

The Use of Anti-shock Garments in the Management of Post Partum Haemorrhage

Idang N. Ojong¹ and Catherine N. Chiotu²

¹Department of Nursing Science,
University of Calabar, Calabar,

²Nursing Services Department,
University of Abuja Teaching Hospital, Abuja,
Nigeria.

Globally, about 11% of the women having live births have severe post partum haemorrhage amounting to 14 million women annually. This paper seeks to explain the use of anti-shock garment in the management of post partum haemorrhage. It also highlighted mechanism of action of anti-shock garment. The associated challenges by its use in continuum of care in post partum haemorrhage was discussed and recommendations made.

Introduction

The WHO estimates that about 600,000 women die every year as a result of child bearing and most of these occur in the developing countries and many of them are preventable (WHO, 2010). Major causes of maternal deaths are haemorrhage, infections, eclampsia, obstructed labour, unsafe abortion, malaria, anaemia and others (WHO, UNICEF and UNFPD, 2010).

Haemorrhage account for 25% of the global maternal deaths while in developing countries it account for 35%. Haemorrhage is the major cause of maternal mortality and morbidity. Severe obstetric haemorrhage leads to hypovolaemic shock if it is not reversed with intravenous fluid, blood transfusion and control of the source can lead to tissue hypoxia and subsequent organ death (WHO *et al.*, 2010).

The leading cause of postpartum haemorrhage is uterine atony which is preventable using uterotonic agents such as oxytocin, syntocinon, ergometrin, misoprostol, control cord traction, uterine massage and active

management of the third stage of labour (AMTSL) can reduce the risk of post partum haemorrhage by up to 60%. The current treatment protocols of post partum haemorrhage (PPH) and hypovolaemic shock includes administration of uterotonic agents, bimanual massage, bimanual removal of the placenta, repair of lacerations, blood transfusion and surgery. All of these are unavailable in low resource settings except at tertiary facilities and women may experience long delays even at these facilities (Oladosu, Imran, Hadea and Miller, 2011).

In low resource settings where delays in management of PPH occur, first aid is needed to stabilize women and increase their chances of survival until definitive treatment is obtained. The Non Pneumatic Anti-shock Garment (NASG) is a low technology first aid device made up of neoprene and hook-and-loop fastening tape that is placed on the legs, thigh, pelvis and abdomen which exert circumferential pressure on the lower half of the body thereby reducing the total vascular space and increasing the volume of blood in the central circulation and translocating the oxygenated blood to the vital organs. It leads to the reversal of haemorrhagic shock and the stabilization of the patient while awaiting transport, during transport or during delays in receiving care at referral facilities (Oladosu *et al.*, 2011).

Anti-shock Garment is a new technique and has been proven to be effective in the management of post partum haemorrhage. In view of the above, the study was designed to assess the use of anti-shock garment in the management of post partum haemorrhage.

Post Partum Haemorrhage

Post partum haemorrhage (PPH) is defined as an excessive bleeding from the genital tract at any time following birth to up to six (6) weeks after delivery. If it occurs during the third stage of labour or within 24 hours of delivery, it is termed primary post partum haemorrhage while, if it occurs subsequent to the first 24 hours following birth until 6th weeks post partum it is termed secondary post partum haemorrhage (Fraser and Cooper, 2008). While according to World Health Organization (2008), post partum haemorrhage (PPH) is defined as a loss of 500 ml or more of blood from genital tract after delivery, but it is important to remember that a lower level loss can cause the women's condition to worsen in certain circumstances. This will include the presence of anaemia or other medical conditions such as cardiac disease like congestive cardiac failure. Usha and Indu (2008) defined PPH as blood loss of more than 500 ml of blood after delivery and blood loss exceeding 1000 ml is considered physiological significant and can result in haemodynamic instability, while

Miller *et al.*, (2009) defined PPH as vaginal bleeding excess of 500 ml after vaginal delivery and in excess of 1000 ml after caesarean delivery.

