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B-Lynch Compression Suture as an Alternative to Paripartum Hysterectomy

Christopher Balogun-Lynch and Tahira Aziz Javaid

Additional information is available at the end of the chapter

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Abstract

Obstetrics haemorrhage is a major killer of women of all categories of class, religion, social and economic status. Women of third world countries suffer the most adversity because of poor resources and infrastructure. In major substandard care, haemorrhage emerges as the major cause of severe maternal morbidity in almost all 'near miss' audits in both developed and developing countries [1, 2, 24].

Paripartum Haemorrhage (PPH) is a serious medical problem. There are about 14 million case occurrences worldwide each year, with a fatality rate of 1%. A total of 140,000 women die each year [3]. Hysterectomy has a very damaging effect in a woman's life. In some ethnic communities this can cause marital breakdown and psychological problems. Hysterectomy for PPH needs experts who have technical skills as usually the patients are already in a compromised condition. Ninety percent of the reason for PPH is because of uterine atony.

Keywords: Pph blynch suture, Hysterectomy, Balloon tamponade, Pph teaching

1. Introduction

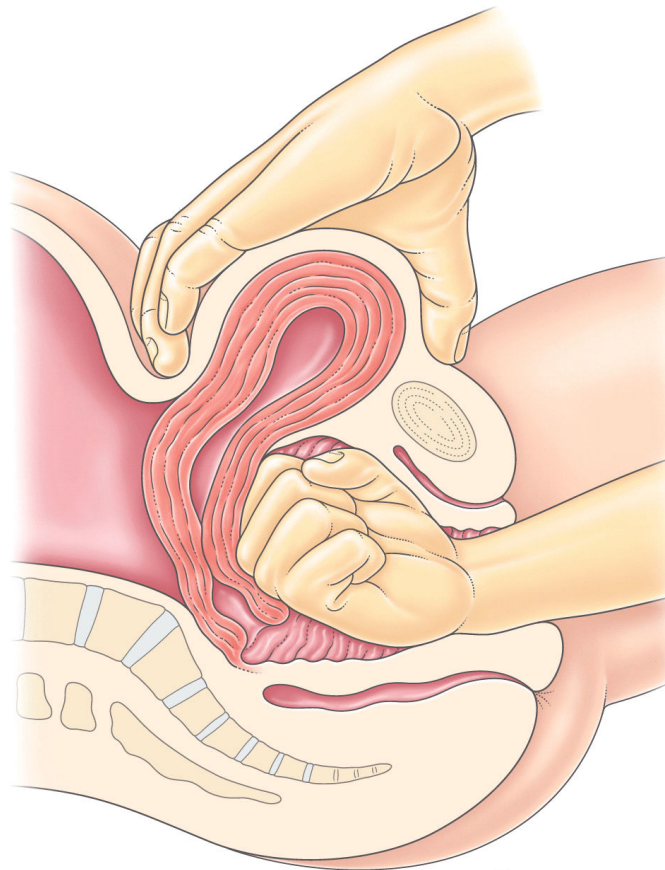
1.1. The Management of paripartum haemorrhage: Avoiding paripartum hysterectomy

1.1.1. Medical management

The medical management of PPH includes using ecbolic such as syntometrin, carboprost, and misoprostol. Sometimes medical management fails and it becomes necessary to proceed to surgical treatment to save the woman's life.

1.2. Conservative surgical management

1.2.1. Bimanual compression of the uterus



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Figure 1. The fist of one hand is placed deep into the vagina while the other hand firmly compresses the uterine fundus in an effort to control bleeding.

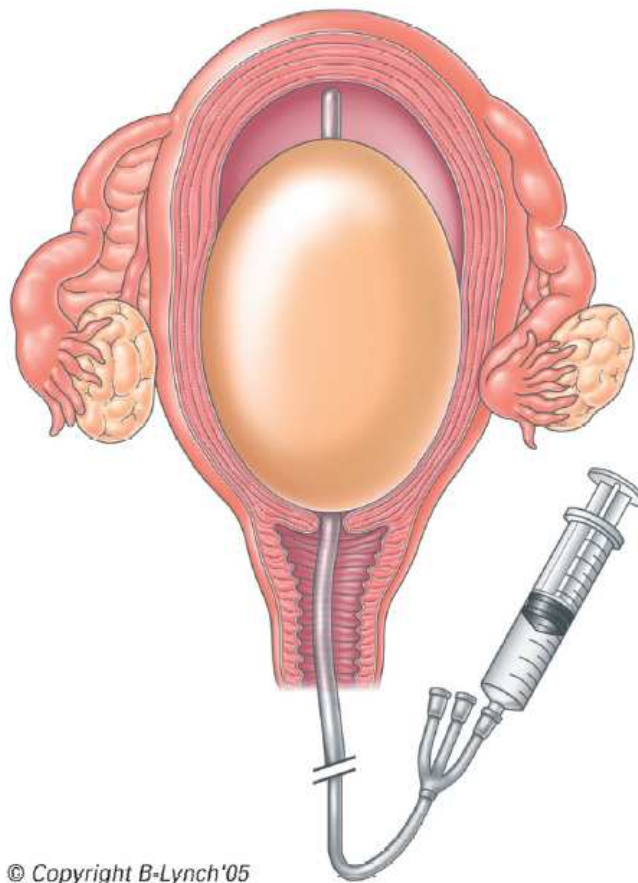
1.2.2. Balloon tamponade

- **Bakri Balloon**
- **Sengstaken-Blakemore Oesophageal Catheter**
- **Rusch Balloon**

Balloon Tamponade was invented to simulate the old traditional way of intrauterine compression by packing and creating intrauterine uniform tension to reduce infection risk. Various balloons have been tried and tested, but we choose to discuss the common varieties [4-6, 8, 9]. The Scottish Confidential Audit of Severe Maternal Morbidity identified 64 cases where balloon tamponade was used for the management of major PPH; hysterectomy was averted in 50 (78%) of the women [10].

