

# Compression suture for the control of obstetric hemorrhage due to atony and preservation of the uterus with the Tovar-Montiel technique. Pilot study.

Valentín Tovar Galván M.D.  
Cesar Montiel Murguía M.D.  
Juan Gustavo Vázquez Rodríguez M.D.  
Brenda González Salinas M.D.  
Martha Mejía Ugarte M.D.  
Juan Carlos Hinojosa Cruz M.D.

Mexico City, México

Original Article

Gynecology and Obstetrics



**Background:** Surgical management of obstetric hemorrhage due to atony with preservation of the uterus continues to be a major unresolved challenge.

**Objectives:** To describe the Tovar-Montiel technique and to analyze the results of its performance in a case series with uterine atony.

**Material and method:** Interventional, cross-sectional, descriptive and analytical study in a case series of 30 patients with uterine atony without response to pharmacological management treated in a High Specialty Medical Unit in Mexico City from March 2018 to May 2019. Performed a compressive uterine suture with the Tovar-Montiel technique. Termination of pregnancy, Tovar-Montiel suture time, total surgical time, estimated bleeding, transfusion requirement, other interventions, and outcome were studied. For data analysis, descriptive and inferential statistical measures were used with the SPSS version 25 program.

**Results:** Age  $30 \pm 7.3$  years, parity 3, primiparity 27% and morbidity 60%. The Tovar-Montiel suture was performed in 90% after cesarean section and in 10% after vaginal delivery through an abdominal incision. Tovar-Montiel suture time 2 to 3 minutes, total surgery time  $58 \pm 20$  minutes, estimated bleeding  $950 \pm 500$  ml, transfusion 57%, hypogastric artery ligation 27%, hysterectomy 3.33%, mid-postoperative pelvic abscess 3.33%, hospital stay 5 days and mortality 0%.

**Conclusions:** With the Tovar-Montiel uterine compression suture, the uterus was preserved in 97% of the cases. The technique may be an option for management of atony and preservation of the uterus.

**Keywords:** Obstetric hemorrhage; Uterine atony; Uterus preservation; Uterine compression suture; Tovar-Montiel technique.

**Keywords:** Obstetric hemorrhage.

Obstetric hemorrhage is defined as cumulative blood loss equal to or greater than 1,000 ml or blood loss accompanied by signs or symptoms of hypovolemia within the first 24 hours after birth. It is the main cause of maternal mortality in Mexico and throughout the world, its frequency has been estimated at 27.1% (1,2). Prevention and timely management have the ultimate goal of reducing morbidity, short- and long-term sequelae, and mortality.

Uterine atony is the main cause of obstetric hemorrhage, in our environment its frequency is 80% (3). The first line of management is physical measures and drug therapy. The different surgical techniques are used secondarily once non-invasive maneuvers have failed. Since its introduction in 1997, the frequency of the use of sutures for uterine compression has increased (4). The choice of a specific technique is determined considering the clinical scenario, the

