International Journal of Reproduction, Contraception, Obstetrics and Gynecology
Bhardwaj S et al. Int J Reprod Contracept Obstet Gynecol. 2019 Mar;8(3):1062-1069
www.ijrcog.org

pISSN 2320-1770 | eISSN 2320-1789

DOI: http://dx.doi.org/10.18203/2320-1770.ijrcog20190880

Original Research Article

Training of maternal health care providers in newer modalities of management of post-partum haemorrhage

Samita Bhardwaj[1]*, Sonal Raut[2], Vidyadhar B. Bangal[3]

[1]IMHI, Jiv Daya Foundation, Mumbai, India
[2]IMHI, Jiv Daya Foundation, Dallas, USA
[3]Department of Obstetrics and Gynecology, Rural Medical College, Loni, Maharashtra, India

Received: 10 December 2018
Accepted: 07 January 2019

***Correspondence:**
Dr. Samita Bhardwaj,
E-mail: sbhardwaj@jivdayafound.org

ABSTRACT

Background: Postpartum haemorrhage (PPH) is a life-threatening complication, that occurs suddenly and unexpectedly. Institutional delivery by skilled birth attendant who are trained in active management of third stage of labour and those who can use of Uterine Balloon Tamponade and Non-pneumatic anti shock garment can reduce incidence and morbidity related to PPH. The objective of the paper was to share the experiences of the training programmes held for maternal health care workers in the newer modalities of PPH management.
Methods: During one and a half year period, 32 Continuation of Medical Education (CME) programmes, with the theme of "Managing Obstetric Emergencies and Obstetric Trauma", covering important topics related to high risk pregnancies like Hypertension, Eclampsia ,Anaemia and Haemorrhage at 32 health institutions, spread over 11 states and 2 union territories in India, were conducted .In addition,42 hands on workshops at various health facilities were conducted with training of more than 2575 maternal health care providers.
Results: The pre and post test scores revealed that 95 percent of the maternal health care providers were unaware about the use of Uterine Balloon Tamponade (Bakri balloon) in PPH and Non-pneumatic anti shock garment (NASG). Seventy percent were unaware about the proper sequence of steps of active management of third stage of labour. Training programmes helped to improve the knowledge, whereas hands on workshop, helped in skill development of the health care providers. The participants expressed great satisfaction regarding the knowledge and skills they acquired through training programme on management of post-partum haemorrhage. They gave positive feedback about the quality, contents and conduct of training programme.
Conclusions: There is need for refresher training of maternal health care providers in newer modalities like AMTSL, NASG and Bakri balloon, which have potential to save lives.

Keywords: Active management of third stage of labour, Bakri Balloon therapy, Emergency obstetric care, Maternal mortality, Non-pneumatic anti shock garment, Post-Partum haemorrhage

INTRODUCTION

Postpartum haemorrhage (PPH) is a life-threatening complication that occurs suddenly and unexpectedly. It has been identified as the most commonly reported complication and the leading cause of maternal deaths (29.6%).[1] In developing countries, approximately 3 to 4 million women die following complications of pregnancy and childbirth.[2] Worldwide, for every 100,000 live births, about 216 women die while in India,130 women die per 100,000 live births. In industrialized countries, 10-13 maternal deaths occur for every 100,000 live births. In America, women have a lifetime risk of 1 in 2,100 of dying from pregnancy related complications, whereas in

Afghanistan up to 1,600 women die for every 100,000 live births and women have a 1 in 11 lifetime risk of maternal death.[3] For every woman who dies, there are 30 women who suffer maternal morbidity and 10 who experience a life-threatening obstetric complication.[4] PPH is defined as blood loss ≥500 ml within 24 h after birth, while severe PPH is blood loss ≥1000 ml within 24 h.[5] The incidence of PPH from India had been reported to be 2%–4% for vaginal deliveries and 6% for caesarean sections, with uterine atony being the main cause in almost 50% of the cases.[6] Once bleeding starts, death can occur in around 2 hours, which leaves a little time for safe referral and effective care, unless available immediately.[7] Around 140,000 deaths, equating to 1 every 4 min, happen as a result of this complication globally.[8,9] Childbirth related morbidities can be serious, which compromise a woman's health, productivity, quality of life, family health and ability to participate in community life. If a mother dies after childbirth, the newborn is ten times more likely to die before the age of two, other children are more likely to suffer from decreased nutrition and decreased schooling. Many motherless families find it difficult to survive, often with older children having to drop out of school in order to work to help support the family or being sent to live with a relative's intact family.[10]

