

Management of Postpartum Hemorrhage in Low Resource Settings

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INTRODUCTION

The global rate of maternal mortality is 260/100,000 live births, and approximately 500,000 mothers are lost annually as a result of pregnancy-related issues¹. Rates of death are disproportionately high in developing countries, where maternal mortality as high as 920/100,000 live births has been recorded in sub-Saharan Africa².

Overall, postpartum hemorrhage (PPH) affects 1–5% of all deliveries^{3,4}, and approximately 30% of maternal deaths are due to hemorrhage, mainly in the postpartum period. Most maternal deaths due to PPH occur in developing countries in settings (both hospital and community) where there are no birth attendants or where birth attendants lack the necessary skills or equipment to prevent and manage PPH and shock⁵. Under such circumstances, it is not surprising that almost 99% of maternal deaths occur in developing countries⁶, and 45% of postpartum deaths occur within 1 day of delivery⁷. The Millennium Development Goal of reducing maternal mortality by 75% by 2015⁸ will remain beyond our reach unless governments act in partnership with the obstetric community to confront the problem of PPH in the developing world as a priority.

Of deaths due to PPH, 90% occur in women who have none of the so-called classic risk factors, although some conditions do predispose to PPH. It is a preventable cause of death, as evidenced by the decline in hemorrhage-related mortality in the developed world. The maternal mortality rate (MMR) is 35-times lower in the developed world compared with that in developing countries (14 versus 400/100,000 live births)².

INDIAN SCENARIO

Rural India is representative of the scope and magnitude of the international problem, where 50% of births occur at home or in rudimentary facilities without a physician in attendance. The MMR in India currently is estimated at 254/100,000 live births with PPH being responsible for 30% of these deaths⁹. This figure mimics that cited above on a worldwide basis.

Although a blood loss of 500 ml of blood following vaginal delivery or 1000 ml following cesarean section

represents the standard and accepted definition of PPH, we propose that a more practical definition of PPH in terms of the developing world would be any blood loss that causes a physiological change (e.g. low blood pressure) that threatens the woman's life. Such a definition would also more accurately reflect the fact that anemic women in developing countries are far more susceptible to adverse outcomes as a result of smaller blood losses after delivery. Thus, the addition of 'a 10% drop in hemoglobin level' to the definition would provide an objective laboratory measure for health care providers who may not be able to assess accurately the true quantity of loss. However, such an addition would presume that even this simple test was available and, in reality, it is not.

PREDISPOSING FACTORS

It is very important to evaluate the following issues in the antenatal period, as they significantly affect a parturient's response to a given blood loss.

- (1) *Anemia* Iron-deficiency anemia affects 66–80% of the world's population¹¹. Anemia, in particular severe anemia, increases the risk of PPH-related maternal morbidity and mortality.
- (2) *Maternal depletion syndrome* This is an extremely important consideration in developing countries where mothers have diminished nutritional status due to early marriage and repeated pregnancies^{12,13}.
- (3) *Obstetric conditions* Mothers with pre-eclampsia, multiple pregnancies, retained placenta, abruptio placentae, placenta previa, operative vaginal delivery, prolonged labor, pyrexia in labor, etc. are more prone to PPH.
- (4) *Medical infrastructure* In developing countries, significant numbers of deliveries occur in the home or rudimentary health centers, often with minimally skilled birth attendants¹⁴. This is despite the fact that a critical component of safe delivery practice is to have a competent health worker with at least midwifery skills present at every birth along with plans that provide transport to a referral facility should this be necessary^{1,14}.

ADEQUACY OF THE DELIVERY SETTING

Countries can be classified in terms of the resources available at the time of delivery.

Low resource settings

Low resource settings are locations where significant numbers of deliveries occur in the home or in rudimentary health centers, often in the presence of minimally skilled birth attendants. Examples of such settings include the developing countries of sub-Saharan Africa such as Nigeria, Senegal and Uganda, while countries in southern Asian are exemplified by India, Bangladesh, Pakistan and Nepal.

High resource settings

High resource settings are locations where most deliveries are conducted in a well-equipped hospital with trained medical and paramedical staff, adequate medications, equipment and space, and facilities to transfer a patient to a center with more complex technology and techniques, as well as a 24-hour power supply and refrigeration facility.

