

A Novel Tourniquet to Reduce Blood Loss during Surgical Treatment of Postpartum Hemorrhage in Cesarean Section

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Abstract: Objective: To evaluate the efficacy and safety of a novel tourniquet in the management of postpartum hemorrhage (PPH) during cesarean section. **Design:** Observational study **Materials and Methods:** This study was conducted in a tertiary university hospital between August 2010 and May 2012. Twenty one women with PPH (group 1) underwent a novel intra-cesarean tourniquet were compared to a well selected matched (21 patients) who developed PPH during cesarean section (group 2). A 16 or 18 French Foley's catheter was inserted around the exteriorized uterus and the infundibulopelvic ligaments at the level of the uterosacral ligaments and tied 3 cm lower to the level of the CS incision. This tourniquet was applied to group 1 before attempting any surgical procedures while stepwise surgical interventions were performed in group 2 according to the hospital protocol. The outcome measures were the intra- and post-operative blood loss, need for blood transfusion, and maternal morbidities and mortalities. Fisher exact and Mann-Whitney tests were used for statistical analysis when appropriate. **Results:** Intra-operative blood loss and the need for blood transfusion were significantly lower in group 1 compared to group 2 ($P < 0.01$). No significant difference between the two groups regarding pre- and post-operative hemoglobin or hematocrite value. Group 2 showed more frequent pyrexia (19% Vs 14%) and wound gapping (19% Vs 9%), however these differences were not significant ($P = 0.50$ and 0.33 respectively). No incidence of urinary injury in both groups. Cesarean hysterectomy was indicated in 10 patients; 5 in each group. One case of maternal mortality and another case with lower limb deep venous thrombosis were recorded in group 2. **Conclusion:** This technique is an effective and safe intervention for controlling postpartum hemorrhage during cesarean section. It may be offered as a preliminary step to prevent massive bleeding and allow time for blood transfusion and further procedures.

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1. Introduction

Primary postpartum hemorrhage (PPH) during cesarean section (C.S) is the most common complication leading to maternal death (1). It contributes to 25-43% of all maternal deaths in developing countries (2). Postpartum hemorrhage remains among the main causes of maternal death in developing and developed countries, and uterine atony is the most common cause (75-90%) of primary PPH (3).

WHO estimated that the annual number of maternal complications of PPH were about 20 millions. In developing world, death from PPH occurs in approximately 1 per 1000 deliveries (4)

In Egypt, PPH is the leading cause of maternal mortality; the maternal mortality rate for PPH was 40 per 100,000. Medical reviews indicated that most of these deaths were avoidable (5). It is an emergency obstetric state that requires a skilled obstetrician to treat it. Primary PPH is defined as blood loss greater than 1000 ml after C.S. in the first 24 hours and is caused by lack of myo-tamponade (3).

Many surgical techniques that require certain surgical skills such as uterine and internal iliac arteries ligation and Uterine compression sutures B-Lynch suture that compresses the uterus will be used before proceeding to hysterectomy(6). However all these previous techniques need time, special skills and sometime ask for calling so the aim of this study was to evaluate this novel tourniquet as a new intervention, and its role in minimizing blood loss during surgical treatment of primary postpartum hemorrhage during CS and comparing retrospectively to those patients do not apply this technique.

Aim of the study

To evaluate this new intervention and its role in minimizing blood loss during surgical treatment of postpartum haemorrhage and comparing retrospectively to those patients don't apply this technique during cesarean section.

2. Patients and Methods

This study was conducted in a tertiary university hospital between August 2010 and May 2012. During that period, forty two patients with C.S deliveries with postpartum hemorrhage met the inclusion

criteria were recruited in the study after approval by the hospital ethics committee. Twenty one women with PPH (group 1) underwent a novel intra-cesarean tourniquet were compared to a well selected matched historical cohort (21 patients) who developed PPH during cesarean section (group 2).

The inclusion criteria of this study was ; women with a tonic PPH not respond to primary measures such as uterine massage, bimanual compression and the use of uterotonics; traumatic lesions not extending beyond the cervix and in cases with abnormal placentation.

However women with coagulopathy disorders, marked uterine adhesions, failed bladder dissection, lower uterine segment tears extended to the vagina, injured retracted uterine artery and antepartum haemorrhage were excluded from the study.

For patients of the study group A, in which the new technique was performed for each case before any advanced surgical techniques was initiated compared to patients of the control group B do not apply the technique in the previous year.