Epidemiology of Post Partum Haemorrhage

Globally, about 11% of women having live births have severe PPH amounting to 14 million women annually. Even with appropriate management, approximately 3% of vaginal deliveries result in post partum haemorrhage. The incidence is higher in operative deliveries that is 6.4% in caesarean deliveries especially when conducted under general anaesthesia and 3.9% in vaginal deliveries (Usha and Indu, 2008).

According to WHO every year it is estimated that worldwide more than 500,000 women die of complications of pregnancy and childbirth. At least 7 million women who survive childbirth suffer serious health problems and a further 50 million women suffer adverse health consequences after childbirth. The overwhelming majority of these deaths and complications occur in developing countries. According to Oladosu *et al.* (2011), a woman suffering from PPH can die within 2 hours unless she receives immediate and appropriate medical care, WHO estimate that 150,000 women bleed to death each year from PPH with over 99% of these deaths occurring in developing countries. Women in developing countries are more than 40 times more likely than women in developed countries to die in childbirth (1 in 61 in developing and 1 in 2,800 women in developed countries).

Aetiology and Risk Factors Involved in Post Partum Haemorrhage

Excessive bleeding occurs because of an abnormality in one of four basic process, referred to as the '4Ts' mnemonic, either individually or in combination: tone (poor uterine contraction after delivery), tissue (retained products of conception or blood clots), trauma (to genital tract) or thrombin (coagulation abnormalities). Many risk factors associated with PPH may be attributed to an abnormality in one of these four physiological mechanisms (Ramanathan and Arulkumaran, 2006).

Prevention of Post Partum Haemorrhage

Active management of third stage of labour is evidence-based, feasible and low cost intervention to prevent PPH and can prevent 60-70% of atonic PPH. Active management which involves administration of uterotonic drug soon after the delivery of the baby, controlled cord traction with simultaneously counter pressure to the uterus supra-pubic and usually early cord clamping and cutting the cord, decreases the risk

TABLE 1
Aetiology and Risk Factors for the 4Ts Processes Involved in PPH

Process	Aetiology	Risk factors
Tone	Uterus: over-distension Muscle fatigue Infection Distortion or abnormalities Relaxing drugs	Multiple pregnancy, macrosomia, foetal abnormalities, prolonged labour, high parity, previous pregnancy with PPH, prolonged spontaneous rupture of membrane, fever, fibroid uterus, placenta praevia, anaesthetic drugs, NSAIDS, nifedipine, MgSO ₄
Tissue	Retained placenta/membrane Accessory lobe/abnormal placenta e.g. succinturiate	Incomplete placenta at delivery Abnormal placenta on ultrasound, previous uterine surgery
Trauma	Cervical/vagina/perineal tears Extended tear at caesarean section Uterine rupture or inversion	Precipitous delivery, manipulations at delivery, episiotomy, malposition, foetal manipulation, deep engagement, previous surgery, extensive traction of cord.
Thrombin	Pre-existing clotting abnormalities Acquired in pregnancy Idiopathic, thrombocytopenic purpura	History of coagulopathy or liver disease, high blood pressure, bruising, foetal death, fever, raised white blood cell count

Source: Ramanathan and Arulkumaran (2006).

of PPH and shortens third stage of labour with no significant increase in the risk of retained placenta. After the delivery of placenta, give gentle massage of the uterus to promote uterine contraction and to minimize bleeding (Usha and Indu, 2008). Stacie *et al.*, (2007) state that active management of the third stage of labour is an evidence-based means of preventing PPH as there is no predictive factor for PPH. In most cases, haemorrhage comes as a complete surprise. Thus, every woman should benefit from available preventive measures. The active management of the third stage of labour includes:-

Steps in Active management of and stage of labour:

- I. Give oxytocin immediately:
 - i) Within 1 minute of birth of the baby, palpate the abdomen to rule out the presence of an additional baby(s) and give oxytocin 10 units intramuscularly.
 - ii) Quickly dry and wrap the baby and give to mother if appropriate.