PRINCIPLES OF MANAGEMENT

The principles of management of PPH are outlined below.

- (1) Quick and efficient management is extremely important, as a recent Egyptian study showed that 88% of deaths occur in the first 4 hours after onset of PPH¹⁵. Other data from WHO note that if left untreated, the parturient can die within 2 hours.

Table 1 Estimation of blood loss

Methods/materials used	Estimated blood loss (ml)
Small 10 × 10 cm 32-ply swab (max saturated capacity)	60
Medium 30 × 30 cm 12-ply swab (max saturated capacity)	140
Large 45 × 45 cm 12-ply swab (max saturated capacity)	350
1 kg soaked swabs	1000
Kidney dish full of clots	500
50 cm diameter floor spill	500
75 cm diameter floor spill	1000
100 cm diameter floor spill	1500
Vaginal PPH limited to bed only	< 1000
Vaginal PPH spilling over from bed to floor	> 1000

Table 2 Drugs used in the management of postpartum hemorrhage

Drugs	Route of administration	Availability of hospital facility/ skilled staff	Storage	Cost in India
Oxytocin	IV/IM	Skilled staff needed	Refrigeration preferable	Rs 22/amp
Prostodin	IM	Skilled staff needed	Refrigeration needed	Rs 98.42/amp (250 µg)
Methergin	IM/IV	Skilled staff needed	Refrigeration needed	Rs 30.20/amp (0.2 mg)
Misoprostol	Oral/sublingual/PV/PR	Basic skilled person enough	Refrigeration not needed	Rs 72/800 µg

Rs, rupees

- (2) Quick assessment of the patient's condition must be made, as well as a decision as to whether she can be treated locally or must be transferred to higher level facility as quickly as possible after initial resuscitation.
- (3) Arrangement of adequate manpower is mandatory, as treatment of PPH cannot under any circumstances be considered a one-person show.
- (4) Arrangement for adequate fluid replacement and blood products when necessary is a crucial part of the initial resuscitation plan.
- (5) Correct estimation of blood loss is essential. In most instances, estimation of blood loss is accomplished visually despite the fact that numerous studies show that this method is up to 50% less accurate than other methods¹⁶⁻¹⁸. Early and accurate estimation of blood loss is crucial because replacement is so often required. The estimation of blood loss from a cesarean section is generally more accurate than after vaginal delivery, because during vaginal delivery blood is generally mixed with amniotic fluid. Estimation is enhanced using the methods outlined in Table 1 after letting the amniotic fluid drain out as much as possible¹⁹. Details regarding the use of a drape under the parturient's buttocks to facilitate blood collection are presented in Chapter 11.

Medical management

Table 2 lists the drugs used in the management of PPH.

Misoprostol

In developing countries available medical facilities are often erratic or non-existent. The most important basic facilities required for safe delivery include staff with appropriate training, around the clock availability of the same, and the presence of a 24-hour electricity supply and refrigeration for the maintenance of uterotonics. It is this latter requirement that has turned the attention of many caregivers in the developing world to misoprostol. This medication requires no refrigeration, is inexpensive and can be administered by individuals with little or no professional training (see Chapter 42).

Analysis of the cost of misoprostol use in developing countries should not be limited to the cost of the tablets. Costs of misoprostol treatment, trained birth

attendant (TBA) training, hospital referrals, hospitalization, IV fluids and blood transfusions should be borne in mind. (These data can be derived from the literature and from field data.) Examples of cost models are shown below.

Cost model for misoprostol arm

TBA training cost + TBA time cost + drug cost + cost of side-effects + cost of transport + cost of hospitalization + cost of treatment for PPH

Cost model for standard care arm

Cost of transport + cost of hospitalization + cost of treatment for PPH

Different studies show that more than 80 TBAs are needed to attend 10,000 deliveries and the cost of a 5-day training per TBA including teachers and materials is US dollars 10.05 (Table 3). On average a home delivery costs US dollars 2, while 1000 µg misoprostol costs US dollars 2.75. Cost of hospital stay is US dollars 27.60 per day, patient transportation to a higher referral center is US dollars 5.31 and hydration of a patient is US dollars 4.48. Blood transfusions are generally very expensive and can cost as much as US dollars 63.87. Table 3 shows that the implementation of a comprehensive misoprostol strategy would save US dollars 115,336 per 10,000 births in transport, hospital fees, IV therapy and blood transfusions (range US dollars 13,991–1,563,593 per 10,000 births)²⁷.