The non-pneumatic anti-shock garment (NASG) is a first-aid device that can save lives of women experiencing obstetric haemorrhage from any aetiology.[11] The NASG is a simple neoprene and Velcro device that looks like the bottom half of a wetsuit cut into segments. The use of the NASG reportedly addresses the immediate life-threatening complication by reversing hypovolemic shock among mothers having shock due to PPH and returns blood to the heart, lungs, and brain by applying pressure to the lower body and abdomen.[12] The use of an NASG can stabilize a patient while awaiting transport, during transport, or during delays in receiving care at referral facilities.[13-15] Institutional delivery by skilled birth attendant, trained in Active management of third stage of labour (AMTSL), use of uterine balloon tamponade and Non-pneumatic anti shock garment (NASG), which are newer modalities in PPH management, can greatly reduce the incidence of PPH and will save mothers from development of life-threatening complications. There is need of sensitization and training of health workers, nurses and doctors in the newer modalities of labour and PPH management. The objective of the study was to present the outcome and experiences of the training programmes conducted by Jiv Daya Foundation in managing Obstetric emergencies and Obstetric trauma at various institutions in India.

METHODS

Jiv Daya Foundation

Jiv Daya Foundation (JDF) is an international health agency working since year 2002 with the mission of improving the quality of life of people around the world. As one of the important activities, maternal health improvement programme is being carried out through its India maternal health initiative (IMHI). Jiv Daya's approach involves building sustainable partnerships and strengthening existing infrastructure for medical institutions in India. Since April 2017, JDF has conducted 29 capacity building workshops at tertiary care medical colleges and hospitals in India. It has prioritized its activities with the objective of reducing maternal mortality. The areas for intervention have been identified, that include hypertension during pregnancy, eclampsia and moderate to severe anaemia during pregnancy and postpartum haemorrhage. In order to reduce the morbidity associated with these complications, JDF provides in kind support to government institutions, in the form supply of drugs, equipment's ,Bakri ballon and NASG.

JDF provides support to medical institutes having high volume work, with the objectives to impart knowledge on newer techniques and modalities of managing obstetrics emergencies and trauma (MOET) for the benefit of peripheral medical officers from referring district. JDF has collaborated with the tertiary centers , Local FOGSI chapters , state government officials for maximizing the participation of doctors and health care workers from the peripheral centers. JDF along with the medical colleges have trained over 2500 doctors, PG students, Medical officers, Nurses and paramedical staff from its partner hospitals in India.

NASG

The Non- pneumatic Anti-Shock Garment (NASG) is a unique, Life -saving first -aid device made of neoprene and Velcro, which is used on women with obstetric hemorrhage. It can be applied by anyone, even those without medical training. The NASG has a unique role in hemorrhage and shock management because it is meant to be used with, not instead of, other technologies. Currently, it is the only tool that aids in stabilizing pulse and blood pressure after a woman has gone into shock from obstetric hemorrhage. NASG can reverse shock and can be used at the same time with other hemorrhage and shock treatments, such as: Uterine massage, Uterotonics, Blood transfusions, Vaginal procedures and surgery ,Uterine balloon tamponade.

Bakri balloon

The Bakri Balloon is a medical device invented and manufactured by Cook Medical.[16,17] The obstetrical balloon is a 24 French, 54 cm-long, silicone catheter with a filling capacity of 500ml. The device is used for the temporary control and reduction of postpartum hemorrhage for women not responding to uterotonics and uterine massage. It can be used following vaginal or caesarean delivery. Procedure includes rapid instillation components to facilitate inflation of the balloon. It is

constructed of latex-free silicone and includes a 60ml syringe, a dual check valve, and 180cm of tubing with attached bag spike. The contraindications for its use are arterial bleeding requiring surgical exploration or angiographic embolization, cases indicating hysterectomy, pregnancy, cervical cancer, purulent infections in the vagina, cervix, or uterus, untreated uterine anomaly ,disseminated intravascular coagulation ,a surgical site that would prohibit the device from effectively controlling bleeding.

