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FIGO GUIDELINES

Non-pneumatic anti-shock garment to stabilize women with hypovolemic shock secondary to obstetric hemorrhage ☆

FIGO Safe Motherhood and Newborn Health Committee [1]

Obstetric hemorrhage is one of the leading causes of maternal death worldwide. Many of these deaths occur in low-resource settings and are preventable with timely and comprehensive treatment. Delays in accessing definitive care increase the risk of mortality or severe morbidity with hemorrhage. These delays include recognizing complications, deciding to seek care, finding transport to care, and receiving quality comprehensive emergency obstetric care at referral facilities.

The non-pneumatic anti-shock garment (NASG) is a low technology first-aid device that buys a woman time to seek definitive and adequate treatment. Made of neoprene and Velcro (Velcro Industries), the NASG comprises six segments: an ankle segment pair, a calf segment pair, a thigh segment pair, a pelvic segment, and two abdominal segments, one of which contains a compression ball. The segments are closed tightly around a woman's lower body; circumferential counter-pressure decreases blood flow to the lower body while increasing circulation in the vital organs of the upper body. This serves to reverse shock and provide time for transportation, blood transfusion, or surgery, particularly in under-resourced and overcrowded settings. The NASG is designed to provide total perineal access as well as stretching in the abdominal segment so that the condition of the uterus can be assessed. NASG application improves access to veins in the arm, thus aiding fluid replacement. The NASG can be safely worn for up to 48 hours, may help avoid unnecessary emergency hysterectomy for intractable uterine atony, and may decrease the need for or the number of blood transfusions. The NASG is reusable and can be disinfected with a 0.01% bleach solution, laundered, hung to dry, and has been tested to last at least 72 washings/uses.

Studies in Egypt, Nigeria, India, Zambia, and Zimbabwe have demonstrated the NASG's efficacy at the tertiary level [1–5]. A systematic review of NASG studies showed a significant 39%—60% reduction in mortality for recipients [6]. These studies also showed statistically significant reductions in blood loss and more rapid recovery from shock. A recent cluster randomized controlled trial at the primary health center level demonstrated a statistically significant decrease in time to recovery from shock and nonsignificant trend toward a reduction in mortality (54% decrease), with no increase in adverse effects [7].

The World Health Organization has added the NASG to its 2012 guidelines for postpartum hemorrhage [8] and included advice for implementation for policy makers to: (1) review their protocols and add NASGs; (2) review their medical and nursing curricula and add NASGs; and (3) procure NASGs for country level programs [9].

Table 1
FIGO recommendations on use of the non-pneumatic anti-shock garment for hypovolemic shock secondary to obstetric hemorrhage.

Population	Any pregnant or postpartum woman with severe hemorrhage showing signs of shock/hemodynamic instability, at the primary healthcare level or if transport to higher facility is necessary: EBL 500 mL, SBP <100 mm Hg, pulse >100 bpm; at high-level facilities: EBL >1000, SBP <90 mm Hg, pulse >110 bpm (or per facility protocols)
Recommendation	Rapidly apply NASG starting at the ankles. NASG to remain in place until source of bleeding found, and bleeding decreased to 25–50 mL/h
Scientific evidence	4 pre/post studies, 1 randomized controlled trial, 1 systematic review
Modifications	Depending on capacity of facility and staff, the NASG could either be applied as first-line first aid before any other intervention or could be used to reverse shock when other methods to stop bleeding have failed, or while awaiting definitive therapy (embolization, surgery, blood transfusions)
Grade	B (temporizing measure)

Abbreviations: EBL, estimated blood loss; SBP, systolic blood pressure; NASG, non-pneumatic anti-shock garment.

Given the devastating consequences of obstetric hemorrhage, and the fact that many women give birth in under-resourced settings where they need to overcome delays, The International Federation of Gynecology and Obstetrics (FIGO) recommends the following:

1. Countries' health systems should examine maternal mortality data or investigate through maternal mortality reviews or audits to determine if hemorrhage is a major contributor to maternal mortality. If it is, follow with point two listed below.
2. Conduct a more in-depth examination of contributing factors. Using the three delays framework (recognition and decision-making; distance and transport; prompt, quality care in facilities), if the second and third delays (transport and delays in receiving blood and surgery) are contributing factors to high rates of maternal mortality from hemorrhage, then consider adding NASGs to the health system.
3. If a decision is made to add NASGs as temporizing first-aid devices, training should start at the referral facility level a few months before introducing at the lower levels or on ambulances.
4. Once referral facilities are proficient in NASG use, training can be conducted at lower level facilities and for ambulance personnel.
5. Training sessions should be both didactic and hands on, with emphasis on practicum. NASG is easy to use, but ease of use increases with practice.

