Using Nonpneumatic Anti-shock Garment for Postpartum Hemorrhage Management and Referral at the Public Health Facilities: A Pilot Study in Two Districts of Bihar

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Abstract

Background: Nonpneumatic anti-shock garment (NASG) is a first-aid device that can save lives of women experiencing postpartum hemorrhage (PPH). Objective: The aim was to explore the feasibility of implementation of NASG intervention at select public health primary care facilities in two high priority districts of Bihar. Methods: Qualitative design was used to document the NASG implementation process. In-depth interviews were conducted with health-care providers in November-December 2015. These healthcare providers were chosen purposively based on their involvement in the use of NASG. The implementation process of NASG, process of training for its use, challenges faced during the rollout of implementation and the recommendations for improving the implementation were explored. Results: Initially, a baseline study was conducted to assess the knowledge and skills of health-care providers regarding diagnosis and management of PPH. Implementation consisted of orientation and training of service providers on the identification of PPH cases and usage of the NASG garment during referrals. The interviews with stakeholders reflected that even after training and appropriate introduction of the practice of using the NASG bag, the initiative did not make a difference in ameliorating the situation of PPH management in the health facilities over 6 months. Conclusion: This study provides lessons for implementation and scaling up of NASG in public health systems, not only in Bihar but also other similar settings. It also calls for robust implementation research studies to generate evidence on the use of NASG at the primary health-care facilities as an intervention in program settings.

Keywords: Hypovolemic shock, nonpneumatic antishock garment, obstetric first aid, postpartum hemorrhage

Introduction

Maternal deaths are infelicitous occurrences gaining alarming stature world over with around 830 women each day succumbing to avertable complications related to pregnancy and childbirth.¹ India contributes to one-fifth of the global burden of maternal deaths.² There has been an estimated 4.7% annual decline in maternal mortality ratio (MMR) since 1990. However, within India, there is marked variation in MMR and healthcare

Special Contribution in the Study


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access between regions and across socioeconomic classes.\textsuperscript{2,3}

Worldwide, postpartum hemorrhage (PPH) has been identified as the most commonly reported complication and the leading cause of maternal deaths (29.6%).\textsuperscript{4} PPH is defined as blood loss $\geq$500 ml within 24 h after birth, while severe PPH is blood loss $\geq$1000 ml within 24 h.\textsuperscript{5} Once bleeding starts, death can occur in around 2 h, which leaves a small time frame for safe referral and effective care, unless available instantly.\textsuperscript{6}

Around 140,000 deaths, equating to 1 every 4 min, happen as a result of this complication globally.\textsuperscript{7,8} The global incidence of severe PPH has been reported at 10.5\%, most of them occurring in low-income countries (both in hospital and community).\textsuperscript{7} The incidence of PPH from India had been reported to be 2\%–4\% for vaginal deliveries and 6\% for cesarean sections, with uterine atony being the medical cause in almost 50\% of the cases.\textsuperscript{9}

Mortality due to PPH in low resource settings is caused mainly due to delay in reaching tertiary care facilities and receiving definitive care such as blood transfusions and surgeries after reaching facilities.\textsuperscript{10-12} Timely diagnosis and referral is the first step to avoid hemorrhagic shock resulting from PPH. Moreover, providing adequate primary care during referral and before initiation of treatment is crucial to save maternal lives from PPH.

The nonpneumatic antishock garment (NASG) is a first-aid device that can save lives of women experiencing obstetric hemorrhage from any etiology.\textsuperscript{13} The NASG is a simple neoprene and Velcro device that looks like the bottom half of a wetsuit cut into segments [Figure 1]. 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.\textsuperscript{14} The use of an NASG can stabilize a patient while awaiting transport, during transport, or during delays in receiving care at referral facilities.\textsuperscript{15-17}

Multiple studies the world over have concluded findings that resonate completely with the point that NASG is an effective tool in reduction of hemorrhage based maternal deaths, especially in low-resource settings, where availability of services for better and skilled management of PPH cases are limited.\textsuperscript{15,18-20} The use of NASG dates back to the 1970s when it was designed by NASA and has since been in use in obstetrics across the world for the management of PPH.\textsuperscript{21} In 2012, the World Health Organization, International Federation of Gynecology and Obstetrics and the Global Library for Women’s Medicine, recommended that NASG could be an efficient tool for stabilizing women while waiting for definitive treatment.\textsuperscript{22} A cost-effective analysis from Nigeria and Egypt\textsuperscript{23} suggested that NASG is very cost-effective in low resource settings and can markedly improve health outcome in cases of severe hemorrhagic shock. A clinical trial was conducted between 2007 and 2012 to study if the earlier application of NASG at the community or primary health care level is advantageous and the study showed a reduction of 54\% in maternal mortality when women received NASG at the primary level before transporting her to tertiary care hospital.\textsuperscript{24} An experimental study suggests a significant increase in the internal iliac artery resistive index with NASG application in a small group of postpartum volunteers, which may provide a physiological explanation of how the NASG might reduce PPH.\textsuperscript{15}

Bihar is trying to tackle a maternal mortality rate of 208/100,000 live births, as per the recent sample registration system estimates released by the office of Registrar General and Census Commissioner of India.\textsuperscript{25} Poor and inefficient management of PPH cases have been found to primarily cause maternal death in Bihar.\textsuperscript{26} To save lives from fatal PPH, UNICEF Bihar introduced NASG at the primary care facilities in select high priority districts. In this paper, we document the process of implementation of NASG intervention at the selected public health primary care facilities, challenges faced during the process and lessons learned.