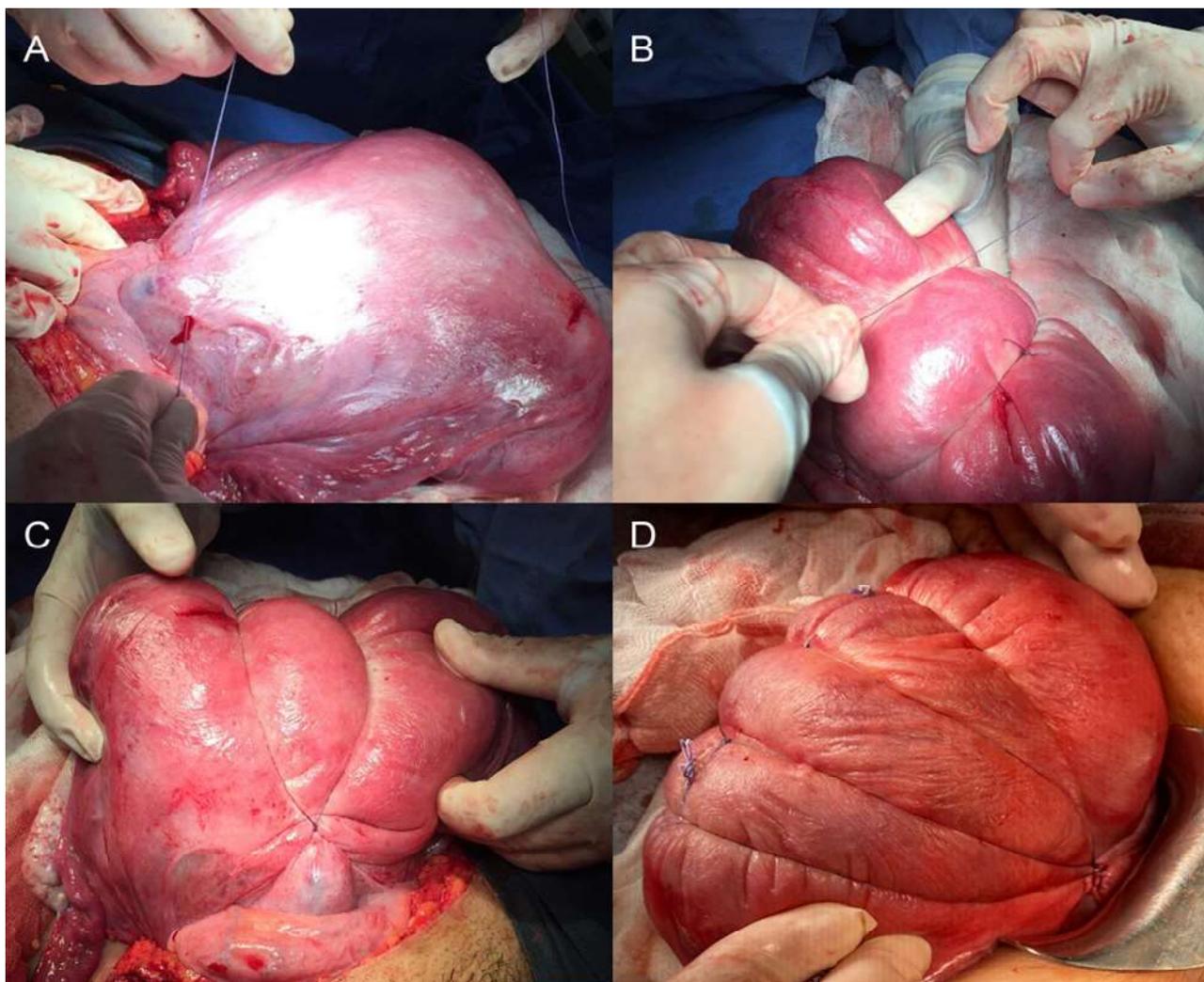
available material resources, the skills and preferences of the obstetrician, the need to preserve the uterus for subsequent pregnancies and more recently the request of the patient or her relatives, among others factors (5,6).

Compressive uterine suture has been implemented in our environment with a new technique introduced by Tovar and Montiel to limit and contain bleeding in cases of atony while preserving the uterus.

## Tovar-Montiel surgical technique

1. A laparotomy should be performed to exteriorize the uterus. If it is a case of hemorrhage during the cesarean section, hysterorrhaphy should be performed in a single plane with a slow-absorbing synthetic suture measuring 68 cm in length with a 37 mm tapered needle.

From the Toco Surgical Unit at High Specialty Medical Unit. Gynecology-Obstetrics Hospital No. 3. Medical Center "La Raza". Mexican Institute of Social Security. Mexico City, Mexico. Received on November 10, 2022, Accepted on November 15, 2022. Published on November 16, 2022.



**Figure 1.** Compression suture for the control of obstetric hemorrhage due to atony and preservation of the uterus with the Tovar-Montiel technique. A. Stitches placed on the anterior surface of the uterus before traction. B. Controlled traction to tie the ends while the assistant presses to invaginate the uterus. C. Final result. D. Additional sutures.

2. The first stitch of the suture is placed on the anterior surface of the uterus, transversely 2 to 3 cm, deep enough to traverse the entire uterine wall from right to left at the level of the segment, or 2 to 3 cm below the hysterorrhaphy, if any. (**Figure 1a**)

3. The knot is completed without losing tension and the suture filament is cut at the end of the needle.

4. The second uterine suture point is placed on the posterior face, at the level of the insertion of the utero-sacral ligaments in a transverse direction at a depth of 3 cm and from right to left.

5. The knot is completed without losing tension and the suture filament is cut at the end of the needle.

6. Controlled traction of the right anterior and posterior cords is performed while the assistant presses steadily on the uterus for the purpose of intussusception. The knot in the fundus is completed without losing tension, and the remaining suture is cut. (**Figure 1b**) The same procedure is performed with the anterior and posterior ends of the left side. (**Figure 1c**)

7. If an extra loop is required, a new stitch is placed 1 cm below the previous one or the sutures are

placed together from the beginning of the knot. The sutures are equidistantly distributed in the uterine fundus. (**Figure 1d**) The application of an anterior and a posterior suture requires 2 to 3 minutes. When additional sutures are required, the time is 5 to 6 minutes.