☆ These guidelines were approved by the FIGO Executive Board in July 2014.

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Box 1
Protocols for applying and removing the non-pneumatic anti-shock garment.

1. Set criteria for NASG use, for example bleeding >750 mL, and either systolic blood pressure <90 mm Hg or pulse >110 bpm.[a]
2. Place woman on open NASG.
3. Ensure that the NASG is placed properly, with the top of the NASG segments at the patient's lowest rib, and the pressure ball over the umbilicus.
4. Start tightly closing each segment pair, beginning at the ankle, first segments, and ending with the fifth and sixth segments directly over the umbilicus.
5. The NASG is adjustable for short women: fold back the ankle segment into the number two segment and close the number two segment on the ankle.
6. To check if the NASG is tight enough, place one or two fingers under the top layer of the NASG segment, pull back the fabric, and let it go. If the segment is tight enough, it will make a sound like the snapping of your fingers.
7. Once placed, ask the woman (if she is conscious) to take a deep breath to be sure she can breathe normally.
8. Consider other means to stop bleeding where available such as uterine balloon tamponade. Routine shock/hemorrhage protocols should be followed, IVs, uterotonics as necessary, examine for source of bleeding, suturing lacerations, blood transfusions and/or surgeries as indicated. Uterine tone can be assessed easily as the abdominal segment stretches to allow uterine palpation. The NASG can remain in place during any vaginal procedure. If surgery is necessary, open only the abdominal segment, and only when the surgery is ready to begin. Close the abdominal segment after the surgery.
9. The NASG must remain on until the source of bleeding is found, corrected, and the woman is no longer bleeding any more than 25–50 mL blood/hour and the pulse and systolic blood pressure have stabilized (approximately pulse <100 bpm, systolic blood pressure >100 mm Hg, e.g. "Rule of 100").
10. Only remove under supervision. The IV should remain running. Take pulse and blood pressure before beginning the removal process:
    a. Removal always begins at the ankle segments.
    b. Open both ankle segments, wait 15 minutes, retake blood pressure and pulse.
    c. As long as there is no change in vital signs (>20 bpm pulse or fall in systolic blood pressure of 20 mm Hg), continue opening each segment pair (number two, number three), waiting 15 minutes, rechecking vitals before proceeding to next segment.
    d. Open single segment four, wait 15 minutes, and then fifth/sixth segments in the same way until the NASG is completely opened. This process takes 1 hour.
    e. If at any time the blood pressure or pulse does change (>20), rapidly reclose the NASG, and look for the source of bleeding.
11. There are no absolute medical contraindications to use of NASGs for women with severe hypovolemic shock. Treating the shock is the most critical aspect of care.
12. Watch for dyspnea and decreased urine output as potential signs of the NASG being too tight; either is very rare. If either occur, slightly loosen the NASG fifth/sixth abdominal segments.[b]

Abbreviation: NASG, non-pneumatic anti-shock garment.
[a]Level of blood loss, systolic blood pressure, and pulse rates will vary. Examples include: range of estimated blood loss: 500, 700, or 1000 mL; systolic blood pressure <100 or <90 mm Hg; pulse >100 or 110 bpm.
[b]Extensive protocols and training tools are available at: www.safemotherhood.ucsf.edu.

6. NASG should be added to pre-service curricula of medical students, nurses, midwives, anesthesiologists, and healthcare workers who attend pregnant, birthing, and postpartum women.
7. NASGs should be made available wherever feasible, according to needs identified, it can be used at all levels of the healthcare system: referral centers, maternity centers (health centers with skilled attendants), on transport vehicles, etc.
8. Implementation of the NASG should involve monitoring and evaluation to ensure proper use, maintenance, and effectiveness at different levels of the healthcare system.
9. NASGs are part of a continuum of care for postpartum hemorrhage; they are not designed as a stand-alone intervention.

FIGO's recommendations on use of the NASG for hypovolemic shock secondary to obstetric hemorrhage are shown in Table 1.

The protocols for applying and removing NASGs are given in Box 1.

NASGs are currently available from the following manufacturers:

- Blue Fuzion Group: makes small and large sizes, prices vary depending on order quantity. Contact: neil.mcconnochie@bfgroup.asia
- Vissco India: small garments. Prices vary dependent on quantity. Contact: maulin.gandhi@visscoindia.com
- Zoex: small, medium, and large NASGs, prices unavailable. Contact: zoex@connpoint.net

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