

## USE OF ABDOMINAL BINDER AS ANTI-SHOCK GARMENT; AN ADJUNCT TO UTERINE TAMPONADE IN UTERINE ATONY

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### ABSTRACT

**Objective:** Aim of the study was to control life threatening post partum haemorrhage (PPH) in women till blood and blood products were made available or the women transferred to a better equipped centre.

**Study Design:** A prospective interventional consecutive case series.

**Place and Duration of Study:** It was conducted in three hospitals; Heavy Industries Taxila (HIT) hospital Apr 2005 to Sep 2010, Pakistan Ordinance Factories (POF) hospital Wah cantt Oct 2011 to Dec 2014 and Combined Military Hospital (CMH) Tarbela Dec 2014 to Dec 2015.

**Material and Methods:** Abdominal binder was used in 22 consecutive women, having moderate to severe primary PPH due to uterine atony, where despite uterotonics (i.v oxytocin, rectal misoprostol) and bimanual compression, uterine tamponade was performed but complete control of haemorrhage was not achieved. Protocols for the treatment of obstetric haemorrhage and hypotensive shock were observed, including administration of intravenous crystalloid fluids and blood transfusion. If required, surgery was performed in the form of uterine arteries ligation or B-Lynch sutures. Obstetric hysterectomy was performed to save the woman's life if conservative procedures failed.

**Results:** Bleeding and hypotension were controlled successfully in 19 (86.4%) of these women. In 03 (14.6%) women, bleeding persisted and so hysterectomy had to be resorted to. There was no maternal mortality. At 06 weeks postnatal follow up, none of the patients were found to suffer from long term debility; physical or psychological.

**Conclusion:** Abdominal binder was found to be very effective in controlling bleeding and hypotensive crisis due to significant PPH due to uterine atony, as an adjunct to uterine tamponade.

**Keywords:** Abdominal binder, Non-pneumatic anti shock garment, Post partum haemorrhage, Uterine atony.

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### INTRODUCTION

Postpartum haemorrhage (PPH) remains one of the leading causes of maternal mortality worldwide especially in low resource settings<sup>1-3</sup>. Uterine atony constitutes 70% of all PPHs<sup>4</sup>. Recently a rise in the rate of PPH has been reported from developed countries<sup>2</sup>. World Health Organization statistics suggest that 25% of maternal deaths are due to PPH, accounting for more than 100,000 maternal deaths per year<sup>2</sup>.

Uterine atony is a failure of the uterine muscle to contract and retract. Retraction is a unique characteristic of the uterine muscle to maintain its shortened length following each

successive contraction<sup>2</sup>. At term, the blood supply of the placenta is approximately 500-700 mL/min. The blood vessels that supply the placenta traverse a crisscross matrix of myometrial fibres<sup>2</sup>. As these fibres contract and retract, these blood vessels are compressed and blood flow to the placenta is occluded.

Significant PPH is especially life threatening in low resource settings because of lack of timely availability of blood and blood products, anaesthetic services, intensive care facilities and trained care providers.

Various methods have been devised and used to reduce obstetric haemorrhage and reverse shock; as a means of delay till transfer to a centre with appropriate emergency care facilities or improved care in a tertiary care facility. Initially

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G suit and then MAST (Medical and military anti-shock trousers) were used<sup>4</sup>. They were pneumatic where a pressure of 20 to 40 mmHg was employed on the legs and also the lower abdomen<sup>5</sup>. Non pneumatic devices are also being used as anti-shock methods. The NASG (Non pneumatic anti-shock garment) applies pressure to the lower body and abdomen, thereby stabilizing vital signs and resolving hypovolemic shock<sup>6</sup>.

We have used abdominal binder as an anti-shock device to reverse shock and decrease bleeding among women with moderate and severe obstetric haemorrhage and hypovolemic shock due to uterine atony. It was used in conjunction with uterine tamponade, when uterine massage and uterotonics failed to maintain a persistent uterine contraction. This increased intra-abdominal pressure was transmitted to the uterus and blood vessels, compressing the uterine and abdominal arteries; reducing blood supply to the lower extremities and shunting blood from abdominal area to the vital core organs. Uterine wall was now compressed between increased intra-abdominal pressure and pressure of intrauterine tamponade. Both these measures combined to reduce the bleeding surface, and compressed the muscle matrix and the vessels in the uterine wall, thereby reducing uterine bleeding. According to the laws of Physics especially Laplace's law, this reduction in the radius of blood vessels and compression on the uterus was effective in reducing blood loss<sup>7</sup>. Once the blood loss was reduced, recovery from shock and hemodynamic stability occurred quickly. Vital signs of the women stabilized early with replacement. The study was conducted in peripheral hospitals where supply of blood products was limited. This was used as a temporizing procedure to control haemorrhage.