- II. Deliver the placenta by controlled cord transaction:
 - i) Just prior to performing cord traction clamp the cord close to the perineum using sponge forceps.
 - ii) Hold the clamped cord and the forceps with one hand
 - iii) Keep slight tension on the cord and await a strong uterine contraction (2-3 minutes)
 - iv) Place the other hand just above the woman's pubic bone and stabilize the uterus by applying counter traction during controlled cord traction. This helps prevent inversion of the uterus.
 - v) When the uterus becomes rounded or the cord lengthens, very gently pull downwards on the cord to deliver the placenta.
 - vi) Do not wait for a gush of blood before applying traction on the cord
 - vii) Continue to apply counter traction to the uterus with the other hand
 - viii) If the placenta does not descend during 30-40 sec of controlled cord traction (i.e. there are no signs of placental separation), do not continue to pull on the cord.
 - ix) Gently hold the cord and wait until the uterus is well contracted again.
 - x) If necessary, use a sponge forceps to clamp the cord closer to the perineum as it lengthens

- xi) With the next contraction, repeat controlled cord traction with counter traction. NEVER PULL ON THE CORD WITHOUT PUSHING THE UTERUS UP WITH THE OTHER HAND

Anti-shock Garment

Pregnancy and childbirth related injuries are the second leading cause of loss of years of healthy life among women of reproductive age in developing countries. For every case of maternal mortality, there are 30 maternal morbidities which compromise women's life time, family health, and ability to participate in community life. In developing countries, an annual estimate of 18 million women experience obstetric complications that result in long term disability (Miller *et al.*, 2009). Obstetric complications leading to maternal morbidity or mortalities include: obstetric haemorrhage, toxemia, sepsis, anaemia, obstructed labour and abortion. Obstetric haemorrhage contribute to about half ($\frac{1}{2}$) of the maternal deaths (Miller *et al.*, 2009).

Post partum haemorrhage is the most common cause of obstetric haemorrhage and 1 of the 5 leading causes of obstetric haemorrhage can be fatal even in high resource settings such as United Kingdom. 10 of the 17 maternal deaths that occurred in 2003-2005 were from post partum haemorrhage (Miller *et al.*, 2008). One recently recommended first aids device for obstetric haemorrhage is the Anti-shock Garment. The International Federation of Gynaecology and Obstetrics (FIGO) and International Confederations of Midwives (ICM) advice exploring the potential of the Anti-shock Garment (ASG) to reduce the mortality associated with obstetric haemorrhage because a woman suffering from PPH can die within 2 hours unless she receives immediate and appropriate medical care. In-low resource settings where delays in management of PPH occur, first aid is needed to assist women and increase their chance of survival until definitive treatment is obtained (Mohammed, 2010).

The non-pneumatic Anti-shock garment is a first aid lower body pressure device made from neoprene and velcro (Zoescorp, Oreg, USA) comprised of nine (9) segments which are wrapped tightly around a woman's legs pelvis and abdomen; a foam compression ball in the abdomen segment applies focused external pressure to the uterus. This device exerts circumferential pressure on the lower half of the body thereby reducing total vascular space and the same time increasing volume of blood in the central circulation and translocating oxygenated blood to the vital organs. These mechanisms of action result in the reversal of haemorrhage shock and stabilization of the patient while awaiting transport, during transport or during delays in receiving care at referral facilities (Oladosu *et al.*, 2011).

According to Mohammed (2010), the Non Pneumatic Anti-shock Garment (NASG) is uniquely suited for use in low resource countries due to its simple design and relatively low cost. Currently, the device cost one hundred and seventy U.S. Dollars (\$170) which is equivalent to twenty six thousand three hundred and fifty naira only (26,350) and training for application is relatively brief. After decontamination and laundering, the device can be re-used up to 40 times. Virginal procedures are performed with NASG in place and abdominal surgery can be conducted by opening the abdominal segment during surgery.