![Figure 1: NASG garment](http://www.ijph.in)
Materials and Methods

The process of NASG implementation was documented using a qualitative study design. For the collection of data, seven in-depth interviews of health-care providers were conducted in 2015 (November-December) in Gaya and Purnea. Interviews were conducted with medical officers, auxiliary nurse midwives (ANMs), ambulance technicians and UNICEF field team members. The interviewees were chosen purposively based on their involvement in the use of NASG and rollout of the initiative. All the interviews were conducted face-to-face in Hindi during the field visits and each interview on an average lasted for more than half an hour.

At the outset, an in-depth interview guide was designed to explore the implementation process of NASG, including the implementation strategy, quality of training for its use, challenges faced during the rollout of implementation and the recommendations for improving the implementation. All interviews were recorded using voice recorder, with consent, and subsequently transcribed and translated into English for the purpose of analyses.

Ethical considerations

The India newborn action project was approved by Institutional Ethics Committee of Indian Institute of Public Health Delhi at the outset, and documentation of the implementation of NASG in Bihar was part of the project activities. The interviews did not include any beneficiaries or vulnerable persons but were health-care providers and program specialists. The goals and objectives of the study were explained to each interviewee before commencing the interviews, and written consent was obtained before each interview. To protect the anonymity of the participants, no information related to the identity of the participants has been presented in the article.

Results

The process of nonpneumatic antishock garment implementation

The pilot intervention was rolled out in select public health facilities of the two districts. Initially, a baseline study was conducted to assess the skills of health-care providers on PPH diagnosis, management of PPH, use of the NASG garment in the early stabilization of PPH and referral to a tertiary care facility. A total of 41 health facilities (including district and sub-district hospitals, referral hospitals and primary health care centers) were covered in both districts for the baseline survey.

The next phase of implementation included orientation and training of 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 and ambulance technicians and drivers. 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. A total of 297 participants were trained during the training sessions over a period. After first training, every monitor visited each facility to provide supportive supervision and to promote the use of NASG for PPH cases.

Baseline study

A baseline study was conducted before rollout of intervention. 26 facilities in Gaya and 15 facilities in Purnea were covered during this phase, and a total of 134 health-care providers were interviewed [Table 1].

The baseline findings indicated that in Gaya, on an average, a medical care facility managed 17 cases of PPH and referred 7 cases to higher healthcare facility each year. Similarly in Purnea, 56 cases of PPH were managed by a medical facility each year, whereas 36

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<th>Table 1: Baseline parameters of the included health facilities in Gaya and Purnea districts</th>
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<td>Average number of maternal death at the each facility/year</td>
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<td>Yearly average of maternal death due to PPH at the each facility</td>
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ANM = Auxiliary nurse midwife, PPH = Postpartum hemorrhage, SBA = Skilled birth attendant
cases were referred to higher health-care facility. Yearly at least one woman in Gaya and 2 in Purnea died due to PPH complications at the facilities. It is important to note that this data does not reflect the maternal deaths that happened during transit or at the referral facilities.

**Use of nonpneumatic antishock garment at the facilities**

The in-depth interviews provided relevant information about actual use of NASG at the public health facilities. Given that most of the facilities are located in rural areas, there were challenges in implementation at various levels. The interviews and discussion with stakeholders reflected that even after training and appropriate introduction of the practice of using the NASG bag, 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 bags 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 bags were readily available in many facilities and staff members were trained in its use; NASG bags 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 bag 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. This was despite the training imparted to them. In addition, the health-care providers faced difficulties in ensuring its safe re-use in the sense that appropriate cleaning is required each time the garment is utilized. Additional logistics and mechanisms were also required to ensure safe return of the garments for re-use, which were not available. The number of re-uses possible without losing the garment’s compressibility was also an issue, which is yet to be sorted out.

However, in one of the facilities of Gurua block of Gaya district, NASG garment has been successfully utilized in the management of two PPH cases. A medical officer expressed that:

“Two women could have died without the bag, as they were in shock, when they reached the primary health centre. The application of the garment on the women and early referral saved their lives.”

In Purnea, medical officers and health care staff expressed the need for having NASG device available at the facility as well as in the ambulance.