It was used as a low-tech device in a low resource setting.

## **PATIENTS AND METHODS**

This prospective interventional consecutive case series including 22 consecutive women was

conducted in three hospitals; Heavy Industries Taxila (HIT) hospital April 2005 to Sep 2010, Pakistan Ordinance Factories (POF) hospital Wah cantt Oct 2010 to Dec 2014 and Combined Military Hospital (CMH) Tarbela Dec 2014 to Dec 2015.

All women with moderate and severe primary postpartum haemorrhage due to uterine atony; where due to a failure of bimanual uterine massage and uterotonics in controlling haemorrhage, uterine tamponade had to be done. Abdominal binder was used to control the bleeding and reduce the need for further intervention. Post partum haemorrhage cut off of a 1000ml was used for entry into the study. Some un-booked patients with home delivery and collapse (blood loss unknown) or those who presented with collapse at blood loss less than this cut off (due to baseline anaemia) were also included. Women after 26 weeks of pregnancy were included in the study. (Before this gestation the case would be labelled as a miscarriage in a low resource country). Women with all other causes of PPH were excluded from the study. Women with placenta percreta were also excluded from the study.

When uterine atony was found to be the cause, after vaginal delivery or caesarean section, and was not corrected by uterotonics and uterine massage, then uterine tamponade was done. Abdominal binder was also applied to reverse shock and keep the patient stable vitally. The abdominal binder was applied with 2 thick hospital gynae pads applying pressure on the uterine fundus, to compress the uterus externally. Uterus was already packed internally. Abdominal binder applied circumferential pressure on the lower abdomen increasing the intra-abdominal pressure.

First two thick hospital gynae pads were placed abdominally at the uterine fundus. An abdominal binder was placed under the lower part of the woman's back. Flaps of one side of the binder were tightly fastened with flaps of the other side starting from above downwards, over

the lower part of the abdomen below or till just above the umbilicus with downward pressure on free elastic and cotton weave material.

Abdominal binders are made of fitted latex

**Table-I: Demography of women having abdominal binder (n=22).**

Age	Number	Percentage*
18-19	1	4.5
20-30	9	40
31-40	11	50
>40	1	4.5
Mean		
Body mass index		
18.5 to <25	8	36.4
25 to <30	9	40
≥30	5	22.7
Social Class		
Upper	2	9.1
Middle	7	31.8
Lower	13	59.1
Background		
Urban	7	31.8
Rural	15	68.2
Parity	Number	Percentage*
Nil	5	22.7
1-2	6	27.3
3-4	9	40.9
>5	2	9.1
Mode of delivery		
Caesarean Section	7	32
Vaginal delivery	15	68

\*Percentages have been rounded off.

**Table-II : Educational status and Haemoglobin at admission (n=22).**

Educational Status	Number	Percentage*
Nil to Primary	10	45.5
Middle	3	13.7
Matriculate	2	9.1
Intermediate	4	18.2
Graduate	3	13.7
Haemoglobin at admission (gm/dl)	Number	Percentage*
10.5-12.5	3	13.6
8-10.5	13	59.1
<8	6	27.3

\*Percentages have been rounded off.

the uterus. Flaps were tight enough to cause circumferential compression but allowed the woman to breathe normally.

Abdominal binders are cheap and easily available in various sizes and with varying number of flaps.

For the 7 cases where delivery was by caesarean section B-Lynch sutures and or uterine arteries ligation, were applied. Tamponade and abdominal binder as per protocol followed this. If all conservative measures failed, hysterectomy was performed to save the woman’s life. Those patients who were transferred to tertiary care hospital after stabilization for blood products were also followed till discharge and postnatal period.

**RESULTS**

Of the 22 women included in the study, 5

In 7 (31.8%) the cause of uterine atony was undetermined. In 4 (18.1%) uterine atony followed prolonged labour. HELLP characterized by Hemolysis, Elevated liver enzymes, and a low Platelet count syndrome was present in 2 (09%) women. Pulmonary embolism with disseminated intravascular coagulation (DIC) was present in 01 (4.5%) woman. In 1 (4.5%) of the women polyhydramnios was present due to uncontrolled gestational diabetes. Massive abruption at 26 weeks was seen in 1 (4.5%) woman. Uterine atony was seen in 1 (4.5%) woman at surgery for dehiscence of previous uterine scar and low lying