Bakri Balloon

In PPH following vaginal delivery, a balloon, such as Bakri, with sufficient volume capacity can be inserted into the uterine cavity after excluding any retained products and also ascertaining that there is no genital tract trauma. The volume of fluid depends on what is needed to achieve haemostasis. The capacity of the balloon is important to correlate with the tension that must be created to maintain adequate haemostasis. This is the tamponade test [11, 12]. The duration of tamponade will vary with the efficiency of bleeding control. Before its complete removal, the balloon could be deflated but left in place to ensure that bleeding does not re-occur.



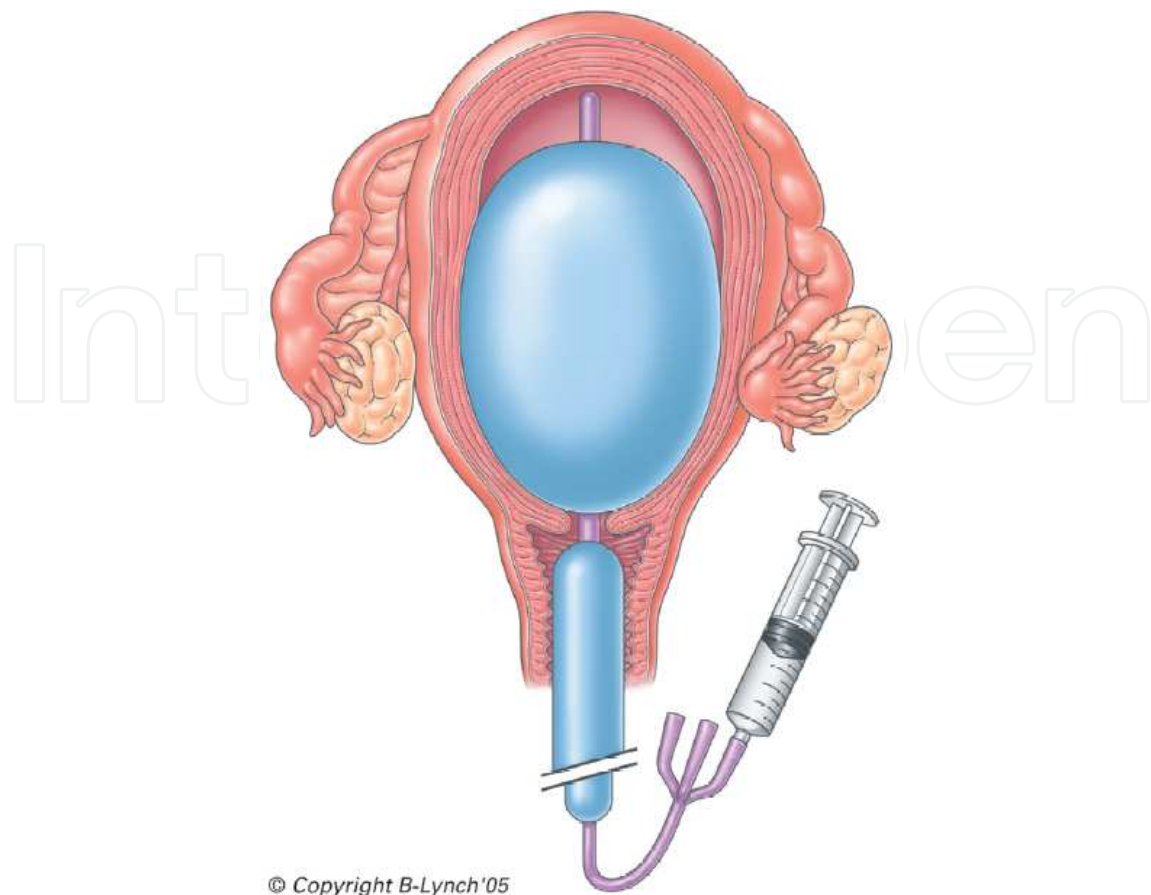
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Sengstaken-Blakemore Oesophageal Catheter

Originally used to control gastro-oesophageal bleeding (haematemesis). If there is continued PPH following balloon tamponade, there becomes an urgent need for laparotomy to arrest haemorrhage.

1.2.3. Haemostatic compression suture

A review published in 2005 of 32 cases of B-Lynch suture reported success in all but one case [13]. In 2002, Hayman et al. described a modified compression suture that does not require



hysterotomy [14] and in 2007, Ghezzi et al. reported success in 10 of 11 cases of women managed with this modified technique [15-17].

It has been reported that hysterectomy was averted in 42 of 52 cases (81%) women where haemostatic brace suturing was used for the management of major PPH [10, 14].

