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Nurses in Low Resource Settings Save Mothers' Lives With Non-pneumatic Anti-Shock Garment

Abstract

Purpose: To discuss the role of nurses and nurse-midwives in preventing and treating postpartum hemorrhage (PPH) from uterine atony in developing countries and examine the role of a new device, the Non-pneumatic Anti-Shock Garment (NASG), in improving the outcomes for these patients.

Study Design and Methods: In this subanalysis of a larger preintervention phase/intervention phase study of 1,442 women with obstetric hemorrhage, postpartum women with hypovolemic shock ($N = 578$) from uterine atony (≥750 mL blood loss; systolic blood pressure ≤100 mmHg and/or pulse ≥100 beats per minute) were enrolled in two referral facilities in Egypt and four referral facilities in Nigeria. The study had two temporal phases: a preintervention phase and an NASG-intervention phase. Women with hemorrhage and shock in both phases were treated with the same evidence-based protocols for management of hypovolemic shock and hemorrhage, but women in the NASG-intervention phase also received the NASG. Relative risks (RRs) with 95% confidence intervals (CIs) were estimated for primary outcomes—measured blood loss, incidence of emergency hysterectomy, and mortality.

Results: Women in the NASG-intervention phase had significantly better outcomes, 50% lower blood loss, reduced rates of hysterectomy (8.9% vs. 4%), and mortality decreased from 8.5% to 2.3% (RR = 0.27, 95% CI: 0.12–0.60).

Clinical Implications: In low-resource settings nurses have few resources with which to stabilize women with severe PPH. With training nurses and nurse-midwives can stabilize hemorrhaging women with the NASG, a low-technology first-aid device that shows promise for reducing blood loss, rates of hysterectomy, and mortality.

Key words: Developing countries; First aid; Maternal mortality; Postpartum hemorrhage; Shock; Uterine inertia.

Every year approximately 358,000 women die due to complications of pregnancy and childbirth; 99% of these women live in developing countries (World Health Organization [WHO], 2010). Globally, maternal mortality has decreased by 2.3% annually from 1990 to 2008, but this is far below the 5.5% annual improvement needed to achieve The Millennium Development Goal target of reducing the maternal mortality ratio 75% by 2015 (WHO, 2010). If this target is to be achieved, deaths from postpartum hemorrhage (PPH), the leading cause of maternal mortality in developing countries (Devine & Wright, 2009), need to be signi cantly reduced.

PPH is de ned as blood loss ≥500 mL, while severe PPH is blood loss ≥1,000 mL. The leading cause of PPH is uterine atony in which the uterus fails to effectively contract and retract once the mother has given birth (American Congress of Obstetricians and Gynecologists [ACOG], 2006). Although some conditions (multiple gestation, age, previous PPH) may predispose women to hemorrhage, most cases (about 2/3) take place in women with no known risk factors for PPH (WHO, 2007). Globally, the focus of prevention and treatment of PPH caused by uterine atony has centered on the evidence-based practice of active management of third stage labor (AMTSL). AMTSL includes controlled cord traction, administration of oxytocin or other uterotonic drugs immediately after birth, and uterine massage, and should be undertaken by skilled birth attendants (WHO, 2007). AMTSL is effective at preventing up to 60% of atonic PPH (Derman et al., 2006; Prendiville, Elbourne, & McDonald, 2002), but thousands of women still experience PPH and death, in part due to the lack of adherence to AMTSL protocols.

In developing countries, up to a third of births currently take place without skilled attendance (WHO, 2010). For the majority of those *with* skilled attendance, it is nurses and nurse-midwives who usually provide birthing care, whether in a rural community clinic or an urban, tertiary level referral hospital (WHO, 2011). These healthcare workers, therefore, are at the forefront of management of PPH. Speedy identi cation and management of PPH is essential, as uncontrolled or untreated hemorrhage can quickly lead to shock and death. A woman may die from hemorrhage in as little as 2 hours of onset if she does not receive proper medical attention (Lazarus & Lalonde, 2005). The repercussions of high maternal mortality rates affect the family, community, and the country. For those women who survive PPH, but are left infertile/childless or with a severe morbidity, the health, economic, and social consequences may be dire (Van Balen & Bos, 2010; Walvekar & Virkud, 2006).