Training programmes for maternal health care providers like doctors, gynecologists, nurses and paramedics, were organized by Jiv Daya Foundation, an international non-governmental organization (NGO) located at Dallas-USA, and Pravara Institute of Medical Sciences, deemed to be university from Loni, Maharashtra ,India ,who are working in the field of maternal health. During one and a half year period, 29 Continuation of Medical Education(CME) programmes, with the theme of "Managing Obstetric Emergencies and Obstetric Trauma", covering important topics related to high risk pregnancies like Hypertension, Eclampsia ,Anaemia and Haemorrhage at 32 health institutions, spread over 11 states and 2 union territories in India, were conducted .In addition,42 hands on workshops at various health facilities were conducted in 1.5 years' time period with training of more than 2575 maternal health care providers.

One day training programme included orientation and training of maternal health service providers on the identification of PPH cases and usage of the NASG garment during referrals. Two separate training curricula were developed; one for clinical practitioners and the other for staff nurses and ANMs working at the primary health-care facilities. The training curriculum aimed to develop skills of health care providers on diagnosis and management of PPH and the use of NASG garment during referral. The training of both clinical and paramedical staff was conducted at the facilities using demonstrations and by providing hands-on experience. In addition to didactic lectures, short video films were shown on principles of AMTSL, use of Bakri balloon and NASG. This was followed up by hands on training on the use of these modalities. Pre-test and post tests were conducted to assess change in knowledge following training programme. Feedback was obtained from participants regarding conduct and usefulness of training programme.

RESULTS

During one and half year period, total of 2575 maternal health care workers of different cadres were trained in batches by master trainers.The master trainers were senior gynaecologists from medical institutes all over India. Maternal health consultants appointed by Jiv Daya foundation also worked as resource persons.The Technical experts from "Intermedics medical instrument company" provided manikins and training material for conducting hands on workshops on Bakri balloon.The participants of the training programme were mainly specialist doctors, general practitioners, nurses, health workers that include health supervisors and ASHA workers. The participants were representing public hospitals, private sector hospitals, charitable hospitals. There was very good response for attending the training from all cadres of the participants. They were all very enthusiastic as they were interested in learning newer modalities in the management of post-partum haemorrhage (Table 1).

Table 1: Number and type of participants in training.

Type of participant	No.	%
Gynaecologist	1054	40.93
Postgraduate students in obstetrics and gynecology	383	14.88
General practitioners/primary physicians	656	25.35
Staff nurses/maternity hospital staff	156	06.16
Village health workers	326	12.68
Total	2575	100

The pre and post test results of training participants revealed that 95% of the maternal health care providers were unaware about Uterine balloon tamponade (Bakri balloon) and Non-pneumatic anti shock garment (NASG) and 75% were unaware about the steps of active management of third stage of labour (AMTSL),as recommended by World health organization. The test scores of specialist doctors were higher than medical practitioners. Training programmes helped to improve the knowledge, whereas hands on workshop, helped in improving the skills of the health care providers about AMTSL and in use of Bakri balloon and NASG (Table 2).

Table 2: Results of pre and post-test to assess knowledge about newer modalities PPH management among participants.

Type of Newer modality	Pre-test (n-2249)	Post test (n-2249)
Components of AMTSL	32.60%	98.40%
Bakri balloon tamponade	20.85%	96.76%
Non-pneumatic anti shock garment	4.60%	95.40%

The participant feedback was very encouraging, Large majority of participants gave positive feedback regarding the relevance of the topic chosen for training. The participants gave favourable feedback regarding training contents, training methods adopted, time management for individual topic. There was very good response and the feedback from the participants regarding hands on training on newer modalities as they were never been exposed to such systematic training programme in the past. The participants expressed great satisfaction regarding the knowledge and skills they acquired through

training programme on management of post-partum haemorrhage. Participants found both modalities as simple to use and suggested that these modalities should be made available at all health facilities (Table 3).

Table 3: Feedback of participants about the training programme and workshop.

Parameter	Average score (n=2575)
Relevance of the topic	4.8
Training material	4.0
Training contents	4.6
Training methods	4.8
Presentation by resource persons	4.3
Group work on PPH management	3.6
Hands on training on newer modalities	4.6
Time allotment	4.0
Time management	4.9
Venue and arrangements	4.0
Average score	4.3

Feedback score (1-Unsatisfactory, 2- Satisfactory , 3-Good , 4-Very Good , 5-Excellent)