The physiological effect of compression suture is twofold:

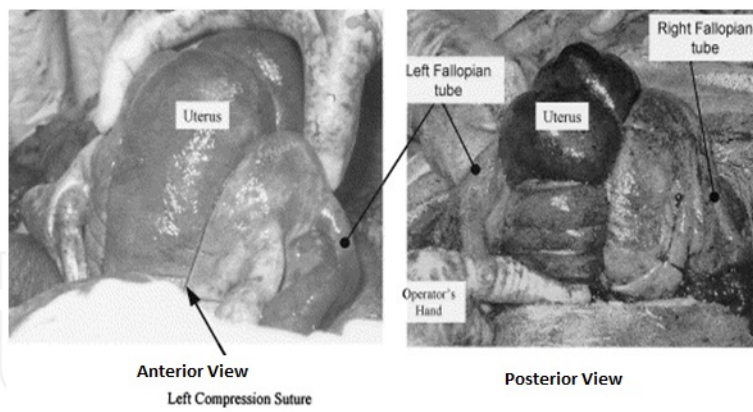
- **First is to enhance the effect of the uterine muscle to slide into contraction**
- **Secondly, it occludes the vascular spaces within the uterus**

Since the b-lynch compression suture was first described by B-Lynch et al. (1997), evidence suggest that over 8,000 women lives and uteri have been saved (B-Lynch personal Communication 2014, www.cblynch.co.uk) [17].

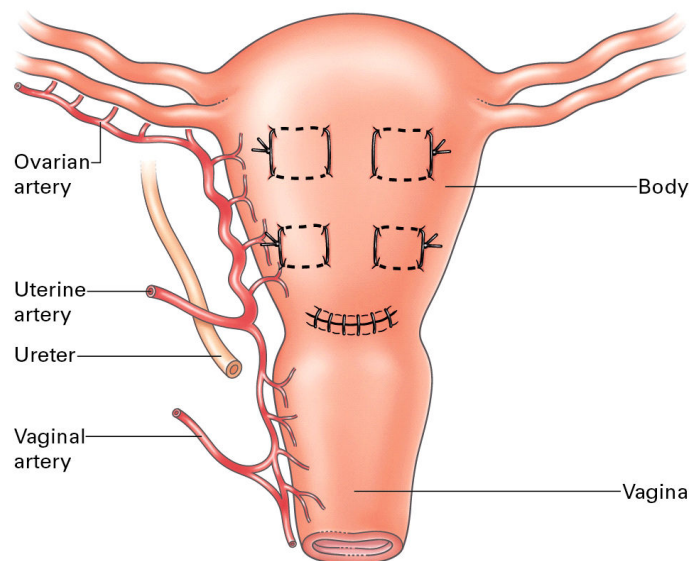
- **Hayman technique**

The potential disadvantages are:

- Restricted drainage of endometrium because anterior and posterior surfaces are compressed
- Suture anchoring causes shouldering, therefore when it slips can cause venous return occlusion, central ischemia, and there is a possibility of pyometra of the uterus



- Homeostatic multiple square suture method



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Special Features

- It pierces the uterus 32 times.
- It impairs involution. It causes poor drainage because the cavity is occluded.
- It does not close all transverse branches of the vascular supply.
- It can cause pyometra and Asherman Syndrome [18].
- It is difficult to apply and to achieve haemostasis when there is DIC (Disseminated Intra-vascular coagulation).

- **The B-Lynch suture compression suture avoiding paripartum hysterectomy**

Indications

- Uterine atony
- Polyhydroamnios
- Multiple pregnancy
- Big baby
- Eclampsia
- Uterine anomaly
- Abruptio placentae
- Abnormal placentation

Requirements for B-Lynch suture are as follows:

- Lloyd Davis or frog-legged position essential
- The uterus must be exteriorised
- Basic surgical competence required
- Bi-manual compression to test for potential success
- Transverse lower segment incision should be made
- Uterine cavity checked, explored, and evacuated
- A 70-mm half circle guarded needle (code: w3709) mounted on a 90-cm monocril No. 1 (Ethicon, Somerville, N.J.) or Catgut suture is appropriate
- Apply suture correctly with even tension (no shouldering)
- Allow free drainage of blood, debris, and inflammatory material.
- Check bleeding control vaginally, using swabs and instruments

B-Lynch suture illustration of technique

In vitro illustration of the B-Lynch suture application

In vivo illustration of properly applied B-Lynch suture

The special features of B-Lynch suture are:

- Even tension
- Free drainage of cavity
- No shouldering
- Facilitates involution