**Table-III: Comparison of patient profile for successful/non successful binder.**

	Successful cases	Obstetric hysterectomy	P
Number	19	3	
Mean age	32yrs	37yrs	NS
Median parity	3	4	NS
Percentage of unbooked	72.7	100	0.21 (NS)
Complicat-ing factor	Timely arrange-ment of blood & blood products.	Anaemia at presentation & bleeding persisted despite uterine tamponade & abdominal binder	

**Table-IV: Distribution of transferred cases (n=10).**

Transfers	Outcome
PIMS 8	Blood products replacement & recovery
MH 2	Blood products replacement & recovery

**Table-V: Blood products transfused.**

	Transfusion	Number of patients
RCC/Whole blood	1-2	0
	3-4	1
	5-8	13
	9-12	8
FFP	2-4	6
	5-8	12
	9-10	4
Cryoprecipitate		3
Platelet concentrates	2-4	14
	5-8	8

(22.7%) were primipara and 17 (77.3%) were multipara. Table-I mentions the characteristics of women at presentation. Majority belonged to lower socioeconomic class.

placenta at 26 weeks with intrauterine fetal demise. Another (4.5%) had uterine atony following caesarean delivery at term for major degree placenta praevia. One (4.5%) had severe

PPH due to uterine rupture following Vaginal birth after caesarean (VBAC). Placenta praevia with increta was the causative factor in 2 (09%) women (figure).

Vaginal delivery was followed by uterine atony and significant PPH in 15 (68%) women. Caesarean sections or hysterotomies were followed by uterine atony and PPH in 7 (32%) women (table-I). Despite uterine tamponade and abdominal binder, 3 (13.6%) women continued to bleed. All 3 had to undergo hysterectomy due to failure of other methods.

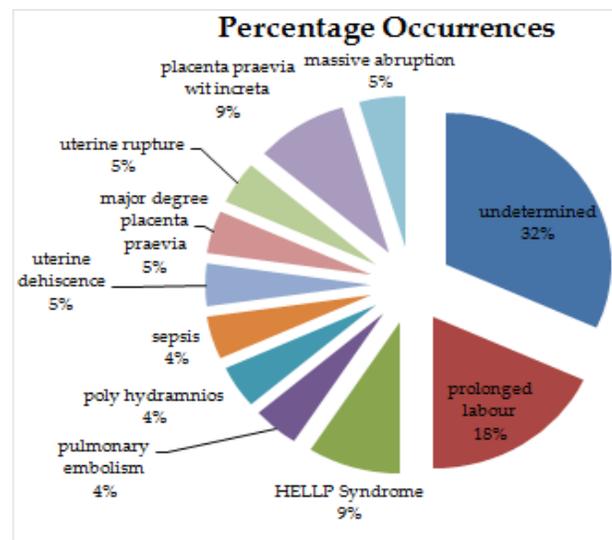
Abdominal binder proved to be a useful adjunct to uterine tamponade in controlling moderate to severe primary PPH due to uterine atony without hysterectomy in 19 (86.4%) women in the study. Table-II shows the distribution of these women as per their parity and education. Majority had low levels of education. Table-II highlights the haemoglobin at the time of admission of these women.

Table-III shows comparison between patient profile of successful and unsuccessful cases of abdominal binder use. The three cases where binder was unsuccessful and life saving hysterectomy had to be resorted to were all unbooked.

After stabilization a total of 10 patients were transferred to Pakistan Institute of Medical Sciences (PIMS) / Military Hospital (MH) Rawalpindi for transfusion of blood products. Out of them 7 women had to be transferred for fresh frozen plasma (FFPs) and platelet replacement, from HIT hospital to PIMS hospital Islamabad. Two of these had HELLP syndrome (table-IV). All of them recovered fully after replacements. Out of the 10, 2 women were transferred from CMH Tarbela, 1 of them, a primigravida, had massive abruption at 26 weeks. She had severe PPH during hysterotomy. She responded well to uterine tamponade and abdominal binder. For further monitoring and intensive care she was transferred to PIMS hospital Islamabad with stable vital signs where she recovered fully after replacement of blood

and blood products. The 2 patients that were transferred in stable condition to MH Rawalpindi had similar outcome.

Table-V shows the blood products given. Majority of women had haematological dysfunction in the form of coagulation disturbance and 8 had massive transfusion. Some women (9) were managed with fresh blood at HIT and POF Wah hospital and responded to treatment, whereas 3 required a life saving obstetric hysterectomy when other methods failed.



**Figure: Percentage occurrences of cases of abdominal binder application.**

\*Percentages have been rounded off

Patients reported at 6 weeks postnatal visit with no long-term physical or psychological debilitating factors.