**Discussion**

NASG is a simple first-aid device, which could be a promising tool to combat immediate complications arising from PPH. The interviews highlighted some remarkable facts about the use of the garment in districts of Bihar, where maternal deaths are still on the higher side, with loss of blood after PPH being the leading cause of many of these deaths. While the NASG garments have been made available to the facilities in both the districts, their implementation is fraught with several deterrents that hinder their effective use. The findings showed that NASG utilization was not initiated in facilities due to various logistic and strategic barriers. Reluctance and lack of motivation among health-care providers to initiate the practice of innovative health technology, clear implementation plan, and poor training quality, as well as supply and logistic issues, attributed to nonutilization of NASG in public health facilities. The use of NASG relies on the training of healthcare providers and a clear delivery system. The promotion of the use of NASG warrants strong local leadership and well-developed training sessions on how to use the device, a well-defined monitoring system, quality of training, and refresher courses at the public health facilities.

The key to saving mothers from dying due to PPH lies in reaching a health facility with comprehensive emergency obstetric and neonatal care (CEmONC) services (that includes cesarean section and blood transfusion) within the first 2 h. The health system has been geared up to provide transportation services to ensure that every woman with such complications can reach the CEmONC facility within the stipulated time. Nevertheless, it becomes equally important to delay the onset of complications resulting from PPH during the transit. Moreover, there...
are hilly areas, difficult to reach terrains, and also places where availability of ambulance may be difficult when in need. In such situations, NASGs could be a saving grace.

Use of NASG at public health facilities addresses an important issue which is a cause of high maternal mortality. With the constrained human resources and insufficient health-care services at the primary level facilities, the NASG garment has the power to provide a life-saving opportunity for women suffering from severe blood loss postdelivery. The strength of NASG lies in its ability to manage women with severe blood loss postdelivery by stabilizing the hemorrhage until they have reached a higher referral facility for intensive care. The cost-effectiveness of the garment in low-resource countries has made it more adaptable and testable in variable settings. Furthermore, the fact that it is a low-maintenance garment which can be easily cleaned and re-used up to 50 times, either at home or in hospital settings, both in rural as well as urban areas, has increased its worth as a life-saver.

NASG has proven to be an effective device for management of PPH globally. It is fairly simple to use by any medical/nonmedical person with 1-h training in its application and use. A pilot study in Nigeria and Egypt compared 158 women who were given standard treatment for obstetric hemorrhage against 208 women who were given standard treatment plus NASG. Results demonstrated a statistically significant 50% decrease in blood loss among those treated with the NASG. In addition, there have been no reported adverse events related to the use of the garment. Another study in Sialkot, Pakistan showed similar results. As in other global resource-poor settings, this garment has proven to be effective in improving maternal health in Rajasthan, Bihar, Maharashtra, and Tamil Nadu through the implementation of the Raksha Project, in which its use was a crucial component. Project data collected from intervention areas between April 2010 and March 2012 indicates that maternal deaths attributable to PPH reduced by 5% and the use of NASG per shock case had gone up by 31%. In Tamil Nadu, 15 NASGs were initially supplied by pathfinder International to four medical colleges, which resulted in saving the lives of >100 women and prevented them from going into shock following PPH. Subsequently, the State Government incorporated its use in the protocols for Acute Management of Third Stage of Labour, and routinely staff members are trained at all levels for its use.

The findings from the current exploratory study indicate that rolling out of NASG in districts where health-care delivery services are sub-optimal may not yield appreciable results. However, taking cue from the success stories of other Indian states, optimal and effective use of NASG can be implemented using the following mechanisms:

- Identification of potential users at the facility and motivating them to use the NASG
- Regular trainings and sensitization sessions for the staff members at all levels
- Increased clarity among service providers about actions needed to prevent PPH/shock related morbidity and mortality.

In addition, the districts should be able to take care of the anticipated logistic issues such as safe return and storage of the garment, cleaning, and re-use. Staff members should be made accountable as also the family member accompanying the mother. It is important to improve the motivation levels of the staff for its sustained use in the management of PPH.

While the significance of the use of NASG cannot be undermined, the garment is a relatively new healthcare technology which is not yet readily available and is also not very cheap (current cost of each device is about $65, INR 3000/-). For its scale-up, there are efforts being made in India by international organizations to bring down the costs and improve the availability of the garment for easy acceptability among consumers. Furthermore, it is important to note that only the use of NASG cannot treat PPH – one would still require skilled intervention of a trained doctor in a health-care facility equipped to deal with such emergencies.

**Conclusion**

The preliminary results of the current study may not be generalizable but, it provides lessons for implementation and scaling up in public health systems, not only in Bihar but also other similar settings. The responses of the interviewees call for robust implementation research studies to generate evidence on the use of NASG at the primary health-care facilities as an intervention in program settings, along with strengthening the delivery of care and management of PPH and rigorous monitoring to document the evidence to scale-up and its impact on mortality and near-miss events.
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Conflicts of interest
Ghanashyam Sethy, is affiliated to UNICEF, Bihar (sponsor of the study and supplement). The views expressed in this paper are those of individuals and not of the organizations they represent.

References