According to Miller and Mohammed (2010), the Non-inflatable Anti-shock Garment (NIASG), is a neoprene garment much like the bottom half ($\frac{1}{2}$) of a wet suit, design in horizontal segments. Using elasticity of the neoprene and velcro fasteners, the garment can apply 30-50 mmHg of pressure to the lower body pressure. NASG is a refinement of the procurematic military (medical) Anti-shock trousers. Both devices provide circumferential counter pressure to the lower body as a means of resuscitation from hypovolaemic shock and haemostasis for bleeding in the lower body.

While Abdurrahman and Umar, (2013) proposed that the NASG is lower body suit articulated neoprene and velcro segments, provides lower body circumferential counter pressure that restores blood pressure (BP) to the core. In a pilot study of obstetric haemorrhage, the NASG significantly decreased bleeding by 50%, decreased morbidities and improved survival.

The Non Pneumatic Anti-shock Garment (NASG) is used to reverse and control haemorrhage during delays in transport from home to the hospital or obtaining appropriate care at the facility level. The NASG is lower body pressure device made from neoprene and hook-and-p fastening tape (Velcro Manchester, MH, USA) that is placed on the legs, pelvis and abdomen. It comprises of nine (9) horizontal segments: 3 for each leg (ankle, calf and thigh), 1 for the pelvic and 1 double segment with a foam compression ball for the abdomen. This device shunts blood from lower extremities to the core organs and decreases the transmural pressure and radius of the uterine, abdominal and lower body vessels, thus decreasing blood flow (Miller and Mohammed, 2010).

Management of Haemorrhage Using Anti-shock Garment (ASG)

Introduction

One out of every four maternal death is due to obstetric haemorrhage (bleeding or blood loss during pregnancy; labour and within 42 days of

termination of pregnancy). Sadly, most of the causes of these deaths are due to one form of delays.

The introduction of Anti-shock Garment (ASG) in the management of severe cases of bleeding especially in patients with hypovolaemic shock had save many lives. Though, this device is novel and is still presently on trial in some countries including Nigeria, results emanating from these trails are promising. Relations of women that were saved with this garment added other names to this device such as “AYORUNBO”. (The one that has come back from heaven), (Miller and Mohammed, 2010).

Anti-shock Garment (ASG)

It is made from an elastic material and when applied, it looks like a trouser. It is labeled 1, 2, 3, 4, 5 and 6 from leg to the navel.

It is:

- a) Efficient
- b) Simple
- c) Easy to apply
- d) Safe for the patients.

When to Apply ASG

Patient with severe blood loss with the following features:

- a) Vital signs: When peripheral pulse is ≥ 100 beats/minute and or blood pressure of $\leq 80/50$ mmHg.
- b) Shock: May manifest as generalized body weakness, dizziness or fainting attacks, loss of consciousness profuse sweating, cold palms or feet, small or absent peripheral pulses and unrecordable blood pressure.

When not to Apply ASG

- a) Pregnant patient with a living foetus
- b) When bleeding is from the chest region
- c) Patient with hearts disease.

Who can Apply the ASG to the Patients

- a) Doctors
- b) Nurses/midwives
- c) Chew
- d) Other health care personnel including drivers.

How to Apply ASG Rules

- a) It must be applied by a single person.
- b) It is better applied on a flat surface.

Specific Application of the NASG

It is advisable that the likely user of this device watch at least a practical demonstration session before trying it because wrongful application will not achieve the expected result on the patient. Following is the sequential protocol:

- a) Patient should be made to lie on flat surface
- b) Put on a gloves
- c) Open the ASG
- d) The patient should be placed on it making sure that the part of ASG labeled Navel (5) matched the patient's naval.
- e) Wrap the garment from each end starting from the lowermost part of the leg (labeled 1) to the naval region. Do this one at a time on each side.
- f) Monitor the patient's pulse rate and blood pressure every 15 minutes till she is stable (i.e. PR <100 beats/minute and or BP >90/50 mmHg).
- g) Monitor the urinary output hourly
- h) Resuscitate the patient with intravenous fluids and or blood as required (Give every 3 ml of fluids of 1 ml of blood loss).
- i) Then look for the cause of haemorrhage
- j) If you can not handle the patient then, refer the patient to the nearest health care facility with a physicians while still on ASG.