The patient was catheterized under general anesthesia and placed in the Lloyd- Davis position, for ease observation of the vaginal bleeding, the uterus will be exteriorized and re-examined to assess the definite cause of bleeding. After dissection of the bladder, the new technique was done by using Foley's catheter NO 16 or 18F - before the surgical method of controlling the bleeding used - by surrounding it around the infundibulopelvic ligament which is long and relaxes during pregnancy, posteriorly at the level of the uterosacral ligament and tied anteriorly at 3 cm lower to the level of the CS incision with meticulous avoidance the tubal involvement. A special bed linen was put under the patients during the operation time and in the first 24 hours after the operation. The weight of this bed linen was estimated before and after 24 hours to estimate the intra and postoperative blood loss.

The cavity was evacuated and swabbed out and take a brief time after application the catheter for

good assessment, preparation of the facilities, take appropriate decisions, and proceeding without stress. We started firstly by devascularization the uterus by the simple haemostatic figure of eight suture bilateral uterine artery ligation, B-lynch suture, internal artery ligation and even hysterectomy step by step from the simple to the advanced surgical techniques. The foley's catheter loosened intermittently every 20 minute or after every surgical technique done for 1-3 minute during the procedures if take a prolonged time and many procedures will be trial to evaluate the effect of each. And the vagina was checked that the bleeding was controlled before proceeding to the next step. As good hemostasis was secured from the bleeding point and no vaginal bleeding the catheter was removed completely with observation if bleeding recurred, then the uterine incision was now closed in the normal way.

The outcome measures which were addressed in this study; operative blood loss (amount of blood in suction and weighting special disposable bed linen), need for blood transfusion and maternal morbidities and mortalities. The changes in the hemoglobin and hematocrite levels were estimated also, as outcome.

Results were tabulated and statistical analysis was performed using Fisher exact and Mann-Whitney tests were used for statistical analysis. A pvalue of < 0.05 was considered statistically significant.

3. Results

The present study show the mechanical tourniquet can be used with different causes of postpartum haemorrhage even with traumatic lesions not extend deeply, from the study we found that the technique not interfere with the surgical procedures.

With regard to socio-demographic data, the mean age of patients in group A (27.52 ±5.48 years) was compared to (26.19±5.33years) in group B, while the mean parity in group A was (2.52±1.66) compared to (2.05±1.59) in group B and 39.43±1.21weeks in group A was compared to 39.33±1.24 weeks in group B without significant difference in both groups (Table 1).

Table (1): Socio-demographic criteria in both groups

Parameters	Study group N=21 Mean ± SD	Control group N=21 Mean ± SD	<i>P</i> value
Age (year)	27.52 ±5.48	26.19±5.33	NS
Parity	2.52±1.66	2.05±1.59	NS
GA (weeks)	39.43±1.21	39.33±1.24	NS

*NS: non-significant difference.

As shown in table 2 there are no statistically significant differences between pre and post-operative hemoglobin (Hb) and haematocrite levels in both

groups. However, as regard to the blood loss and transfusion, statistical significant differences were found between the both groups.

Table (2): Indicators of the blood loss in both groups.

Parameters	Study group N=21; Mean \pm SD	Control group N=21; Mean \pm SD	P value
Pre-operative Hct (%)	32.95 \pm 2.20	32.93 \pm 2.16	NS
Post-operative Hct (%)	31.92 \pm 2.42	30.69 \pm 2.73	NS
Pre-operative Hb (gm/dl)	10.86 \pm 0.95	10.69 \pm 0.90	NS
Post-operative Hb (gm/dl)	10.43 \pm 1.02	10.07 \pm 1.09	NS
Blood loss(ml)	1976.19 \pm 511.77	3119.05 \pm 1223.77	P < 0.01
Blood transfusion (units)	3.05 \pm 0.97	5.00 \pm 1.73	P < 0.01

* Significant P value (P < 0.05).

The blood loss in atony, placenta accreta, placenta praevia and wound extension is presented in Table 3. The data revealed that, the blood loss in the study group was found to be lower. The differences

were statistically significant in atony, placenta accreta and placenta praevia, but in wound extension no significant difference.

Table (3): Blood loss in relation to cause of haemorrhage in both groups.