Providers at tertiary level facilities may have a variety of options for treating a woman suffering from uterine atony and shock including: bimanual compression; parenteral uterotonics; intravenous (IV) uids; blood transfusions; and surgery including compression sutures, ligation of arteries, and hysterectomy. However, even in the largest tertiary facilities in low resource settings, there are long delays in obtaining appropriate, quality care (Turan et al., 2011). Many more women give birth at home or in lower-level facilities where staff lack the training, equipment, or supplies to prevent and manage PPH and shock (McCarthy & Maine, 1992). Nurses and nurse-midwives working at the community or primary healthcare (PHC) level may have few tools at their disposal for stabilizing and treating women with intractable uterine atony. The Non-pneumatic Anti-shock Garment (NASG) is a low technology rst-aid device, which can be used to resuscitate and stabilize women suffering from hypovolemic shock until de nitive treatment is available (Brees, Hensleigh, Miller, & Pelligra, 2004; Miller, Martin, & Morris, 2008).

The NASG is a light-weight compression garment made of neoprene. The garment has nine segments that fasten with Velcro around the woman s legs, pelvis, and abdomen (see Figures 1 and 2). The abdominal segment incorporates a small foam ball that applies pressure to the uterus. The NASG works by decreasing pelvic blood ow (Hauswald, Williamson, Baty, Kerr, & Edgar-Mied, 2010), in particular, by increasing the resistive index of the pelvic blood vessels (hypogastric and uterine arteries) (Lester, Stenson, Meyer, Morris, Vargas, & Miller, 2011). The NASG can be applied by any healthcare staff after a brief training, and it results in the reversal of hypovolemic shock and the stabilization of the patient for many hours, during transport, examinations, and delays in receiving de nitive treatments such as blood, procedures, and surgeries. The NASG is applied as soon as signs of hypovolemic shock are identi ed. If IV uids are not already running, veins are easier to nd after placement of the garment. The NASG is not replacement for standard care; shock/hemorrhage protocols should be followed in addition to NASG application. The NASG is left in place for vaginal procedures; for abdominal surgery, only the abdominal and pelvic panels are opened.

Previous studies of the NASG have highlighted its effectiveness in reducing blood loss, more rapid recovery times from shock, and reduced maternal mortality and morbidity from all etiologies of obstetric hemorrhage (Miller et al., 2006; Miller et al., 2007; Miller et al., 2008; Miller, Ojengbede, Turan, Morhason-Bello, Martin, & Nsima, 2009; Miller, et al., 2010). The objective of this article is to discuss the role of nurses and nurse-midwives in managing PPH with the NASG and to examine whether adding the NASG to standard protocols for managing hypovolemic shock secondary to PPH due to uterine atony can improve maternal outcomes.

Study Design and Methods

Design

This study was part of a larger preintervention phase/NASG-intervention phase project conducted between 2004 and 2008 (N = 1,442). The current study presents results from six referral hospitals: two in Egypt (Cairo and Assuit) and four in Nigeria (Southern and Northern Nigeria). These locations represent an array of settings from the well-resourced urban areas of Cairo to the limited resourced rural areas of Northern Nigeria. The

methods applied for this study have been described in more detail in previously published articles (Miller et al., 2006; Mourad-Youssif et al., 2010). Basically, the study was a preintervention (observational) phase, followed by an NASG-intervention phase. The sample size was not calculated beforehand but was determined if a woman meeting criteria was in the facility during the speci c time phase, preintervention phase (standard protocol only) or NASG-intervention phase (standard protocol plus NASG). Eligibility included women with hypovolemic shock from obstetric hemorrhage (≥750 mL blood loss; systolic blood pressure [SBP] ≤100 mmHg, and/or pulse ≥100 beats per minute).