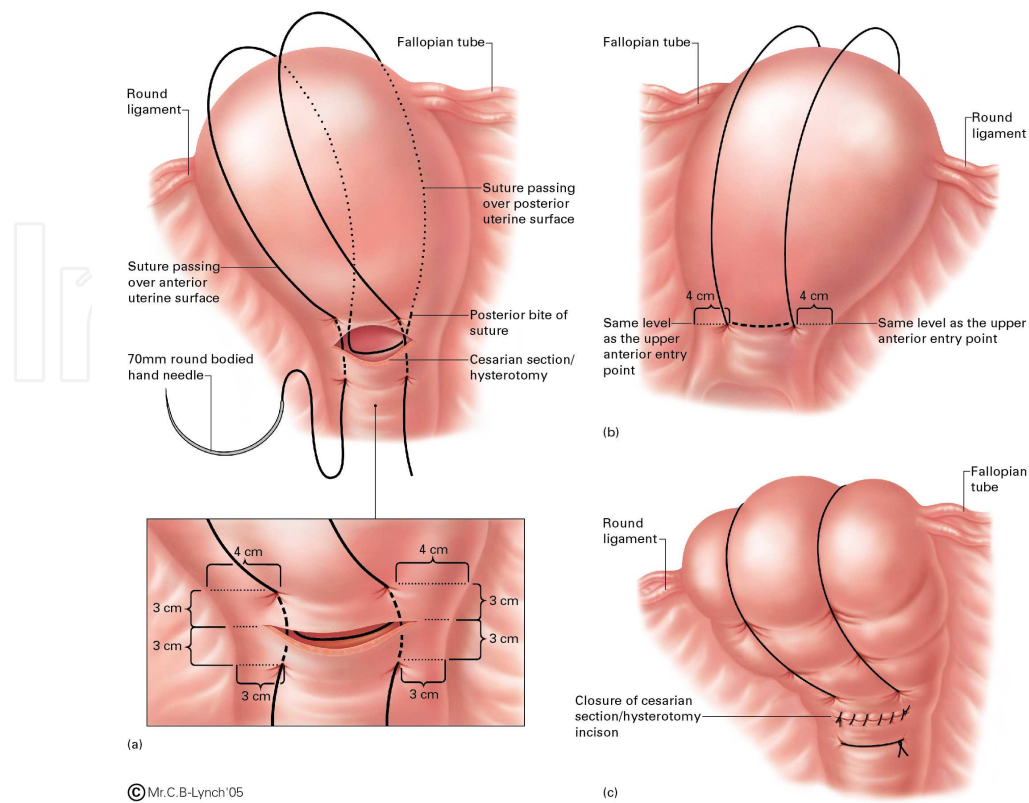
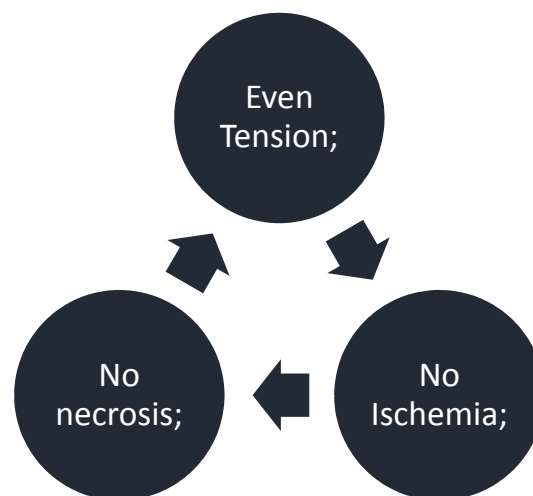


Figure 2. Anterior View

- Easy to confirm haemostasis
- Confirms no retained products and uterine cavity is empty
- Easy to confirm no decidual tear/trauma



Figure 3. Posterior View



- The uterus should be exteriorised and the surgeon demonstrates to his assistant bimanual compression and ante version. The second assistant checks the vagina to ensure that bleeding is controlled and the surgical technique will work.

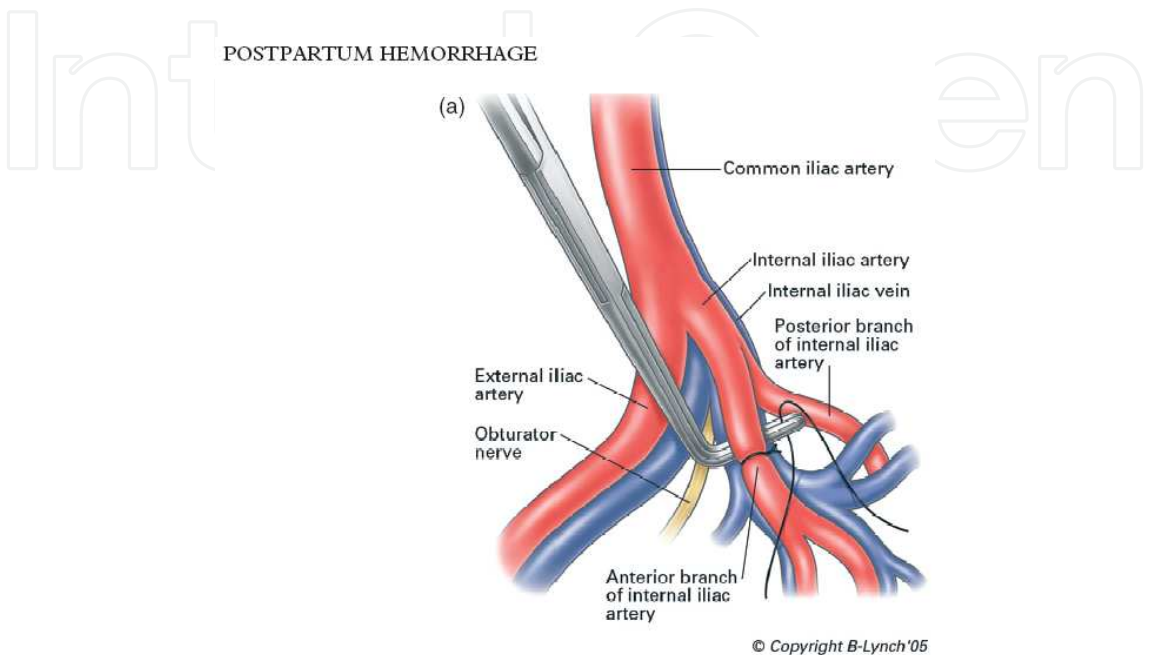
Causes of failure

- Placenta percreta
- Wrong technique causing uterine necrosis
- Uncontrolled DIC
- No pre-operative test done
- Not properly applied

- Delayed application

1.2.4. Other surgical techniques

- Internal iliac artery ligation



A recent case series describes 84 women with PPH from various causes who underwent internal iliac artery ligation as the first-line surgical intervention. Hysterectomy was required in 33 (39%) of the women.