DISCUSSION

Postpartum haemorrhage is the leading cause of maternal mortality in India. There are multiple factors responsible for the high mortality. In addition to non-recognition of high-risk pregnancies and timely referrals, the delays at all levels contribute in causation of maternal deaths. Three types of delays have been identified, which contribute to death in PPH. Delay in decision making by patient and relatives regarding seeking institutional care and delay in transport of PPH cases to appropriate health care facility are main causes of delays. At times there is delay in providing care at the health facility level either due to lack of doctors or the drugs, blood products, Oxytocic's and equipment's at the health care facility. Time lapse between occurrence of PPH and reaching to tertiary care facilities determines the outcome. Unfortunately, there is very narrow margin of safety as regards to time. Treatment received in first two hours, following PPH determines the survival. Institutional deliveries and facility preparedness to tackle this complication help in saving life of young women. In order to avoid type three delay, facility preparedness to deal with postpartum haemorrhage is very crucial.

A woman suffering from postpartum haemorrhage can die within two hours unless she receives immediate and prompt medical care; therefore, when delay in managing postpartum haemorrhage occurs, first aid is needed to resuscitate and stabilize women with hypovolemic shock until definitive treatment is obtained.[18-20] One way this problem can be addressed is with the use of a lightweight, cost-efficient compression garment, the non-pneumatic anti-shock garment (NASG), which stabilizes women who have lost excessive blood, allowing them to survive delays in travelling to or receiving care at CEmOC facilities. NASG is mainly useful to stabilize a patient while evaluating, transporting, and preparing for definitive surgical treatment .A woman can safely and comfortably wear the NASG for up to 48 hours. The NASG remains on the woman during treatments and until she has been hemo-dynamically stable for 2 hours. NASG has 6 segments. Segment 1, 2, and 3 (in pairs) are placed around the patient's legs, Segments 4, 5, and 6 are placed around pelvis and abdomen, A ball in segment 5 and segment 6 is placed over the woman's umbilicus , adding more pressure. Segment 6 is closed over segment 5. Indications for the use of NASG are -to manage any condition, where there is severe bleeding below the diaphragm ,all forms of obstetric hemorrhage (in excess of 750 ml) like in ectopic pregnancy, abruption, acute or chronic, placenta praevia, ruptured uterus, hydatidiform mole, spontaneous abortion. After delivery NASG is used in uterine atony, retained products of conception, obstetrical trauma. The contraindications for the use of NASG are -A viable fetus (unless there is no other way to save the mother's life and both mother and fetus will die), bleeding above diaphragm, open thoracic wounds ,patients with severe congestive heart failure or pre-existing mitral stenosis. In trauma victims with injury to the chest or head, redistribution of blood to the injured area with NASG placement raises the possibility of associated increased hemorrhage.

Until now, there have been questions if NASGs can be implemented effectively in rural areas. This first aid device buys valuable time, to enable transfer from rural and lower level facilities, and during the often-long delays for blood transfusions or surgeries that can occur, even in tertiary and university teaching hospitals. In the present study, due to non-availability of NASG in Public health system, majority of doctors and nurses (more than 95%) had not even seen or heard about NASG. Very few gynecologists (10%) had heard about it but had not seen or used it in clinical practice. In a study published from UCH, Ibadan, awareness about the existence of anti-shock garment was high among midwives as 96% of the respondents said they have heard about it through seminars, conferences and other means. Many of them could describe NASG application, removal and its general function in the prevention of post-partum haemorrhage. Majority of them could correctly explain various advantage of NASG as well as some maternal and fetal conditions that are contraindicated in the use of NASG. It shows that many of them have been exposed to the use of anti-shock garment through workshops, conferences and seminars. However, this seems to be the limit of their knowledge; many of them have never applied it on bleeding woman. Their knowledge seems to be only theoretical as only 35% of them have had opportunities to apply NASG; the rest 65% had never applied it on clients. The purpose of the study therefore, is to determine the midwives' knowledge on utilization of anti-shock garment in the prevention of postpartum haemorrhage shock in the University College Hospital,