Figure 1: The NASG Open

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Figure 2: The NASG Applied

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Sample

This article reports on a subanalysis of 578 women with hypovolemic shock secondary to PPH due to uterine atony, with 224 women in the preintervention phase and 354 women in the NASG-intervention phase. Women in the preintervention phase were treated using a standardized, evidence-based hemorrhage and shock protocol, and women in the NASG phase were treated using the same protocol plus the NASG. In the facilities, all of the providers (physicians, nurses, and nurse-midwives) were trained to recognize shock, apply the NASG, conduct standard protocol for shock and hemorrhage with the patient in the NASG, and remove the NASG, as well as how to ll in data collection forms. Training also included hands-on practice of placement and removal. The study protocol was for nurses and nurse-midwives to make the decision when to apply the NASG and to apply the NASG without needing physician supervision or agreement. The nurses and nurse-midwives were also able to implement NASG removal following the protocol for patient hemodynamic stability for 2 hours before initiating removal.

After the study was explained to the women, preintervention study participants gave verbal consent to use their data. All NASG participants gave written consent for the application of the NASG and to use their data. A U.S. Federal waiver of consent/authorization for minimal risk research was obtained (45 CFR 46, 45 CFR 164.512) for women who were unconscious or confused at study entry. These women were enrolled and treated, but their data were only used if written consent was granted after the patient returned to normal sensorium or a relative gave consent on their behalf. Approval of the study was obtained from the Committee on Human Research (approval number H6899-23524), National Reproductive Health Research Committee of the Nigerian Federal Ministry of Health, El Galaa Maternity Teaching Hospital, and Assuit University Women s Health Center.

Study Procedure

Women with hypovolemic shock secondary to PPH due to uterine atony, an initial blood loss ≥750 mL, and at least one clinical sign of shock (SBP ≤100 mmHg and/or pulse ≥100 beats per minute) were eligible for the study. Both women who gave birth and started bleeding at home or a clinic and were transferred with bleeding, and those who gave birth and began bleeding at the hospital were eligible. Once a woman was enrolled in the study, normal nursing and nurse-midwifery care for shock/hemorrhage patients was followed, with nurses or nurse-midwives recording vital signs, level of consciousness, urine output, and blood loss. Once the source of bleeding was found and corrected, the woman s vital signs had stabilized (SBP >100 mmHg, pulse <100 beats per minute) for 2 hours, and blood loss had decreased to <50 mL per hour for 2 hours, the woman

could be discharged from the study. Blood loss after study entry was measured in both phases using a closed-end calibrated drape (Brass-V Fixable Drape, Madurai, India).

Before the preintervention phase, the clinicians, mainly nurses and nurse-midwives, were trained in evidence-based protocols for obstetric hemorrhage and hypovolemic shock. The protocol in both phases included: administration of crystalloid IV uids (≥1,500 mL in the rst hour), administration of uterine massage and uterotonic medications (oxytocin, ergometrine, syntometrine, and misoprostol), vaginal procedures (bimanual compression, manual removal of placenta, and dilation and curettage for retained tissue), provision of blood transfusions, and when required abdominal surgeries (compression sutures, arterial ligation, and hysterectomy).

Application of the NASG on study entry was added to the standardized protocol during the NASG-intervention phase. If a woman in the NASG-intervention phase required a vaginal procedure, all sections of the NASG were left in place. If she required surgery, the abdominal section would be opened prior to the rst incision and closed immediately once surgery was completed.

The clinicians were also the data collectors, so that the nurse or nurse-midwife caring for the patient also completed data collection forms. Information captured on these forms included hospital admission/discharge and entry/exit from the study; the patient s vital signs; level of consciousness; urine output and blood loss; and treatments such as uids and blood replacements, medications, vaginal procedures, and surgeries. All of these data were standard clinical data for care of shock/hemorrhage patients. The only new information on these forms was time of NASG application and time of NASG removal for patients in the NASG-intervention phase.

Data Analysis

Completed data forms were reviewed by data supervisors and principal investigators in each country for completeness and accuracy. All the data forms were further checked by the data team for any errors or discrepancies before analysis.