Table 3 Estimation of cost-effectiveness of misoprostol

Parameter	Quantity/cost (US dollars)	References
Number of TBA needed to attend 10,000 deliveries	83	20, 21
Cost of 1 home delivery	\$2	22
Cost of 5 day training per TBA, teachers and materials	\$10.05	21, 23
Cost of 1000 µg misoprostol	\$2.75	24, 25
Cost of hospital bed/day	\$27.60	—
Cost of transportation to hospital	\$5.31	—
Cost of IV fluids/IV cannula	\$4.48	—
Cost of blood transfusion	\$63.87	21, 26

TBA, trained birth assistants

A joint statement of the International Confederation of Midwives (ICM) and the International Federation of Gynecology and Obstetrics (FIGO), and a 2007 WHO recommendation for the prevention of PPH advocate the use of misoprostol in situations where no oxytocin is available or the birth attendant's skills are limited. Therefore, misoprostol can play an important part in the strategy to reduce PPH in countries where most births occur in the home (see Chapter 42).

Surgical management

As mentioned previously, and noted in several other chapters of this book, the majority of deaths due to PPH occur in the first few hours after the onset of bleeding. It is also true that most bleeding is due to atony which responds to medical management in most instances. However, medical management alone is not always effective and often must be supported by surgical interventions, some of which can be applied in settings which are not fully equipped for abdominal interventions. Of these more simple techniques, tamponades can be effective because they apply pressure at the site of the placental detachment. Commonly used materials for uterine tamponade and described in other chapters of this book are variable length ribbon gauze, condom catheter, Foley catheter, Sengstaken–Blackmore tube, Bakri balloon, etc. Of these, the use of ribbon gauze, condom catheters and Foley catheters are low cost and very effective in low resource settings. In contrast, the Bakri balloon and Sengstaken–Blakemore tube are expensive and not widely available or affordable in developing countries (Table 4). At the other end of the spectrum, major surgical procedures such as internal iliac artery ligation (see Chapter 52), systemic devascularization or obstetric hysterectomies are not only very expensive, but also accompanied by increases in secondary costs due to prolonged hospital stay. Their widespread application is also hampered by the lack of expertise in performing the operations. Uterine artery embolization (see Chapter 49) can also be an effective procedure, but again it is expensive and needs expert radiology facilities.

Table 4 Cost of surgical equipment and procedures

Method	Material/facility needed	Provider of treatment	Cost in India
Ribbon gauze	Can be done in minor OT	Medical officer	Low cost
Condom catheter	Widely available	Medical officer	Low cost
Foley catheter	Widely available	Medical officer	Rs 95
Bakri balloon	Not widely available	Medical officer	Rs 11,000
Sengstaken–Blakemore tube	Not widely available	Experienced person	Expensive
B-Lynch suture	Major OT set-up	Medical officer	Moderate cost
Uterine artery ligation	Major OT set-up	Medical officer	Moderate cost
Ovarian artery ligation	Major OT set-up	Medical officer	Moderate cost
Internal iliac ligation	Major OT set-up	Experienced person	Expensive
Obstetric hysterectomy	Relatively good hospital set-up	Experienced person	Expensive
Uterine artery embolization	Good hospital set-up with radiology facility in OT	Experienced person	Expensive

OT, operating theater; Rs, rupees

HEALTH CARE INFRASTRUCTURE IN RURAL INDIA

The Indian health care industry (used here as a model of the events occurring in other developing nations) is seen to be growing at a rapid pace and is expected to become a US dollars 280 billion industry by 2020²⁸. Even so, the vast majority of the country suffers from a poor standard of health care infrastructure, which has not kept up with the growing economy. Despite having centers of excellence in health care delivery, the numbers of such facilities are limited and they are inadequate in meeting the current health care demands. From a practical point of view, it is important to recognize that 40% of primary health centers in India are understaffed. India also faces a huge needs gap in terms of availability of number of hospital beds per 1000 population. With a world average of 3.96 hospital beds per 1000 population, India has a long way to go to bring its present statistic of 0.7 hospital beds per 1000 population to a more reasonable level.