Ibadan Nigeria. Through incidental and purposive sampling methods, 110 respondents were selected for the study. Data collection was carried out with self-developed structured questionnaire. However, only 100 returned a fully completed questionnaire. Ages of the respondents ranged from 20 to 59 with a mean 31 ± 2.6 and 100% of the midwives are females. The respondents' years of experience as midwives ranged from 1 to 27 with a mean 13 ± 5.9. Respondents held different views on the number of emergency cases of post-partum haemorrhage referred weekly to UCH, Ibadan from other hospitals. The results revealed that 7% of them had no idea of the number, 46% said it is 10-20, 34% believed it is 21-30 while 13% believed it is >30. Awareness about the existence of non-pneumatic anti-shock garment (NASG) was high among the respondents as 96% of them said they have heard about it through various sources ranging from seminars and conferences (60%), textbook (16%), journals (11%), internet (7%) and electronic media (2%). As much as 76% of them could describe NASG application, removal and its general function in the prevention of post-partum haemorrhage. Similarly, majority (74%) could correctly explain various advantage of NASG as well as some maternal and fetal conditions that are contraindicated in the use of NASG. However, their knowledge seems to be only theoretical as only 35% of them have had opportunities to apply NASG; the rest 65% had never applied it on clients. Because the respondents have never had opportunity to apply NASG on bleeding woman, their theoretical knowledge is of little use.[18-20] The researchers have compared the morbidity and mortality outcomes using the NASG to outcomes with standard treatment of shock/haemorrhage in women with a variety of obstetric haemorrhage(OH) aetiologies, and the NASG was found to be effective in decreasing blood loss by over 50%.[21-24]

A systematic review including 5 studies and 1247 women with shock found a decreased mortality of 48% (Relative Risk (RR) 0.52 (95% Confidence interval (CI) 0.36 to 0.77) at referral, tertiary-level facilities.[25] A Cluster Randomized Clinical Trial (CRCT) was conducted in Zimbabwe and Zambia to determine if early application of the NASG at the primary health facility level improved outcomes compared to later application at the referral facilities.24The reduction in mortality was clinically significant at 55%, but there was an inadequate sample of women in hypovolemic shock (actual sample size, n = 880 vs. the predicted n = 2400) necessary to have adequate power to determine statistical significance.[26] The NASG is currently recommended by the International Federation of Gynecologists and Obstetricians (FIGO)] and the World Health Organization (WHO) and can be found in PPH guidelines and manuals, such as WHO (Managing Complications 2nd edition) Global Library of Women's Medicine (GLOWM) PPH Recommendations and JHPIEGO's Helping Mothers Survive Bleeding After Birth as well as in JHPIEGO's 2018, 5-year report "Survive and Thrive".[27-32] A healthcare technology assessment performed for WHO resulted in a positive recommendation for including the NASG in Emergency Maternal and Obstetric Care (EMOC) management.[33] Despite these global recommendations and endorsements and despite pilot implementation and scale up projects conducted in India Nigeria, Ethiopia, Niger , Timor Leste , and Colombia , there have been fewer publications on how the NASG is accepted and used by clinicians and health systems.[34-39]. The reports on NASG use in Purnea and Gaya district from Bihar revealed that the interviews and discussion with stakeholders reflected that even after training and appropriate introduction of the practice of using the NASG, the initiative did not translate into making a difference in ameliorating the situation of PPH management in the health facilities over a period of the following 6 months. The NASG were procured by national health mission and supplied in ambulances to the facilities. In Gaya district, NASG was supplied in 24 facilities, whereas in Purnea, it was available only in few facilities. The ambulance technicians at the respective facilities were in-charge of the NASGs. In both the districts, health personnel were receptive towards the idea of having NASGs at their facilities for use in PPH management. However, it was reported that though the NASG were readily available in many facilities and staff members were trained in its use; NASG were not being utilized. One of the interviewees mentioned that this was probably because: "Enough training was not provided to them, and they had no idea about how to use the NASG to prevent PPH cases. "While interacting with the various health-care providers, it was realized that they lacked skills to identify the cases of PPH and use the NASG garment appropriately.[40]

Training need was identified by JDF for the health care providers in WHO approved protocol in the form of AMTSL and use of newer gadgets and techniques of prevention and management of postpartum haemorrhage. Jiv Daya Foundation and Pravara Institute of Medical Sciences in collaboration with other prominent government health facilities having large patient turnover were identified. These facilities were supported through supply of the essential drugs , instruments, equipment's, and training. As observed through the pre and post test results, it was very obvious that the participants i.e. doctor and nurses ,who were involved in provision of routine and emergency obstetric care, were not aware about the available gadgets and their use for prevention and management of post-partum haemorrhage. The trainee were explained about the steps undertaken in AMTSL, as per WHO guidelines and same was demonstrated during training programme. The NASG was an introduction to most of the trainee including Gynecologists. They expressed keen interest in understanding the use of this first aid device and were very much convinced with the usefulness of the device in cases of obstetric haemorrhage with hypovolemic shock. They expressed great desire to procure NASG in their set up. The display of video and actual demonstration of its use further helped them to understand finer aspects of the

use and storage of NASG. Majority of participants volunteered to do hands on training on use of NASG.