- Stepwise de vascularisation (sites of vascular occlusion)

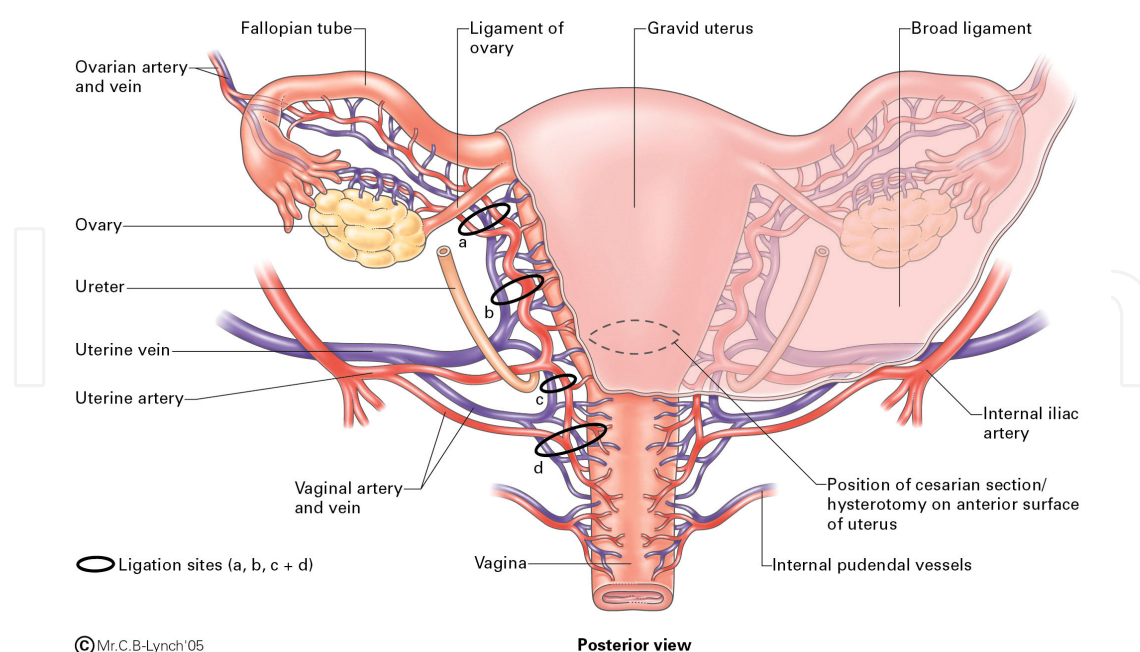
This is relatively easy to perform but time consuming.

- Selective arterial occlusion or embolisation by interventional radiologist

A 2002 review summarised a case series totalling 100 women and reporting 97% success with selective arterial embolisation for obstetric haemorrhage [19, 20].

Method	No. of Cases	Success Rate
B-Lynch + other compression sutures	94	90.4 %
Arterial embolization	218	91.0 %
Arterial ligation	264	83.7 %
Uterine balloon tamponade	135	83.7 %

Table 1. Table of success rate of each procedure (B-Lynch Personal Communication 2014)