Demographic characteristics, severity of the woman s condition on study entry, and treatment received in the two study phases were compared using *t*-tests (assuming unequal variance), Wilcoxon rank-sum tests for nonnormally distributed continuous variables, and χ^2 tests for categorical variables. The severity of the woman s condition on study entry was calculated using mean arterial

Table 1: Demographics and Condition on Entry to Study (*N* = 578)

	Preintervention *N* = 224	NASG Intervention *N* = 354	*p* value
Study Sites			
Egypt: 2 referral hospitals	169	269	—
Nigeria: 4 referral hospitals	55	85	—
Demographic Characteristics			
Age: Mean years of age (*SD*)	28.8 (6.1)	29.6 (5.9)	0.084
Median age (IQR)	28 (24.5-32.5)	30 (25-34)	0.062
Parity: Median parity (IQR)	3 (1-5)	3 (2-4)	0.385
Pregnancy duration: Median weeks (IQR)	39 (38-40)	39 (37-40)	0.578
Condition on study entry			
Where hemorrhage began			<0.001
Transferred in bleeding (%)	71 (36.6)	57 (20.7)	
Began bleeding in hospital (%)	123 (63.4)	218 (79.2)	
Estimated revealed blood loss at study entry. Median (IQR) (mL)	1000 (1000-1500)	1000 (1000-1500)	0.618
Women with MAP < 60 or nonpalpable BP (%)	71 (31.7)	97 (27.4)	0.268
Women with nonpalpable pulse (%)	26 (11.6)	23 (6.5)	0.032
Women unconscious at study entry[b] (%)	14 (6.5)	11 (3.2)	0.064

Note. BP = blood pressure; IQR = interquartile range; MAP = mean arterial pressure; NASG = Non-pneumatic Anti-Shock Garment. Data are *n* (column %), mean (*SD*), or median (IQR). Tests of significance of differences by study phase were χ^2 for categorical variables, *t*-tests (assuming unequal variances) for normally distributed continuous variables and Wilcoxon rank-sum tests for nonnormal distributions.

[a] Data missing for 8 patients.

[b] Data missing for 13 patients.

Table 2: Treatments for Shock and Hemorrhage Administered During Two Study Phases ($N = 578$)

Treatment	Preintervention $N = 224$	NASG $N = 354$	p value
Any uterotonics administered[a]	217 (96.9)	345 (97.7)	0.528
≥1,500 mL IV fluids within first hour from study admission[b]	190 (84.8)	260 (73.5)	0.001
≥1,500 mL IV fluids within second hour from study admission[b]	203 (90.6)	318 (89.8)	0.755
Blood transfusion within first hour from study admission	171 (76.3)	239 (67.5)	0.023
Blood transfusion any time after study admission	213 (95.1)	334 (94.4)	0.701
Median minutes from study admission to first blood transfusion (IQR)[c]	35 (29–46)	30 (28–72.5)	0.229

Note. IV = intravenous; IQR = interquartile range; NASG = Non-pneumatic Anti-shock Garment. Data are *n* (column %). The denominator is the entire population, unless otherwise noted. Tests of significance of differences by study phase were χ^2 for categorical variables and Wilcoxon rank-sum tests for nonnormal distributions.

[a] Data missing for 1 person.

[b] The protocol asked for ≥1,500 mL to be administered in the first hour of resuscitation.

[c] Data for 36 patients missing (14 preintervention and 22 in intervention phase).

pressure (MAP = [2 × Diastolic Blood Pressure] + SBP/3). Women with an MAP ≤60 or nonpalpable pulse were considered to be in severe shock (The Clinicians Ultimate Reference, 2010). Treatment variables included administration of ≥1,500 mL crystalloid fluids in the first hour after study admission, administration of blood transfusions, and administration of uterotonics. For the outcome of cumulative median blood loss, which was measured hourly after study admission, we compared across study phases using the Wilcoxon rank-sum test. Relative risks (RRs) with 95% confidence intervals (CIs) were computed for the other two outcomes: rates of emergency hysterectomy and mortality. Data were analyzed using STATA version 10 (StataCorp, College Station, Texas, USA).