The Bakri Postpartum Balloon is indicated for use in the event of primary postpartum hemorrhage within 24 hours of delivery. The device should not be left indwelling for more than 24 hours. The balloon should be inflated with a sterile liquid such as sterile water, sterile saline, or lactated Ringer's solution. The balloon should never be inflated with air, carbon dioxide, or any other gas. The maximum inflation is 500 mL. Over inflation of the balloon may result in the balloon being displaced into the vagina. Patients in whom this device is being used should be closely monitored for signs of worsening bleeding and/or disseminated intravascular coagulation (DIC). In such cases, emergency intervention as per hospital protocol should be followed.

Patient monitoring is an integral part of managing postpartum hemorrhage. Signs of a deteriorating or non-improving condition should lead to a more aggressive treatment and management of the patient's uterine bleeding. The patient's urine output should be monitored while the Bakri Postpartum Balloon is in use. Uterine balloon tamponade in the form of Bakri Baloon was also a new introduction to majority of the participants. They could not reply correctly to the questions asked in pre-test. During training programme, training participants were educated through power point presentation, video demonstration and demonstration on manikin. Hands on training helped them to get confidence in the use of Bakri balloon in atonic Post-partum Haemorrhage. This was reflected through the significantly improved post test scores. There was good discussion after every session and participants shared their experiences and it was useful to all participants. Various local modifications were being used as substitute to Bakri balloon at different health care facilities due to high cost of Bakri balloon. The advantages of Bakri balloon over other locally available devices were discussed by the technical experts. Participants were satisfied with the training contents ,methodology used for training, time allotted for training on each treatment modality, training material provided, experience sharing, comments by experts etc. All participants were convinced that NASG has proven to be an effective device for management of PPH globally and it is fairly simple to use by any medical/nonmedical person with 1-hour training in its application and use.

CONCLUSION

Obstetric haemorrhage remains one of the leading causes of maternal mortality, particularly in rural areas. Government is unable to provide Comprehensive Emergency Obstetric Care (CEmOC) in rural and remote areas. All maternal health care providers must be fully aware about the principle and steps of AMTSL the non-pneumatic anti-shock garment (NASG) has been demonstrated to reduce mortality as it buys time for women in shock to be transported to or to overcome delays at referral facilities. There is need for training of maternal health care providers in newer modalities like NASG and Bakri balloon, which have potential to save lives in PPH cases. Simulation trainings, repeated trainings, and close hands-on supportive supervision via site visits can be the training/learning methods. Government should make NASG and Bakri Balloon or similar type of modality available in all health care facilities, for use in an emergency, when PPH occurs.

Recommendations

There is immediate need for training and retraining of doctors, nurses and health workers of private, state and local government health facilities, as well as the trained birth attendants on AMTSL, the application of NASG and Uterine balloon tamponade.This will assist in preventing PPH and stabilizing the bleeding woman and preventing complications as well as maternal death before getting the woman to the referral hospital. The health education unit should organize on regular basis workshop on the use of UBT and NASG for all its health personnel; and the hospital authority should make UBT and NASG available for the use of the personnel. As survival of the patient is the utmost goal of any health facility, there should give more freedom to midwives/nurses on provision of life saving procedures as they are key persons in maternal health. One of such area is the application of NASG on bleeding woman. This should not be limited to resident doctors and consultant Obstetricians and Gynaecologists alone. With the proper implementation strategies, NASG utilization can be high and should be associated with decreased mortality among mothers at risk of death from obstetric haemorrhage.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: Not required

REFERENCES

1. Khan KS, Wojdyla D, Say L, Gülmezoglu AM, Van Look PF. WHO analysis of causes of maternal death: A systematic review. Lancet 2006;367(9516):1066-74.
2. Hogan MC, Foreman KJ, Naghavi M, Ahn SY, Wang M, Makela SM, et al. Maternal mortality for 181 countries, 1980–2008: a systematic analysis of progress towards Millennium Development Goal 5. The Lancet. 2010;375(9726):1609-23.
3. UNICEF. Information by Country - Statistics-Women's Health.
4. Beyond the Numbers: Reviewing Maternal Deaths and Complications to Make Preganancy Safer". Geneva: WHO; 2004.
5. World Health Organization Library. WHO Recommendations for the prevention and treatment of postpartum haemorrhage. Geneva, Switzerland: World Health Organization Library; 2012.