1.3. Learning to treat paripartum haemorrhage: A spectrum of modern teaching/learning modalities

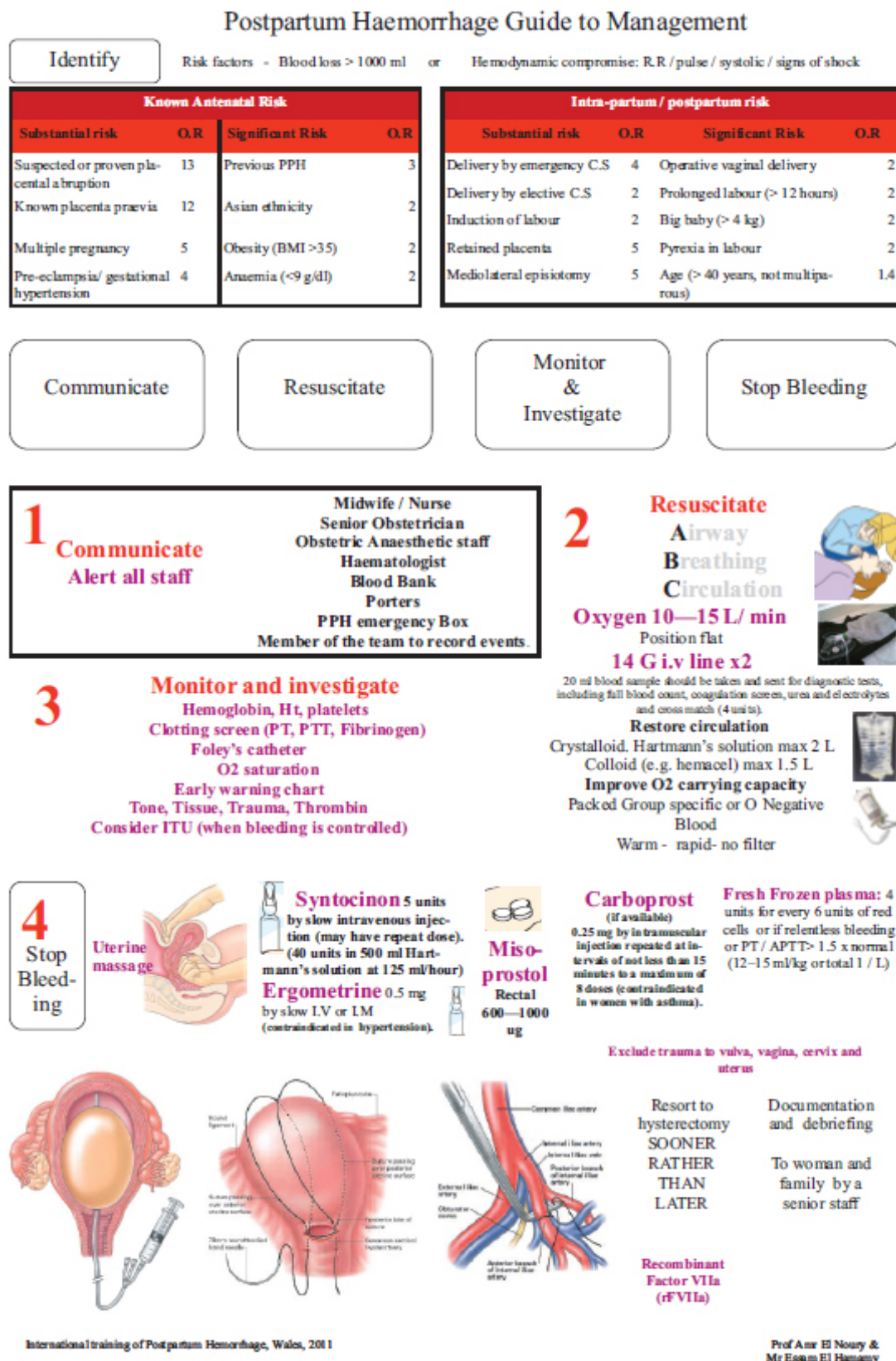
William Osler (1849-1919) brought forth the concept of bedside teaching/learning in the 19th century [21]. Although more than a century has passed since he first aired this concept, and the practice of medicine both at the bedside and in the office has changed radically, his statement remains entirely true with regard to the management of PPH.

Specifically, in recent years training in emergency obstetric skills (including PPH training) has moved from the traditional clinical teaching, normally conducted in the labour ward to specific, targeted skills and scenario-based courses that utilise mannequins and simulators most often away from the bedside. Such changes are currently seen as necessary, largely as a result of the limitations of traditional clinical teaching when it comes to genuine patient encounters in an emergency situation [22].

The authors are grateful to Professor Amr El Noury of Cairo University for designing the poster that provides a stepwise guide to the management of PPH (Figure 12).

2. The drivers for paripartum haemorrhage training

The incidence of PPH is increasing in both developed and developing countries [23, 24]. The World Health Organization (WHO) has set a goal to reduce maternal mortality by 75% by 2015, mainly by reducing maternal deaths related to PPH by training health workers in both developing and developed countries [25]. Recently, further initiatives have been undertaken by WHO in addressing women's health crisis in Africa by providing a report on women's health in the African Region [26].



Prior to these efforts, the Federation of Gynaecology and Obstetrics (FIGO), together with the Confederation of Midwives (ICM), advocated the Global Initiative on the Prevention of Postpartum Haemorrhage in 2004. In addition, both organizations recommend that every skilled attendant (doctors, nurses, and midwives) likely to be present at birth have training in uterine massage and bimanual compression. The same document also advises that all skilled birth attendants have access to technical training in administering uterotonics and other techniques such as intravenous infusions and tamponade balloons, and that every doctor who can perform laparotomy be provided with surgical training to perform 'simple conservative surgery' for PPH including compression sutures and sequential devascularisation [27].

In the UK, successive Confidential Enquiries into Maternal Deaths have linked the increased numbers of deaths from PPH to recent changes in medical training. Specifically, the reduction in the overall length of obstetric training and in working hours during training may have reduced the amount of experience gained compared with the experiences obtainable in the past. Moreover, these reports have shown a trend towards sub-specialization among consultants in the UK, and those with a special interest in obstetrics do not necessarily have highly developed surgical skills. These reports recommend regular 'fire drills' or 'skills drills' for the modern management of PPH for all grades of staff in every obstetric unit.