Results

There were 224 cases in the preintervention phase and 354 in the NASG-intervention phase. Patients in the two phases were similar with regards to demographics (Table 1). There was also similarity between patients in terms of condition on study entry: estimated blood loss and severity of condition (MAP ≤60 or nonpalpable pulse). There were differences in where bleeding began, with more women in the preintervention phase having begun bleeding at home or in a clinic and been transferred with bleeding than in the NASG-intervention phase (36.6% vs. 20.7%, $p < .001$). However, the time between hemorrhage start and study entry was not significantly different between the phases (data not shown).

While the protocol for treatment was the same in both phases, more women in the preintervention phase received ≥1,500 mL of IV fluids and blood transfusions within the first hour from study admission, but by the second hour, administration of fluids was no longer statistically significant between groups, and blood transfusions within the entire study period were similar between phases. Administration of treatment uterotonics was equally high in both phases (96.8% vs. 97.7%, $p = .528$) (Table 2).

The study outcomes (Table 3) were significantly better for women in the NASG-intervention. Measured median blood loss from study entry was 50% lower in the NASG phase (median 400 mL preintervention vs. 200 mL NASG-intervention, $p < .001$), the percentage of women who required emergency hysterectomy was reduced from 8.9% to 4.0% (RR 0.442, 95% CI: 0.228 0.859), and mortality was reduced from 8.5% to 2.3% (RR 0.266, 95% CI: 0.119 0.598). We repeated the analysis of outcomes for the patients who were in a more serious condition when they entered the study (MAP ≤60 or nonpalpable pulse) ($n = 168$). Findings were equally strong with significant reductions in further blood loss, emergency hysterectomy, and mortality (Table 4).

Limitations

Due to the study design, it is possible that selection bias existed and that not all women who were eligible were enrolled in the study. As the study was sequential, it is possible that clinicians' skills in treating hemorrhage improved during the course of the study. While staff were trained on clinical protocol for hemorrhage and shock, in these busy, understaffed, challenging environments, protocols were not always followed. Also, data were not collected on delivery of AMTSL, timing of treatment uterotonics, and further uterine massages given; neither was information on confounding (unrelated) illnesses collected, all of which would have provided more information to better interpret results.

Table 3: Outcomes between Standard Hemorrhage and Shock Management (Preintervention) and Standard Management Plus NASG (Intervention) (*N* = 578)

Outcome	Preintervention *N*= 224	NASG *N*= 354	Relative Risk (95% CI)	*p* value
Measured vaginal blood loss in drape: Median (IQR)[a] (mL)	400 (300–450)	200 (200–200)		<.001
Emergency hysterectomy	20 (8.9)	14 (4.0)	0.443 (0.228–0.859)	—
Mortality	19 (8.5)	8 (2.3)	0.266 (0.119–0.598)	—

Note. IQR = interquartile range; NASG = Non-pneumatic Anti-Shock Garment. Data are *n* (column %). The denominator is the entire population, unless otherwise noted.

[a] For cases in which the calibrated blood collection drape was used and there were data for blood loss. Wilcoxon rank-sum test used to compare distributions by study phase. Data are for 509 cases.

Table 4: Outcomes by Phase for Women with MAP ≤60 (*N* = 168)

Outcome	Preintervention *N* = 71	NASG Intervention *N* = 97	Relative Risk (95% CI)
Measured vaginal blood loss in drape: Median (IQR)[a] (mL)	400 (250–600)	240 (100–335)	<0.001
Emergency hysterectomy	18 (25.4)	10 (10.3)	0.407 (0.200–0.827)
Mortality	17 (23.9)	8 (8.2)	0.344 (0.157–0.753)

Note. CI = confidence interval; MAP = mean arterial pressure; NASG = Non-pneumatic Anti-Shock Garment. Data are *n* (column %).

[a] For cases in which the calibrated blood collection drape was used and there were data for blood loss. Wilcoxon rank-sum test used to compare distributions by study phase. Data are for 113 cases.