The **objectives** of this research was to describe the Tovar-Montiel technique and to analyze the results of its execution in a case series with uterine atony.

### Methods

An interventional, cross-sectional, descriptive and analytical study was carried out in a case series of 30 patients with obstetric hemorrhage due to uterine atony who were treated at the Toco-Surgical Unit of the High Specialty Medical Unit Gynecology-Obstetrics Hospital No. 3 of the National Medical Center "La Raza" of the Mexican Institute of Social Security, Mexico City in the period from March 2018 to May 2019. The 30 patients were selected for convenience who underwent the uterine suture implemented by Tovar and Montiel. The common characteristic of the patients was the diagnosis of

Characteristic	Data	Characteristic	Data
Age (years), mean±DE	30 ± 7.3	Vaginal births n (%) *	3 (10)
Parity median (limits)	3 (1-5)	Births by cesarean section n (%)	27 (90)
Primiparity n (%)	8 (27)	Indications for cesarean section n (%)	
History of urinary infection n (%)	14 (47)	Iterative	7 (23)
Threatened abortion n (%)	7 (23)	Severe preeclampsia	7 (23)
Morbidities n (%)	18 (60)	Unreliable fetal status	1 (3)
Rheumatoid arthritis	1	Prolonged labor	2 (7)
Bronchial asthma	1	Twin pregnancy	1 (3)
Diabetes mellitus type 2	2	Antepartum hemorrhage	3 (10)
Primary hypothyroidism	4	Previous placenta	5 (17)
Gestational diabetes	3	Breech presentation	1 (3)
Glaucoma	1	Total surgery time (minutes) mean±DE	58 ± 20
Arterial hypertension	2	Tovar-Montiel suture time (minutes)	2 to 3
Uterine myomatosis	1	Estimate bleeding (milliliters), mean±DE	950±500
Thyroid nodule	1	Transfusion requirement n (%)	17 (57)
Gestational thrombocytopenia	2	Hypogastric artery ligation n (%)	8 (27)
		Obstetric hysterectomy n (%)	1 (3)
		Complications during surgery n (%)	0
		Pelvic abscess n (%)	1 (3)
		Mortality	0

**Table 1.** General data.

uterine atony refractory to pharmacological management, which was defined as the lack of uterine tone after the application of uterotonic drugs (3).

The files were consulted to record their general data, obstetric history, the end of the pregnancy, the time in minutes of performing the Tovar-Montiel technique, the total time of the surgery in minutes, estimated amount of bleeding, transfusion requirement, Hemoglobin (Hb) concentration, the need for interventions other than uterine suture such as ligation of the hypogastric arteries, pelvic packing or obstetric hysterectomy, and the outcome of the patients. The approval of the local Committee for Research and Ethics in Health of the Hospital was previously obtained (Registry 3504-2018-23).

For data analysis, descriptive and inferential statistical measures were used with the SPSS version 25 program. The quantitative variables with normal distribution are presented as the mean and standard deviation (SD) and the variables with free distribution are shown as the median and the ranks. The comparison between quantitative variables was made

\* Postpartum vaginal hemorrhage required laparotomy and the Tovar-Montiel technique.

**Table 2.** Surgical data.

using the Pearson correlation coefficient adjusted with the Bonferroni test. Qualitative variables are presented as frequencies (n) and percentages (%).

## Results

The mean age was 30±7.3 years, median parity 3 (limits 1 to 5) and primiparity 27% (8 cases). The frequency of morbidities was 60% (18 cases), its distribution and general data are shown in (Table 1). Of the 30 patients included, the Tovar-Montiel technique was performed in 90% (27 cases) after termination of pregnancy with cesarean section and in

	Total surgery time (min)	Uterine suture time (min)	Estimated bleed (ml)	Hb difference (g/dL)	Hospital stay (days)
Total surgery time (min)	1				
Uterine suture time (min)	0.092	1			
Estimated bleed (ml)	0.442*	0.135	1		
Hb difference (g/dL)	0.082	0.078	0.259	1	
Hospital stay (days)	0.566**	0.044	0.122	0.095	1

\* p = 0.014  
\*\* p = 0.001  
Hb = Hemoglobin

**Table 3.** Correlations.

10% (3 cases) after vaginal delivery. **(Table 2)** Due to the fact that all of them developed uterine atony refractory to pharmacological management, in the first group the uterus was exteriorized using the same incision as in the cesarean section and in the second group a new median infraumbilical incision had to be made to perform the compression technique.