	Study group N=21; Mean \pm SD	Control group N=21; Mean \pm SD	P value
Atony	1833.337 \pm 353.55	2750.00 \pm 654.65	P < 0.01
p. accreta	2333.33 \pm 763.76	4500.00 \pm 1154.70	P < 0.01
p. praevia	2166.67 \pm 605.53	3333.33 \pm 1402.38	P < 0.01
Wound extension	1666.67 \pm 288.68	1833.33 \pm 288.78	NS

The variations in the blood loss according to the technique used are shown in Table 4. From these data, we can notice that the blood loss was significantly decreased in the study group as regard to

B-lynch, devascularization, stitches in situ and hysterectomy, but was no statistical significance as regard to repair of extension.

Table (4): The amount of the blood loss in relation to the type of the surgical technique.

	Study group N=21; Mean \pm SD	Control group N=21; Mean \pm SD	P value
B-lynch	1750.00 \pm 267.26	2571.43 \pm 449.88	P < 0.01
Devascularization	2333.33 \pm 288.68	3375.00 \pm 478.71	P < 0.01
Stitches in situ	1500.00 \pm 0.00	2250.00 \pm 353.55	P < 0.01
Repair of extension	1666.67 \pm 288.68	1833.33 \pm 288.68	NS
Hysterectomy	2500.00 \pm 612.37	4800.00 \pm 1095.45	P < 0.01

Table (5) shows maternal morbidities and mortalities in both groups. No significant differences were observed in group A and B as regards to the postoperative complications such as fever and postoperative wound infection. However, in this study, one patient had gaped wound with rectus

dehiscence in group B and one patient had DVT versus no cases in group A. No maternal mortality was recorded in group A versus one case of maternal death occurred in group B after bilateral internal iliac ligation subtotal hysterectomy and due to uncontrolled post-partum hemorrhage.

Table (5): The postoperative complications.

	Study group (N=21)		Control group (N=21)	
	Number	Percentage	Number	Percentage
Pyrexia	3	14.29	4	19.05
Haematometra			1	4.76
Wound infection and gaping	2	9.52	4	19.05
DVT			1	4.76
Partial necrosis and sloughing				
Urinary bladder injury				
Mortality			1	4.76

*DVT deep venous thrombosis

4. Discussion

Postpartum hemorrhage remains a serious life threatening obstetric complication with common risk factors as placenta previa and uterine atony⁽⁷⁾. Published data suggested when a variety of traditional treatment including bimanual compression, oxytocin and prostaglandin is unsatisfactory and fail to control post partum hemorrhage, and operative interventions are required⁽⁸⁾.

So, the idea of this research was stemmed from two aspects, the first one, that we need more time for good thinking and proceeding further without stress of blood loss and in another aspect this technique is popular in gynecological practice especially during myomectomy and recommended by many gynecologists⁽⁹⁾.

Tourniquet can preserve life and fertility and it has been recommended by various authorities worldwide in gynecological practice and recommended as it is simple, inexpensive and quick procedure and the procedure can be performed by surgeon with average surgical skills at unit of limited resources⁽¹⁰⁾.

Up to our Knowledge this is the first study which used this technique in the obstetric practice during postpartum hemorrhage. This novel Tourniquet is simple method and has a prompt effect to control the uterine hemorrhage in a variety of circumstances. It is likely to reduce the blood flow to the uterus from its lateral margins and may also occlude bed vessels. The immediate haemostatic effect can be visualized during application of this technique before surgical interference.

This technique helps uterine compression sutures which have proved to be valuable in the control of massive atonic post partum hemorrhage as an alternative to hysterectomy⁽¹¹⁾ which become more effective and easy done with clear field after tourniquet application and also not interfere with the ligation of uterine, internal iliac arteries and even hysterectomy by giving the time necessary for calling senior obstetrician and proceed in advance step by step.

In our study the decrease in blood loss in spite of the cause of haemorrhage or the type of the surgical interference was significant in the study group, thus the need for blood transfusion was significantly decreased in study group.

After application the technique in group A, the frequency of maternal mortality and morbidity were low, opposite to group (B) as we had one case of maternal mortality due to severe uncontrollable postpartum hemorrhage.

We need more controlled studies with a big number of cases for evaluation this new technique in Obstetric practice to be accepted and used by the Obstetrician as an important preliminary step during management PPH encountered during CS.

Conclusion

It is a simple and rapid intervention with prompt stoppage of bleeding in postpartum haemorrhage. Application as early as possible gives better results. It's recommended that to be an essential preliminary step before any surgical intervention should be considered.

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