Clinical Nursing Implications

Our findings show that the NASG can reduce further blood loss and decrease adverse outcomes including mortality in women with PPH and shock from intractable uterine atony. The NASG may have major implications for nurses and nurse-midwives attending or assisting in childbirth in low-resource setting with delays in obtaining definitive therapy.

Expanding Nurses' and Nurse-Midwives' Skill Sets: Management and Treatment of Atonic PPH

There is evidence that staff responsible for maternity services in many countries have severe gaps in skills related to prevention of PPH including lack of training in AMTSL (Cherine, Khalil, Hassanein, Sholkamy, Breebaart, & Elnoury, 2004; Oladapo et al., 2009; Prevention of Postpartum Hemorrhage Initiative, 2009) and mismanagement of the third stage of labor (Ajenifuja, Adepiti, & Ogunniyi, 2010). This also seems to be the case for management of PPH. Not only are many of the techniques for treating the source of PPH available only to physicians at tertiary level facilities (mostly surgical options including compression sutures, ligation of arteries, and hysterectomy), but evidence suggests that nurses and nurse-midwives may not have adequate training or may not be able to consistently and correctly use management options available to them (bimanual compression, parenteral uterotonics, IV fluids, and blood transfusions) (Koblinsky et al., 2006).

As this study has shown, administration of fluids and blood products are frequently delayed or not given. Other research has shown only a low percentage of skilled birth attendants in various developing countries attending hospital and clinic-based births are able to perform bimanual compression and IV insertion correctly (21.5% and 68.5%, respectively), suggesting a wide gap exists between evidence-based standards and levels of competence (Harvey et al., 2004). This may be due to lack of didactic training, lack of hands-on skills training or opportunities to practice skills, and shortages of basic supplies, especially blood (Bates, Chapotera, McKew, & van den Broek, 2008).

These skill gaps must be addressed and remedied; all birthing facilities should support training and skills practice (Koblinsky et al., 2006) using proven active learning techniques such as simulation-based drills, which have been shown to be successful in obstetric units (Birch et al., 2007; Guise, 2007). In addition to ensuring nurses and nurse-midwives are adequately trained, there is a need to further investigate new technologies that could be used by these providers for treating PPH, such as the Bakri balloon tamponade (Vitthala, Tsoumpou, Anjum, & Azi, 2009) and the NASG.

The NASG: A Potential Tool in a Nurse's Management Arsenal

New interventions for healthcare workers are imperative. The NASG offers nurses and nurse-midwives a new,

simple, low-technology device that can be used to stabilize hemorrhaging women. As noted by a leading Nigerian obstetrician: *"For years, healthcare workers have had to stand by helplessly and watch these women die of something that's almost entirely preventable. Now there is hope."* (Professor Ojengbede, personal communication, 2009).

Qualitative studies of the NASG have described how staff feels empowered having a new tool to use and one that yields quick results. One nurse from Nigeria asserted: *"Yes, it saves lives. Because I witnessed it and I applied it. Almost all of us here have applied it. We are seeing the results. At the time, some of the women will be unconscious for hours, then we will see them coming back."* (Oshinowo, Miller, & Hensleigh, 2007). This sense of empowerment was also expressed by an auxiliary nurse in a PHC unit in Mexico: *"She [the patient] was stable at all times and that made me feel much calmer, and also I felt that the fact she had the NASG on was going to prevent her from further hemorrhage"* (Berdichevsky, Tucker, Martinez, & Miller, 2010).

The NASG has particular use in poor resource areas for various reasons. First, it is a simple technology that can be learned easily; while it is possible some people may not use it to its full effect, it is unlikely to cause harm. Second, it is a low-maintenance device that does not take much shelf space, is easy to clean, and is reusable. Third, it is low cost. In many developing countries, especially in sub-Saharan Africa, where spending on maternal health is less than $2 per person (Kimani, 2008), high cost interventions are impractical. The NASG is available at $55 per garment or <$1.50 per use (RTI International, 2011). Further, all healthcare staff can be easily trained in its use as no specialized knowledge is required to apply it. This paper, and others published on the NASG, have shown that nurses and nurse-midwives are able to learn and correctly use the garment, making it an important tool for these providers. Finally, the NASG is the only device available to stabilize women with shock until definitive treatments can be given. As hypovolemic patients may not have access to surgery and/or blood, the NASG can be useful for maintaining patients while they await definitive care.