6. Amy JJ. Severe postpartum haemorrhage: A rational approach. Natl Med J India. 1998;11(2):86-8.
7. Rao KA. Presidential address. The 44th All India Obstetric and Gynecological congress. Ahmedabad.2000. J Obstet Gynecol India. 2001;51: 25-8.
8. AbouZahr C. Global burden of maternal death and disability. British Medical Bulletin. 2003;67(1):1-1.
9. American College of Obstetricians and Gynecologists. ACOG practice bulletin: Clinical management guidelines for obstetrician-gynecologists number 76, October 2006: postpartum hemorrhage. Obstet Gynecol 2006;108(4):1039-47.
10. Commission on Behavioral and Social Sciences and Education (CBASSE) (2000). The Consequences of Maternal Morbidity and Maternal Mortality: Report of a Workshop. Washington, D.C: The National Academies.
11. Turan J, Ojengbede O, Fathalla M, Mourad-Youssif M, Morhason-Bello IO, Nsima D, et al. Positive effects of the non-pneumatic anti-shock garment on delays in accessing care for postpartum and postabortion hemorrhage in Egypt and Nigeria. J Womens Health (Larchmt). 2011;20(1):91-8.
12. Non-pneumatic Anti-shock Garment-Compendium of New and Emerging Technologies that Address Global Health Concerns. Geneva: World Health Organization; 2011. Available from: http://www.who.int/medical_devices/innovation/new_emerging_tech_30.pdf.
13. Pileggi-Castro C, Nogueira-Pileggi V, Tunçalp Ö, Oladapo OT, Vogel JP, Souza JP. Non-pneumatic anti-shock garment for improving maternal survival following severe postpartum haemorrhage: A systematic review. Reprod Health 2015;12:28.
14. Maknikar S, Nanda R, Miller S. NASG reduces mortality in Indian women with PPH. Int J Gynecol Obstet 2012;119:S413.
15. Magwali T, Butrick E, Mambo V, Ayadi A, Lippman S, Bergel E. Non-pneumatic anti-shock garment (NASG) for obstetric hemorrhage: Haraze, zimbabwe. Int J Gynecol Obstet 2010;119:S410.
16. Bakri YN. Balloon device for control of obstetrical bleeding. Eur J Obstet Gynecol Reprod Biol. 1999;86(12):S84.
17. The Bakri Balloon Up to Date. Available at www.uptodate.com.
18. Balachandram V. Maternal Mortaltiy in Kaduna, Nigeria Med J.1995;5:366-70.
19. Bais JM, Eskes M, Pel M, Bonsel GJ, Bleker OP. Postpartum haemorrhage in nulliparous women: incidence and risk factors in low and high risk women: a Dutch population-based cohort study on standard (≥500 ml) and severe (≥ 1000 ml) postpartum haemorrhage. Europe J Obstet Gynecol Reproduct Biol. 2004;115(2):166-72.
20. Magann, EF, Evans S, Flutechnison M, Collins R, Lanneau G. and Mirrison JL. Postpartum heamorhage after cesarean delivery: an analysis of risk factors. S Med Jorn.2005:98(7):618 – 5.
21. Miller S, Ojengbede O, Turan JM, Morhason-Bello IO, Martin HB, Nsima D. A comparative study of the non-pneumatic anti-shock garment for the treatment of obstetric hemorrhage in Nigeria. Int J Gynecol Obstet. 2009;107(2):121-5.
22. Miller S, Fathalla MM, Ojengbede OA, Camlin C, Mourad-Youssif M, Morhason-Bello IO et al. Obstetric hemorrhage and shock management: using the low technology Non-pneumatic Anti-Shock Garment in Nigerian and Egyptian tertiary care facilities. BMC pregnancy and childbirth. 2010;10(1):64.
23. Turan J, Ojengbede O, Fathalla M, Mourad-Youssif M, Morhason-Bello IO, Nsima D, Morris J, Butrick E, Martin H, Camlin C, Miller S. Positive effects of the non-pneumatic anti-shock garment on delays in accessing care for postpartum and postabortion hemorrhage in Egypt and Nigeria. J Women's Health. 2011;20(1):91-8.
24. Miller S, Bergel EF, El Ayadi AM, Gibbons L, Butrick EA, Magwali T, et al. Non-Pneumatic Anti-Shock Garment (NASG), a First-Aid Device to Decrease Maternal Mortality from Obstetric Hemorrhage: A Cluster Randomized Trial. Abdel-Aleem H, editor. PLoS One. 2013;8(10):e76477.
25. Pileggi-Castro C, Nogueira-Pileggi V, Tunçalp Ö, Oladapo OT, Vogel JP, Souza JP. Non-pneumatic anti-shock garment for improving maternal survival following severe postpartum haemorrhage: a systematic review. Reprod Health 2015;12(1):28.
26. El Ayadi AM, Butrick E, Geissler J, Miller S. Combined analysis of the non-pneumatic anti-shock garment on mortality from hypovolemic shock secondary to obstetric hemorrhage. BMC Pregnancy Childbirth 2013;13(1):208.
27. Lalonde André. Prevention and treatment of postpartum hemorrhage in low-resource settings. Int J Gynecol Obstet. 2012;117(2):108-18.
28. World Health Organization. WHO recommendations for the prevention and treatment of postpartum haemorrhage. Geneva: World Health Organization; 2012. Available from: http://www.who.int/reproductivehealth/publications/maternal_perinatal_health/9789241548502/en/. [cited 2015 Aug 23]
29. World Health Organization, UNICEF, United Nations Population Fund (UNFPA) Managing complications in pregnancy and childbirth: a guide for midwives and doctors. 2. Geneva: World Health Organization; 2017.
30. Karoshi M, Keith L, Arulkumaran S, Lalonde A. Postpartum hemorrhage: Guidelines for Immediate Action, Wall Chart. Global Library of Women's Medicine. 2012.
31. JHPIEGO. Helping Mothers Survive Bleeding After Birth: Providers Guide: Jhpiego Corporation; 2015. p. 48. Available at https://www.jhpiego.org/wp-content/uploads/2016/03/Helping-Mothers-Survive-Bleeding-after-Birth_0.pdf