1. GENERAL APPLICATION OF THE NASG

There are five steps which needs to be followed accordingly:

- a) **Step 1**
 - i) To apply the NASG, place it under the woman, the top of the NASG should be at the level of her lowest rib.
 - ii) Starting at the ankles, close segments #1 tightly around each ankle.
 - iii) Tight enough so that you can snap it and hear a sharp sound!
- b) **Step 2**
 - i) Next, close segment #2 as tightly as possible
 - ii) Try to leave the woman's knee free so that she can bend her leg. She may be in the NASG for a long time

- c) **Step 3**
 - i) Apply segments #3, the thigh segments, in the same way as segments #1 and #2
 - ii) Remember: Tight enough so that you can snap it and hear a sharp sound!
- d) **Step 4**
 - i) Segment #4, the pelvic segment, goes all the way around the woman at the level of the pubic bone
- e) **Step 5**
 - i) Place segment #5, with the pressure ball, over her umbilicus
 - ii) Then, close the NASG using segment #6
 - iii) Even if there are two people placing the leg segments, **only one person**, using as much strength as possible should close the abdominal segment
 - iv) Do not close the segment so tightly that it restricts her breathing
- f) **When Finished**
 - i) Make sure the patient can breathe normally with the NASG segment #6 in place.
 - ii) If the source of bleeding appears to be uterine atony, administer uterotonic drugs and massage the uterus. The NASG stretches, allowing room for your hand.

2. APPLICATION IF THE WOMAN IS UNCONSCIOUS

In this case you will need 2 people:

- a) **Step 1**
 - i) Fold the NASG in half along the dotted line
 - ii) Then, turn the woman on her side with her back facing you and place the dotted line along the woman's spine.
 - iii) Push the flat half of the abdominal and pelvic sections under her body.
 - iv) Principle is the same as that of making an occupied bed.
- b) **Step 2**
 - i) Then, roll her back towards you, turning her to her other side, spreading the NASG under her.
 - ii) Then, have the second person helping pull the flat half of the abdominal and pelvic sections out from under the woman.

c) Step 3

- i) Finally, close the NASG starting at her ankles.

How ASG Work

- a) It divert blood from peripheral areas of body to vital organs like kidney, heart and brain.
- b) It reduces the amount of blood loss especially bleeding from the lower part of body.

Working Mechanisms of ASF

The theoretical framework employs laws of physics that discuss the working mechanisms of anti-shock garment. These include the following laws:

- i) Poiseuille's law: $F = (P_1 - P_2) R^4/8NL$
- ii) Laplace law: $T = PR$

Theoretical Framework

The theoretical framework employs laws of physics that discuss the working mechanisms of Anti-shock Garment. These include the following laws:

1. Poiseuille's law: $F = (P_1 - P_2) R^4/8NL$

F = Flow, P_1 = entrance pressure, P_2 = exit pressure, R = radius, N = viscosity, L = length. The rate of flow through a blood vessel is associated with the size of the vessel radius, so that the blood flow rate that can pass through a blood vessel per unit time is related to the fourth power of the radius. By placing external pressure on the vessels and reducing the vessel radius by one half, the NASG will reduce the blood flow through the vessels by pressure. Decreasing the vessel radius has three outcomes: i) A decreased volume of blood in those vessels compressed by the NASG, ii) A reduced flow of blood through the compressed part of the vascular system which increases flow in the rest (uncompressed areas) of the circulatory system, and, iii) If the flow remains the same to those vessels with reduced diameters, more pressure is required to force it through, (systematic vascular resistance). All of these results in increased perfusion to the uncompressed parts of the body (core organs).