The total time of the surgery considered from the initial incision to the suture for the closure of the skin, including the compressive suture with the Tovar-Montiel technique, was 58±20 minutes. The Tovar-Montiel technique required 2 to 3 minutes because in 100% (30 cases) only the anterior and posterior suture was performed. **(Figure 1)** No additional sutures were necessary, and no complications were recorded during its execution. **(Figure 1; a,b,c)** The mean amount of estimated bleeding was 950±500 ml (limits 500 to 1,500). In 57% (17 cases) transfusion was required (median 2, limits 1 to 2). After performing the uterine compression suture with the Tovar-Montiel technique, hypogastric artery ligation was performed in 27% (8 cases) and in 3% (1 case) hysterectomy obstetric was required to control persistent bleeding. When comparing the concentration of Hb before and after surgery, a postoperative reduction of 2.01±1.9 g/dL was found. Hospital stay was 5 days (limits 3 to 8). In the immediate postoperative period, a pelvic abscess was detected in 3.33% (1 case). Mortality was 0%. **(Table 2).**

A non-significant positive correlation was found between the total surgery time and the suture time ( $r=0.092$ ), a moderately significant positive correlation between the total surgery time and the

amount of estimated bleeding ( $r=0.442$ ,  $p=0.014$ ), a non-significant positive correlation of total surgery time with postoperative Hb concentration ( $r=0.082$ ) and a significant positive correlation of total surgery time with hospital stay ( $r=0.566$ ,  $p=0.001$ ). The correlations of the suture time with the Tovar-Montiel technique were the following: with the amount of estimated bleeding  $r=0.135$ , with the concentration of postoperative Hb  $r=0.078$  and with the hospital stay  $r=0.044$ , they were interpreted as not significant. **(Table 3).**

## Discussion

Obstetric hemorrhage is the leading cause of maternal mortality in Mexico and worldwide, especially in developing countries (7). Uterine atony is responsible for most cases. Compression sutures of the uterus are a useful therapeutic resource to inhibit bleeding and preserve the organ. There are different techniques, each of them has advantages and disadvantages for its execution (5,6). Surgical results may be different because they depend on the clinical characteristics of the patients and their morbidities, the cause and timing of the atony, the degree of bleeding and infiltration of the uterine walls, the effect of the drugs previously administered on uterine muscle tone, hospital resources, and surgeon skill and experience. In this scenario, the recommendation of the experts is to perform the technique that is most reliable for the surgical team (8,9). Each obstetric care center must adapt its material and human resources to the needs of patients with uterine atony and hemorrhage who are candidates for emergency surgery.

The hospital that hosts this investigation is a highly specialized center founded 58 years ago that receives the most complicated cases from the northern area of Mexico City and neighboring states. It is a highly resolute tertiary hospital in which emergency surgery is familiar to its medical staff who care for patients 24 hours a day. In this site, the use of uterine compression suture techniques considered traditional or classic is routine. Based on surgical experience, it has been found that these techniques are not sufficient to resolve the hemorrhage and atony with preservation of the uterus in all cases (4-6,8-10). The Tovar-Montiel technique has emerged as a viable alternative to solve the problem. This is a pilot study, it is the first report of the results of the Tovar-Montiel technique applied to a case series of 30 patients selected for convenience during the period from March 2018 to May 2019.

The mean age was in the fourth decade of life with a parity of 3, only 27% were primiparous women and the morbidities were varied. Two patients had gestational thrombocytopenia and one patient had uterine myomatosis, two predisposing conditions for bleeding. (Table 1) Cesarean section was more frequent than vaginal delivery (90 vs 10%) and its main indications were iterative cesarean section (23%), severe preeclampsia (23%) and antepartum hemorrhage (10%).

The total time of abdominal surgery that included the application of the uterine compression suture with the Tovar-Montiel technique was performed in 58±20 minutes, an acceptable surgical time, and the suture time was 2 to 3 minutes.

The estimated bleeding, always less than 1,500 ml, was reflected in a drop of Hb of around 2 g/dL. The transfusion requirement in 57% could have been overestimated because the degree of anemia and the hemodynamic stability of the patients do not fully justify it. As an individual technique, the Tovar-Montiel suture was performed in 63% (21 cases) and as a combined procedure with ligation of the hypogastric arteries it was performed in 27% (8 cases), both modalities resolved the bleeding problem in 97 % (29 cases) with preservation of the uterus. Only 3% (1 case) required obstetric hysterectomy due to persistent bleeding. Radical surgery should not necessarily be interpreted as a failure related to the suture technique because several factors can intervene in the surgical outcome (5-7,9,10). No additional sutures were necessary, and no complications were recorded during its execution. A case of pelvic abscess identified days after surgery is irrelevant because it is a series of 30 patients undergoing bloody and urgent surgery and because it is an infectious complication that can occur after any type of pelvic or abdominal surgery. The hospital stay of the patients (5 days) was not far from the general average for other causes and no cases of

death were recorded. The correlations of surgery time, suture time, estimated bleeding, Hb differences and hospital stay are encouraging, but not conclusive.