Types of facilities

Three broad categories of facilities are generally available in developing nations: public, private and traditional. The official Indian policy on public facilities requires that there should be one subcenter, or sometimes an aid-post, staffed by one trained nurse (ANM), for every 3000 individuals. These subcenters provide the first point of care, while the primary health centers or community health centers are the next step, leaving the referral hospitals to deal with the most serious health problems. A primary health center serves 20,000–30,000 individuals and has on average five or six medical personnel appointed, including at least one doctor.

Private facilities include a wide variety of options ranging from facilities run by people who have completed their medical training and have additional post-graduate medical degrees, to traditional birth attendants (Daima's) and pharmacists who in most cases have no formal medical training whatsoever. The degree to which such facilities come under the oversight of any governmental or academic authority is minimal and the quality of care provided varies enormously.

The problem of health care

Delivery of high-quality social services to the poor is never easy, and several factors make it especially difficult. The decision about when and where to seek health care often has very little to do with the nature of the medical condition itself. It often relates to what is available close to a person when help is needed, but it could just as well reflect how the person is feeling about life in general and health in particular. These considerations aside, obtaining health care at any facility depends on a combination of one or more of the following factors: availability or non-availability of doctors at primary health centers; inadequate physical infrastructure and facilities; insufficient quantities of drugs; lack of accountability to the public and lack of

community participation; and lack of set standards for monitoring quality care, etc.

STRATEGIES TO PREVENT MATERNAL MORTALITY FROM POSTPARTUM HEMORRHAGE IN LOW RESOURCE SETTINGS

It is important to build strategies to manage preventable causes of maternal death in low resource settings.

Short-term strategies

Prevention where there is a skilled provider

When women give birth with a skilled provider at home or in a hospital facility, up to two-thirds of PPH can be prevented using safe, low-cost, evidence-based practices. Advantages to this set-up are:

- (1) Skilled health care providers are able to diagnose the risk factors early and accurately;
- (2) Blood loss can be estimated during delivery;
- (3) Active management of the third stage of labor (AMTSL) can be provided to all patients in addition to less expensive uterotonics (misoprostol);
- (4) Cell phone calls to a more experienced health care provider can be made for advice regarding onsite management or early referral to an institution or center with more advanced therapeutic capabilities.

Prevention where there is no skilled provider

About 66% of births in the least developed countries occur in the home without skilled providers to perform AMTSL. In these low resource settings, use of misoprostol can be a life-saving intervention as it is inexpensive, readily available without refrigeration, can be taken orally without supervision of a medical provider, and provides significant reduction in blood loss from acute PPH and acute severe PPH (see Chapters 13–15)

Community-based emergency care or home-based life-saving skills (HBLSS) can be used in settings where there is no skilled provider. Anyone who attends a delivery can be taught simple home-based life-saving skills.

Community-based obstetric first aid with HBLSS is a family and community focused program that aims to increase access to basic life-saving measures and decrease delays in reaching referral facilities. Family and community members are taught techniques such as uterine fundal massage and emergency preparedness. Field tests suggest that HBLSS can be a useful adjunct in a comprehensive PPH prevention and treatment program³⁰. Key to the effectiveness of treatment is the early identification of hemorrhage and prompt initiation of treatment.

Long-term strategies

For long-term efficacy, community involvement and development of political will is important. Aspects of such programs include:

