she developed hypotension and oozing of blood from the abdominal incision, and was found to have coagulation failure and shock. At laparotomy, the uterus was congested and distended between the compression sutures, giving it a lobulated appearance. The sutures had

cut through and were embedded in the uterine wall while intervening portions were distended with blood. There was a haemoperitoneum of 2 L. A total hysterectomy was performed with bilateral internal iliac artery ligation. It was postulated that the coagulopathy that developed in the postoperative period led to continued bleeding within the uterine cavity, resulting in outpouching of the uterine walls.[13] This report emphasises the need for close patient surveillance, and prompt recognition and correction of coagulation failure in cases of treated PPH where the uterus is still present, even if a B-Lynch suture had been in place.

Long-term complications include the formation of bowel adhesions, and this was described in a patient delivered by caesarean section for poor progress in labour. In this case, four vertical brace sutures were added using Vicryl (polyglactin 910) in addition to the conventional B-Lynch suture, as the author found that the central portion of the uterus continued to bleed, and the sutures from the conventional brace suture threatened to slide off. A diagnostic laparoscopy performed ten months later to investigate painful and heavy periods revealed dense adhesions from the omentum and uterus to the anterior abdominal wall, and the author suggested that this could have been caused by the sutures.[5]

In our series, none of the patients had any known adverse outcomes to date. Our series of seven patients illustrates the usefulness of the B-Lynch procedure in the management of intractable PPH, thus avoiding hysterectomy. To date, we have no further data of continued fertility in patients whose uteruses were conserved. There is no randomised controlled data comparing B-Lynch procedure to other methods of haemostasis for PPH, and it is unlikely that such data would ever be forthcoming, given that PPH is often unanticipated and occurs under urgent or life-threatening situations, thereby rendering randomisation and the process of controlling for variables extremely difficult, if not impossible, to implement and ethically questionable.[10]

In conclusion, our initial series of cases of PPH treated with the B-Lynch procedure shows that it is an effective method of containing PPH. The B-Lynch brace suture has the advantage of being applied easily and rapidly. It should be attempted as early as possible in order to maximise its success, and prophylactic application should be considered in patients at high risk. Application of a B-Lynch suture should be taught to all trainees and registrars in obstetrics. Its relative simplicity and ease of application, its life-saving potential, relative safety, and above all, its capacity for preserving the uterus, make it the recommended procedure of choice if conservative measures do not control PPH, and should be attempted before any radical surgery is considered.

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