The 2004 and 2007 Confidential Enquiry into Maternal and Child Health (CEMACH) reports repeatedly highlight the role of inadequate clinical care, as well as poor communication and teamwork, within labour ward teams and suggest that as many as half of all maternal deaths might be prevented with better care [28, 29]. Following this line of thought, the 2011 CEMACH report recommended that all units should have protocols in place for the identification and management of PPH and that all clinicians responsible for the care of pregnant women, antenatal, postnatal, and intrapartum, including those practicing in the community, should carry out regular skills training for such scenarios [30]. The need for such a recommendation follows the 2007 survey among obstetric trainees in London that documented a reported decline in the numbers of individuals who could manage major PPH. 44.6% of respondents felt confident to perform a caesarean hysterectomy, whereas a similar number (41.7%) could apply a B-Lynch suture, and a much smaller number (27.1%) could dissect the ureter if need be. Additionally, a few respondents were less confident in performing any surgical procedure necessary in the management of major obstetric haemorrhage. This finding may have serious implications in the provision of out of hours senior cover for maternity units in the future (32).

The Scottish Confidential Audit of Severe Maternal Morbidity 2008 highlighted errors and substandard care in the management of women who have sustained PPH. It is essential that blood transfusion service and laboratory test results are obtained and not ignored. There should be teamwork and efficient equipment to comply with PPH management. Any deficiency could be improved with adequate and target training.

The UK Obstetric Surveillance System (UKOSS) publication [34] echoes the growing recognition articulated that prompt action is essential in managing PPH. Those who provide care should try to do so within the first 2 hours of the diagnosis and certainly not beyond a delay of 6 hours. Morbidity rises sharply after 2 hours, when it becomes much more likely that hysterectomy will be necessary.

3. Modalities of training: Hands-on training

Hands-on training is a simple method for an on-the-job facilitator who works with small numbers of participants to teach them certain procedural applications. The working concept is to prepare the trainee at a workstation to mimic the procedure or scenario, let them practice it, and then review their competency.

This model of training is suitable for teaching practical skills such as the application of bimanual compression of the uterus, the uterine brace suture, uterine tamponade, etc. However, because of the small number of participants, it is not suitable to teach communication skills.

4. Lecture-based training

PPH is one of the catastrophic events where proper management requires a variety of hospital workers with different unique expertise. It is often difficult to get all these people together to arrange a simulation or hands-on training, and lecture-based teaching may be more appropriate. All staff should attend, obstetric physicians, midwives, nurses, house staff, anaesthesia providers, scrub technicians, and unit secretaries participate in the same formal classroom instruction. The purpose is for all team members to hear the same material, to learn the same teamwork language and behaviours, and to feel empowered to flatten hierarchy. The participants from varying disciplines should be allowed ample opportunity for conversation and sharing of varying points of view. It is mandatory that the team should be able to understand each other's roles and competing interests that may not be self-evident.

5. Simulation

There are two types of simulators, those with high and low fidelities. The high fidelity type is often used to describe computer driven simulators, whereas the term low fidelity is used to describe simulators that are not computer controlled. High fidelity is desirable in simulation, because the more contextually accurate is the simulation-based instruction, the more likely the learning that takes place will transfer to the reality of applied practice. The disadvantages of this type of training include costs, the need to remove clinicians from clinical care, and a lack of realism compared with the clinicians' own experience [35, 36].

Simulation-based training is an appropriate proactive approach for reducing errors and risk in obstetrics, improving teamwork and communication, and giving students a multiplicity of transferable skills to improve their performances. The drivers for simulation include patient safety, limitation of current educational processes, shortening of the training period, high risk emergencies, and the pressure of health care agencies in an attempt to reduce malpractice concerns [37, 38, 39]. Haemorrhage drills and simulation-based training may help providers

achieve timely and coordinated responses [40]. Protocols may help to standardise management in cases of PPH, thereby minimizing unnecessary errors or delays in care [41].

Only a few models have been used for PPH training. Deering et al. used a standard obstetric birthing model equipped with an inflatable uterus to simulate uterine atony. The residents were assessed upon completion of this exercise. The authors found that the majority were unable to correct the haemorrhage within 5 minutes and half made at least one error, either in the dose or the route of administration of medications used to arrest the bleeding [41, 42].

Teamwork training in a simulation setting resulted in improvement of knowledge, practical skills, communication, and team performance in acute obstetric situations. Training in a simulation centre did not further improve outcome compared with training in a local hospital [40].

A simple low fidelity model has been used for the past few years by the authors. It is made of knitted wool and has an incision-like opening in the lower part to give the impression of a Paripartum uterus after the baby and the placenta have been expelled, along with the blood supply of the uterus and the ovaries. It is a useful tool to learn the placement of a B-Lynch or other type of compression suture and it also gives one the ability to practice a form of step-wise devascularisation.

6. Invaluable resources for PPH training

1. For PPH hands-on training and workshops, visit <http://www.pphinternationaltraining.org/>.
2. A short video demonstration of the B-Lynch suturing technique. This video is presented in real video format. There is a link provided to download, which is available at: <http://www.cblynch.co.uk/video-of-an-operation-demonstrating-the-b-lynch-suturing-technique/>.
3. Internet-based training. Visit The Global Library on Women's Medicine, launched November 2008 and is available at: www.glowm.com.
4. Poster of the B-Lynch suture technique to be displayed in the labour ward. This is available at: www.sapienspublishing.com/pph_pdf/PPH_Poster.pdf.
5. Pocket manual of the synopsis of PPH. A special leaflet or wall chart summarising the immediate action that needs to be taken when PPH occurs. www.sapienspublishing.com/pph_pdf/PPH-Guidelines.pdf.
6. A Comprehensive Textbook of Paripartum Haemorrhage, 1st edition, 2006, edited by B-Lynch (43). This first standalone textbook describes a comprehensive guide to evaluation, management, and surgical intervention for PPH. Available at: www.sapienspublishing.com and also from www.glowm.com.
7. PPH issue of Best Practice & Research Clinical Obstetrics & Gynaecology [44].