- (1) *Education of women* Patients in low resource settings generally have a low socioeconomic status. Many are illiterate or have minimal education. Despite this fact, programs that strive to improve pregnancy related morbidity and mortality must include some discussions related to female health education and PPH. Premarital and periconceptional counseling play a vital role in decreasing pregnancy related complications as well as PPH. Girls and young women should be educated regarding the ideal age at marriage, proper spacing of children and correction of anemia before pregnancy or during the antenatal period well before delivery.
- (2) *Awareness* The level of awareness regarding the diagnosis and treatment of PPH must increase among health care workers at all levels, and information must be provided to both male and female health workers as well as health assistants and other paramedic staff. Sometimes, involvement of social workers and/or respected personalities from a given locality may help to increase awareness levels.
- (3) *Involvement of specialty in district level* Generally almost all of the facilities required for management of PPH are available at the district level. District health officials should make leaflets for attending mothers in the antenatal clinic about the dangers of PPH, correction of anemia, improving nutrition, etc. There should be regular seminars and continuing medical education programs with emphasis on PPH. There should be regular and repeated PPH drills (see Chapter 36) especially involving junior doctors.
- (4) *Availability of tertiary care institution* Excellent co-ordination of different departments, experienced doctors, paramedic staff and relevant facilities is the most important treatment component that is available on a 24-hour basis in a tertiary care unit. Any delay in starting treatment in patients referred from a lower level should be avoided.
- (5) *Transport/infrastructure* Treatment of PPH and its sequelae demand very rapid action or intervention. Because so many rural communities are truly isolated, not only in India, but also in other developing countries, the most basic arrangements must be thought of in advance. The use of a cell phone method of triage and referral for local transportation has proved useful in many areas of the world where there is no access to ambulances or a 24-hour flying squad with experienced medical and paramedic personnel with basic life-saving support. The use of the NSAG (Chapter 39) is very helpful when the need arises to transport a patient.
- (6) *Involvement of government* Strong political will and strengthening health policy for mothers are very important. At the minimum, governments in developing countries should increase health expenditure, strengthen health policies for mothers along with the health infrastructure, increase health awareness, improve the armamentarium of drugs and equipment, and train birth attendants and people in the community with HBLSS.
- (7) *Involvement of non-governmental organizations (NGOs)* Involvement of NGOs is very important when governments fail to take the necessary steps, especially in remote areas of the country. Their roles are to help provide necessary funds for increasing health awareness, training birth attendants and training for HBLSS.
- (8) *Involvement of professional societies* Local professional bodies such as the obstetrics and gynecological society or national bodies like the Federation of Obstetric and Gynaecological Societies of India (FOGSI) also can take a very important role in decreasing maternal mortality from PPH. Some of their functions include arranging continuing medical education and seminars on PPH throughout the country, performing medical audits, determining the cost-effectiveness of various training programs and assisting the government to determine whether progress is being made towards decreasing mortality from PPH.
- (9) *Involvement of international bodies* Organizations such as WHO, FIGO and ICM can play an important role by improving access to knowledge and guidance, providing support, and advocating/facilitating more investment in management and development.
- (10) *Emergency obstetric care (EmOC)* The International Conference on Population and Development³¹ led the way to an increased understanding of the pathways to avert maternal deaths and disabilities as well as providing strategies to achieve the most favorable results. Although the provision of EmOC is generally accepted as the corner stone of any successful approach to reduce maternal deaths and disabilities, its integration into existing health services and monitoring of its use remain a challenge to existing health systems in developing countries.
The United Nations process indicators describe the vital elements and performance of health systems for women with obstetric complications³¹. EmOC is one of the three-pronged strategies, taken by United Nations Family Planning Association (UNFPA) in the millennium development goals at the Millennium Summit 2000 to reduce maternal mortality, the other two being family planning and skilled attendance at every birth. EmOC refers to a series of functions performed in health care facilities that can prevent the death of a woman experiencing complications of pregnancy. Used properly and in a timely fashion, it can go a long way to averting death from PPH.
To be qualified as a *basic EmOC* center, the health care provider should be able to administer

intravenous or intramuscular antibiotics, uterotonics and anticonvulsants. Staff should be able to perform manual removal of placenta, assisted vaginal delivery and removal of retained products of conception. Well-trained nurses and midwives can perform most functions at basic EmOC facilities, and most, if not all, of the requirements can be accomplished in the absence of an operating theater.

Comprehensive EmOC refers to the ability to perform a more complex surgical intervention such as cesarean section to relieve obstructed labor and the ability safely to collect, screen and store blood. In general qualified medical personnel and paramedic staff are required to perform the functions of a comprehensive EmOC facility, as is an operating theater.

CONCLUSION

Considering the magnitude of the problem and the fact that PPH is literally a 'serial killer' responsible for the deaths of thousands of women per year, cost-effective means to combat the problem are of particular importance to developing nations.

These same considerations mean that information directed only towards the medical fraternity and health workers will never be sufficient. A combined effort involving society organizations, NGOs and doctors to create awareness and training will go much further in reducing preventable maternal mortality and preventing the disruption of family fabric.

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