The data suggest that uterine compression suture with the Tovar-Montiel technique is a procedure that can be performed in any hospital with the minimum amount of surgical material, either as a single technique or combined with vascular surgery or obstetric hysterectomy. It has the advantages that it is a simple technique that requires a short surgical time, represents minimal uterine aggression, and allows hemodynamic stabilization for the patient who needs additional, more aggressive surgery immediately or in the short term such as hysterectomy, for example (11).

Alone or combined, the technique did not resolve bleeding in 100% of cases. This situation seems to be inherent to all the techniques used to control bleeding due to uterine atony (5-7,9-11). The main strength of the research is the innovation of a simple, fast and accessible technique that, individually or with other procedures, can control bleeding and preserve the uterus. The weaknesses of the study lie in its design as a pilot study with a small number of patients selected by convenience.

Its application in a greater number of cases and its reproduction in other surgical research centers are necessary to document its strengths and disadvantages.

## Conclusion

The uterine compression suture implemented by Tovar-Montiel is a safe technique, easily reproducible, quick to apply and with immediate satisfactory results. This is a technique that may be an option for managing bleeding due to atony, especially in patients in whom it is important to preserve the uterus.

## Conflicts of interest

No conflicts of interests.

## References

1. Informe semanal de notificación inmediata de muerte materna. Semana epidemiológica 37 de 2022. Subsecretaría de prevención y promoción de la salud. Dirección general de epidemiología. México. Secretaría de Salud. 2022.
2. Quantitative Blood Loss in Obstetric Hemorrhage. ACOG Committee Opinion Number 794. American College of Obstetricians and Gynecologists. *Obstet Gynecol.* 2019;134(6):e150-e156.
3. Diagnóstico y tratamiento del choque hemorrágico en obstetricia. Guía de referencia rápida. Guía de Práctica Clínica. México. Instituto Mexicano del Seguro Social. 2017.
4. B-Lynch C, Coker A, Lawal AH, Abu J, Cowen MJ. The B-Lynch surgical technique for the control of massive

- postpartum hemorrhage: an alternative to hysterectomy ? Five cases reported. BJOG. 1997;104(3):372-375.
5. Matsubara S, Yano H, Ohkuchi A, Kuwata T, Usui R, Suzuk M. Uterine compression sutures for postpartum hemorrhage: an overview. AOGS. 2013;92:378-385.
  6. Matsuzaki S, Jitsumori M, Hara T, Matsuzaki S, Nakagawa S, Miyake T, et al. Systematic review on the needle and suture types for uterine compression sutures: a literature review. BMC Surgery. 2019;19:196.
  7. Maswime S, Buchmann E. A systematic review of maternal near miss and mortality due to postpartum hemorrhage. Int J Gynaecol Obstet. 2017;137:1–7.
  8. Marasinghe JP, Condous G, Seneviratne HR, Marasinghe U. Modified anchored B-Lynch uterine compression suture for post partum bleeding with uterine atony. Acta Obstet Gynecol Scand. 2011;90(3):280-283.
  9. Saroja CSM, Nankani A, El-Hamamy E. Uterine compression sutures, an update: review of efficacy, safety and complications of B- Lynch suture and other uterine compression techniques for postpartum haemorrhage. Arch Gynecol Obstet. 2010;281(4):581–588.
  10. Mostfa AAM, Zaitoun MM. Safety pin suture for management of atonic postpartum hemorrhage. ISRN Obstet Gynecol. 2012: Article ID 405795, 4 pages.
  11. Shellhaas CS, Gilbert S, Landon MB, Varner MW, Leveno KJ, Hauth JC, et al. The frequency and complication rates of hysterectomy accompanying cesarean delivery. Obstet Gynecol. 2009;114(2) Part 1:224229.

Juan Gustavo Vázquez Rodríguez  
Toco Surgical Unit  
High Specialty Medical Unit  
Gynecology-Obstetrics Hospital No.3  
National Medical Center “La Raza”. Mexican Institute of  
Social Security  
Mexico City, México