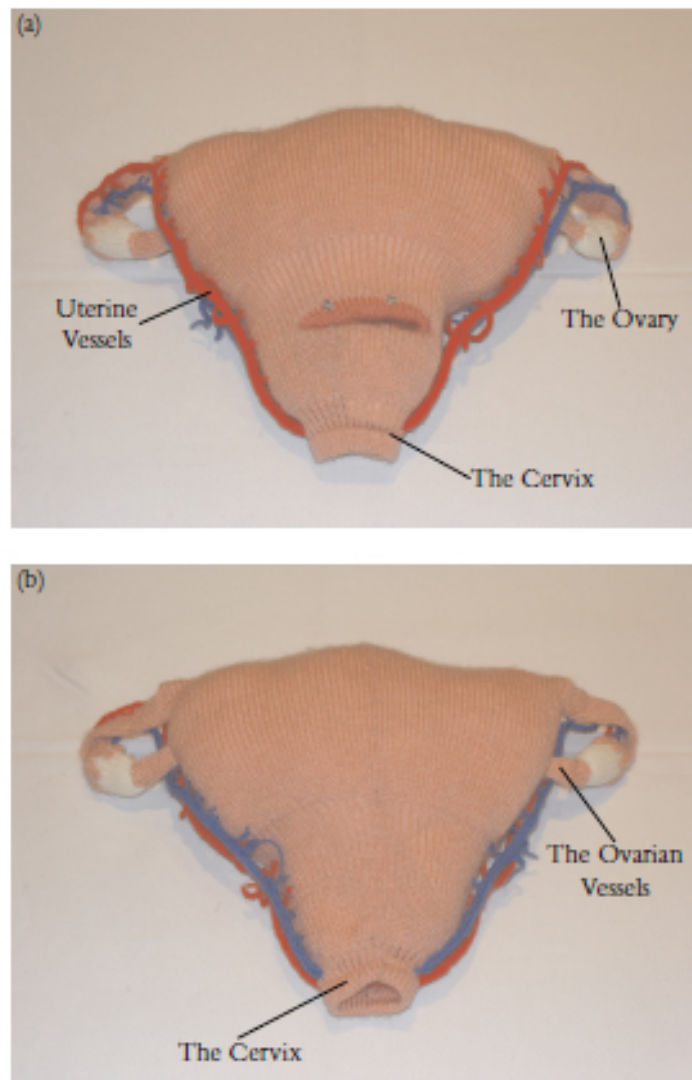


Figure 5. Uterine model (a) front view and (b) rear view.

7. Courses and workshops

A number of workshops that provide PPH training have been developed. These are available as either separate or part of other obstetric emergencies such as Advanced Life Support in Obstetrics (ALSO) [45], Maternal Obstetrics Emergency Trauma (MOET) [46] and Practical Obstetric Multi Professional Training (PROMPT) course [47]. The International Training and Workshop for the Management of Massive PPH Group was set up in 2009 in London with the objective to provide hands-on training and workshops in the management of PPH. The group is chaired by the senior author and includes experts who are renowned for their expertise in the management of PPH across the world.

The International Training Group has organized and run regular courses in Milton Keynes and South Wales, UK, all of which were very successful. Recently, the group has run a series

of study days and workshops in both Cairo and Alexandria with successful feedback response. It seems that this training program and workshop would be beneficial to other developing countries to reduce maternal mortality rate from PPH [48].

Simulators should be put together to give the candidate and trainees the confidence of feeling a real life situation.

Multiple training modalities are used to accomplish knowledge transfer for modern management of PPH. All are necessary, as it is clear that the traditional methods of reading or attending a lecture are insufficient to prepare the trainee for responsible action when it is needed in an emergency situation. Like many other skills in medicine, the training necessary to attend to a patient who has a life-threatening haemorrhage cannot be thought of as 'see one, do one, and teach one'.

8. Essentials for effective training

- Regular drills and skills training are essential in the management of PPH.
- Trainees should be allowed dedicated and protected time for training.
- Simulation of obstetric procedures and emergencies can only augment, not replace, the learning that occurs by caring for actual patients.
- In-house training is cheap and associated with improved outcomes.
- Funding should be available for training to reduce the cost of medical litigation as a result of substandard care.
- Team work is essential for proper coordination of the management.
- Above all, patients and their relatives must be kept fully informed at all stages of management.

9. Post-operative care

9.1. Intensive and high-dependency unit

Once the bleeding has been controlled and initial resuscitation has been completed, continuous close observations in either intensive care unit or high-dependency unit is required. The recording of the observation on an obstetric early-warning score system would help in the early identification of continuous bleeding, especially in cases that are not apparent, as recommended by CEMACH [2].

10. Debriefing

To avoid future complications and need of care, an action plan should be prepared for all subsequent pregnancy management.

11. Conclusion

B-Lynch suture has been the most effective and successful haemostatic compression suture to prevent maternal morbidity and mortality by controlling severe PPH and in reducing the need for hysterectomy. It is important that conservative methods such as bi-manual compression of the uterus, balloon tamponade, and, more recently, endometrial suction and selective arterial occlusion are carried out before hysterectomy is considered.

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