32. Survive and Thrive. Guiding the way forward: Survive and Thrive 5-year Report (2012-2017).2018. Available at https://surviveandthrive.org/about/Documents/Survive%20%20Trive%205%20year%20report%20FINAL.pdf.
33. Chhaya VA, Sharma JK, Ameel M, Sundararaman T. Healthcare Technology Assessment for Non-Pneumatic Anti Shock Garment for Obstetric Shock Prevention. Available at [http://www.who.int/medical_devices/global_forum/E02.pdf]
34. Satia JK, Jayantilal K, Misra M, Arora R, Neogi S. Innovations in maternal health : case studies from India. New Delhi: Sage Publications; 2014.
35. Mankikar S, Nanda R, Miller S. NASG reduces mortality in Indian women with PPH. Int J Gynecol Obstet. 2012;119(S3):S413.
36. Sloan Nancy L., Storey Andrew, Fasawe Olufunke, Yakubu Jamila, McCrystal Kelly, Wiwa Owens, Lothe Lene Jeanette, Grepstad Mari. Advancing Survival in Nigeria: A Pre-post Evaluation of an Integrated Maternal and Neonatal Health Program. Mat Child Health J. 2018;22(7):986-97.
37. Mbaruku G, Therrien MS, Tillya R, Mbuyita S, Mtema Z, Kinyonge I, Godfrey R, Temu S, Miller S. Implementation project of the non-pneumatic anti-shock garment and m-communication to enhance maternal health care in rural Tanzania. Reproduct Health. 2018;15(1):177.
38. Gebrehiwot Y. Use of the Non-Pneumatic Anti-shock Garment (NASG) to Reduce Maternal Mortality in Ethiopia. Ethiopia: Tewodros Emiru; 2013. PLoS ONE. 8(4):e62282.
39. Zeidou A. Lutte contre la mortalite maternal: Experience du Niger. Lome, Togo: Presentation at Togo Ministry of Health Postpartum Hemorrhage Technical Meeting; 2017.
40. Sharma J, Negandhi P, Das AM, Sethy G, Neogi BS. Using nonpneumatic anti-shock garment for postpartum hemorrhage management and referral at the public health facilities: A pilot study in two districts of Bihar. Indian J Public Health 2016;60(4):316-22.

Cite this article as: Bhardwaj S, Raut S, Bangal VB. Training of maternal health care providers in newer modalities of management of post-partum haemorrhage. Int J Reprod Contracept Obstet Gynecol 2019;8:1062-9.