The data were analysed using descriptive statistic SPSS 16.

## DISCUSSION

Abdominal binder proved to be an excellent support and adjunct to uterine tamponade in saving precious lives in this study. It was found to be useful in low resource settings in stabilizing a bleeding and severely hypotensive woman, till blood and products were made available or transfer to a better equipped centre for replacement with blood and blood products. The

volume replacement requirements were also reduced.

It also helped patient stabilization in tertiary care centres; reducing medical surgical morbidity and patient mortality. Moreover most of the patients were spared the psychological trauma of a hysterectomy as uteri were conserved.

The first recorded use of pressure suit to maintain blood pressure in a hypotensive surgical patient was in 1903 by Crile, followed in 1940s and 1950s G suits, anti-gravity suits, used by fighter pilots to prevent retinal haemorrhage and hypotension. At about the same time, G suit was used in the US to save the life of a woman having PPH with massive intraabdominal bleed which continued despite 2 laparotomies and 57 blood transfusions. The hospital administration sought advice and help from NASA where they came up with this solution. It corrected her bleeding and within 24 hours of its application, only 1 more blood transfusion had to be done. Kaplan and his colleagues first used it in civilian pre medical services in 1973<sup>7-9</sup>.

In early 1990s, it was found that simpler non pneumatic elastic devices, NASG or NIASG (Non inflatable anti-shock garment) could generate these low pressures (20-40mmHg) which were sufficient to control haemorrhage and hypotension<sup>10-12</sup>. Dr Paul Hensleigh, started to use the NASG to treat patients of obstetric haemorrhage locally and in low-resource settings around the world. Suellen Miller, was inspired and started to use it. Miller founded the Safe Motherhood Program. Both the scientists joined hands, formulated a team and conducted studies worldwide in countries like Pakistan, Nigeria, Sudan, Zambia and Zimbabwe etc<sup>13-15</sup>. In Pakistan, they used it in 2004 in 14 women in obstetric shock. They were able to save 13 of them. Our study also found abdominal binder very useful with no mortality in this case series.

The combined results of all the studies on NASG showed that it reduced the odds of death from hypovolemic shock. We had no mortality in our series luckily. In these studies mortality was

linked to certain haemorrhagic aetiologies like placental abruption. In our study failure of tamponade and binder was linked to the same aetiology. Unlike these studies we used abdominal binder as an adjunct to uterine tamponade where the control of bleeding with tamponade alone was not adequate. Their studies showed a reduction in blood loss and mortality by 50% in the PPH patients. By 2012, WHO and FIGO recognised it officially and included it in their guidelines on PPH. A cheaper modification called Lifewrap has been introduced in various countries<sup>7</sup>. Miller<sup>14</sup> found it especially useful for pronounced blood loss of more than 1500 ml. We also found the binder extremely useful in these circumstances.

This study is based on an inspiration by these studies of great scientists who are trying to reduce maternal mortality worldwide. Our modification is in the use of only an abdominal pressure binder. No leg compression is used. Rather uterine tamponade has been used simultaneously while abdominal binder is used as an adjunct in primary PPH due to uterine atony. Uterus is compressed between increased intraabdominal pressure externally and tamponade internally, reducing PPH. It has satisfying results, with a success rate of 86.4% in controlling PPH without hysterectomy with no mortality in this study. Similar study is being carried out in Holy Family hospital Rawalpindi with encouraging results (personal communications with Prof Rizwana Choudry Head of the Department). To date no published study combining the use of tamponade with abdominal binder could be found in literature. Our success rate was 86.4% for a combination of intra uterine balloon and abdominal binder. Large meta-analysis show a success rate between 76-83% for intrauterine balloon alone<sup>16,17</sup>. The extra benefit could be attributable to the binder.

It is recommended to be included in the protocols of the management of PPH. It had a special importance in women who needed to be transferred from low resource centres to tertiary care centres for replacement of blood and blood

products and intensive care facilities. It also helped to avoid further intervention and to conserve uteri in young patients. More studies need to be conducted with the use of only an abdominal binder without uterine tamponade, in areas where there is no trained person available, in cases with PPH due to uterine atony<sup>18-20</sup>. One limitation of the study was that it did not have a control group. Comparative studies may also be done between women in whom abdominal binder is used and in whom it is not used with an intra uterine balloon.

### CONCLUSION

Abdominal binder was found to be very effective in controlling bleeding and hypotensive crisis due to significant PPH due to uterine atony, as an adjunct to uterine tamponade.

### CONFLICT OF INTEREST

This study has no conflict of interest to declare by any author.

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