2. Laplace Law: $T = PR$

T = Tension inside a blood vessel, P = Transmural pressure, and R = Vessel radius.

The NASG places external counter pressure, thus compressing lower body and splanchnic blood vessels, and reducing both the transmural pressure and the radius of the vessels. These synergistically reduce the difference in tension across the vessel, which in turn reduces blood loss.

Advantages of ASG

- a) Stabilizes the patient while trying to look for the cause of bleeding.
- b) Keep patient alive while transporting to a referral centres
- c) May stop bleeding and thus prevent surgery
- d) May reduce or prevent blood transfusion and its associated problems
- e) It can be applied by any trained health care personnel.

Removing the NASG

Following four steps needs to be taken into account very carefully:

a) Step 1

i) Begin removing the NASG only when the woman's condition is stable

- a) Bleeding has stopped <50 mL/hour
- b) Hemoglobin level is >7 or the hematocrit 20%
- c) Pulse <100 and the systolic blood pressure >100 mlHg

b) Step 2

i) Removal of the NASG begins with the lowest segment i.e. #1 or #2 if the woman is short and proceeds upwards.

ii) Wait 15 minutes while removing each segment for redistribution of blood

iii) Before proceeding to the next step, note pulse and blood pressure.

c) Step 3

i) 15 minutes later remove the next section

ii) Before proceeding to the next step, note pulse and blood pressure.

iii) Continue following this procedure: Remove a segment, wait 15 minutes, note pulse and blood pressure.

d) Step 4

Continue following this procedure until all parts of the NASG are removed

Problems removing the NASG**a) Rule of 20:**

If the blood pressure falls by 20 mmHg or The pulse increases by 20 beats/min after a segment is removed. Then do the following:

- i) Rapidly replace all segments, starting at segment #1, and consider the need for more saline or blood transfusions.
- ii) If there is recurrent bleeding, replace the NASG and determine the source of bleeding.

Associated Challenges of NASF Use in Continuum of Care for Post Partum Haemorrhage

Implementation framework according to WHO, 2010 are:

1. Key elements are:
 - a) Staff training
 - b) Implementation
 - c) Monitoring.
2. Staff training
 - a) Nigeria/India team – trains doctors, nurses and midwives and other related individuals
 - b) Training covers application, removal, care and maintenance of NASG as well as treatment of shock with IV fluids.
 - c) Once staff are trained, garments are given to each facility.
3. Implementation
 - a) All trained staff may place garment when needed.
 - b) In any location, the aim is to train tertiary, secondary and primary centers so they can collaborate
 - c) Primary and secondary facilities can refer to tertiary center for definitive treatment and removal of NASG.
4. Monitoring
 - a) Continual monitoring of the implementation process

- b) Monitoring system should be in place to ensure adherence to protocol and track outcomes.
- c) Garments need to be replaced if no longer effective.

Summary and Conclusion

Haemorrhage is the leading cause of maternal mortality and account for 35% of maternal mortality in developing regions despite the fact that it is preventable (WHO, 2010).

Anti-shock garment is a new technique and has been proven to be effective in the management of post partum haemorrhage. It is used to reverse shock and control of haemorrhage during delays and helps in supply of blood to the peripheral organs like brain, liver and kidneys monitoring system should be in place to ensure adherence to protocol and track outcomes after training.

Recommendation

Keeping in mind the importance of PPH following are the recommendations:

1. Seminars and workshop on Anti-shock garment should be organized for nurses and midwives working in maternity unit.
2. Effort should be made in ensuring adherence to protocol and the need to have the protocol written in English/local language after training.
3. Trained staff should be monitored and also continual monitoring of the implementation process should be conducted.
4. More Anti-shock garments should be provided to all the levels of health care facilities.

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