Ensuring NASG is used as First Aid Device, Not as Treatment

While the NASG can buy time, it is important that standard treatment with IV fluids and blood transfusions not be neglected when using the NASG, which is only a first-aid device. The findings indicated fewer women in the NASG phase received ≥1,500 mL of fluids and received a blood transfusion in the first hour. For women with MAP ≤60, even though it is these women who make up the majority of emergency hysterectomy cases and mortalities, there was a similar trend for NASG women receiving less prompt treatment. This was observed in other NASG reports (Miller, et al., 2010) and may be due to a complacency developed by staff on seeing the immediate effect of the NASG. On its application, the patient's pulse lowers, the BP rises, consciousness may be regained, and the bleeding may diminish. However, considering that women can die in less than 2 hours from hemorrhage, especially for women in severe shock, rapid, definitive treatment is essential. While the NASG can improve outcomes for women, it is not definitive care in itself, and training in its use must emphasize the importance of following protocols for fluid therapy and blood replacements. The importance of well-equipped facilities is underlined as well. With the Egyptian facilities being more likely to have blood banks on site, we saw patients receiving blood products more quickly than in the Nigerian sites (Turan et al., 2011).

Future Research and Use of the NASG

To date, the NASG has been trialed at tertiary facilities. A randomized cluster trial is currently under way in nurse-midwifery-led clinics that refer patients in the NASG to higher-level facilities to examine efficacy at this level of healthcare facility (http://www.clinicaltrials.gov: NCT00488462). Another area for future research may be examining whether the NASG could be useful as a tool kept on ambulances, especially in poor-resourced, rural or remote areas. In fact, this may also be a relevant use of the NASG in developed countries; research has been proposed to examine the efficacy and cost effectiveness of the NASG in the United States for women experiencing delays during transport from a rural primary facility to a tertiary care facility, as well as its use for women who have long waits for specialized expertise and equipment, such as for uterine artery embolization, in U.S. hospitals.

Conclusion

Globally, too many childbearing women die from preventable causes. The Millennium Development Goal 5 recognizes this with the goal of reducing maternal mortality by 75% by 2015. Until deaths due to hemorrhage are reduced, there will be no overall reduction in maternal mortality. It is often nurses who are attending births and managing complications of pregnancy and childbirth in poor resource areas. While nurses can perform AMTSL to reduce the incidence of PPH due to uterine atony, there are not many tools to help them save the life of a woman with intractable uterine atony with severe hemorrhage and shock. The NASG may prove to be a tool nurses can use to stabilize these women until they receive definitive treatment. An increased focus on extending nurses and nurse-midwives skills and on placement of new technologies in basic healthcare facilities could yield the improvements in maternal outcomes necessary to meet this Millennium Development Goal. ✣

Acknowledgements

This study was funded by a grant from the John D. and Catherine T. MacArthur Foundation, but the Foundation did not play a direct role in the design, execution, and analyses of the study data or in the decision to submit the article for publication. We acknowledge the staff, patients, and

Suggested Clinical Nursing Implications

- Ensure all staff trained in AMTSL.
- All members of the healthcare team should understand the importance of standardized treatment of atonic PPH including bimanual massage and uterotonics and, especially for women in more severe conditions, adequate and rapid fluid and blood replacement.
- Training should emphasize that while the NASG is a useful tool for PPH, it must be used in conjunction with rapid implementation of definitive hemorrhage treatment protocols.
- There is a need for regular retraining and/or drills to ensure staff are able to respond in timely and correct manner when a tool, such as the NASG, is introduced.

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The authors have no financial interest in the non-pneumatic anti-shock garment.

The authors declare no conflicts of interest.

DOI:10.1097/NMC.0b013e318252bb7d

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