Contents available at **PubMed**
www.anmm.org.mx

PERMANYER

Gac Med Mex. 2016;152:604-7

GACETA MÉDICA DE MÉXICO

ORIGINAL ARTICLE

Determination of postoperative hemoglobin levels and their correlation with the weight of the transoperative textiles

Yadhira Elizeth Montes-Casillas[1] and María Fernanda Zazueta-Medina[2]*

[1]Department of Gynecologic Urology; [2]Department of Obstetrics and Gynecology, Hospital General Regional No. 1, IMSS, Ciudad Obregón, Son., Mexico

Abstract

Objective: *To determine postsurgical hemoglobin levels and the correlation with trans-surgical textile weight.* **Materials and methods:** *A cross-sectional study, including 120 patients who underwent gynecological surgery, was performed in the HGR 1 in Cd. Obregon Sonora, from June to July 2015; the account of textile weight blood loss estimation was carried out and subsequently became an association of hemoglobin levels in the postoperative period, performing the conversion of a gram to one milliliter. There was expected to be an association between blood loss with low levels of hemoglobin; for each lost 500 ml, the hemoglobin decreased by 1 g.* **Results:** *120 patients were evaluated; the average age was 48.65 years. The surgical events were divided in abdominal in 76.67%, breast surgery 19.17%, and vaginal 9.17%. There was a decrease in hemoglobin of 0.74 mg/dl and hematocrit of 1.93%. We found significant association between blood loss and the decrease in hemoglobin with relative risk of 3.01 (95% CI: 1.69-5.36).* **Conclusions:** *The main conclusion of this study is to establish that a loss > 500 ml has a direct association with > 1.1 g postoperative hemoglobin decrease and hematocrit reduction > 6%.* (Gac Med Mex. 2016;152:604-7)

Corresponding author: *Yadhira Elizeth Montes-Casillas, yadhira18@hotmail.com*

KEY WORDS: *Gravimetry. Hematocrit. Hemoglobin. Surgical event.*

Introduction

Warranting safe surgical practices is an issue of considerable interest in public health matters. There validated methods for blood loss estimation, although some have turned out to be unpractical or immeasurable[1]. Collection-specific materials can also affect quantification accuracy[2]. Visual estimation is the most widely used method, in spite of its lack of precision, accuracy and reproducibility having been demonstrated[3]. A comparison between the visual technique and the weighing of textiles has been carried out, and an up to 30% bleeding underestimation has been found[3].

The University of Cartagena conducted a study among anesthesiologists, where a trend towards overestimation was observed[4]. In May 2014, Zuckerwise et al. assessed the use of pictograms with the purpose to improve visual evaluation and found higher estimation efficacy by the healthcare personnel[5]. In 2012,

Correspondence:
*Yadhira Elizeth Montes-Casillas
Departamento de Urología Ginecológica
Hospital General Regional N.º 1
IMSS
San Miguel, 1118, Villa California
C.P. 85038, Ciudad Obregón, Son., México
E-mail: yadhira18@hotmail.com

Date of reception: 19-08-2015
Date of acceptance: 28-09-2015

Table 1. Frequency of patient comorbidities

Type of condition	Frequency	%
Obesity	63	52.50
High blood pressure	23	19.17
Anemia	21	17.50
Undernourishment	1	0.83
Diabetes mellitus	7	5.83

Stahl et al. assessed bleeding by using presurgical hemoglobin, gravimetry and postsurgical hemoglobin, and found two limitations: there was no existing valid technique to measure hemoglobin in textiles, and the possibility of occult bleeding was dependent on losses[6]. There are alternative methods, such as hematocrit measurement, but measurement veracity depends on calculated blood volume and fluid status of the patient[7].

Measurement of hemorrhage by means of textiles weight is the most accurate and practical method to determine the volume of blood not captured in the containers. It is obtained by subtracting the dry weight of absorbent materials from the weight of the blood-containing absorbent materials, using the 1 g = 1 ml conversion[8]. In this study, we found that there is a statistically significant relationship between postsurgical hemoglobin decrease and trans-surgical textiles weight when blood loss is larger than 500 ml.

Material and methods

After authorization was obtained from the 2601 Local Research and Ethics Committee (CLIES – *Comité Local de Investigación y* Ética), R-2015-2061-31, a cross-sectional study was carried out, where 120 female patients undergoing gynecologic surgery (abdominal hysterectomy, vaginal hysterectomy, exploratory laparotomy and breast surgery) were analyzed. By means of consecutive cases sampling, the sample-size calculation was made taking into account and infinite population with an accuracy of 5%, considering that previous medical research studies establish an estimated prevalence of trans-surgical hemorrhage of 10% in the population undergoing a gynecologic surgical procedure.

The research was carried out at the surgical area of the Nº. 1 Regional General Hospital (HGR – *Hospital General Regional)* of Ciudad Obregón, in Sonora, over the months of June and July, 2015. The inclusion criteria that were taken into account were the following: women older than 35 years and younger than 75 who were undergoing any gynecologic-type surgical procedure and that had signed the informed consent form.

During the procedure, the gravimetric method was used by means of the weight of blood-tissue containing textiles, based on the following parameters in the dry status: 10 x 10 cm gauzes weighing 3 g, 65 x 65 cm compresses weighing 45 g and 80 x 45 cm folded gauze weighing 15 g. A Dymo Pelouze gram scale with 5 lb/2.2 kg capacity (model SP5) was used to measure each textile excessive weight. This was added the blood tissue contained in the suction canisters and, this way, the loss in grams was estimated by making the 1 g-to-1 ml conversion. At the completion of surgery, the anesthesiologist and the gynecologist were asked to make a blood loss visual estimation.

Prior to surgery, hemoglobin and hematocrit values were made available; after the procedure, a new measurement was postoperatively carried out to look for association with the gravimetric estimation. Study variables were the following: comorbidities: high blood pressure, diabetes, obesity, anemia and undernourishment. Other of the study variables was age.

The study was considered to be of lower than minimal risk with adherence to international research standards and informed consent signature, without experimenting with the patients or revealing their names or affiliation numbers; only information of scientific nature was obtained.

The statistical analysis was made by applying central tendency measures, RR and the χ^2 test, with a p-value of 0.05 being considered to be statistically significant.

Results

A total of 120 patients with a mean age of 48.65 years were analyzed. Table 1 shows the comorbidities that were found. Surgical procedures were classified into 3 categories: abdominal surgery (76.67%), breast surgery (19.17%) and vaginal surgery (9.17%).

According to preoperative measurements, hemoglobin and hematocrit were at a mean of 12.44 mg/dl and 37.11%, respectively. Postsurgically, both showed a slight decrease: mean hemoglobin had a decrease of 0.74 mg/dl, and mean hematocrit showed a 1.93% loss.

In the assessment of hemoglobin decrease with regard to the type of surgery, a decrease higher than 1 g

Table 2. Risk association between blood tissue loss by gravimetry and hemoglobin decrease

Blood tissue loss	Hemoglobin decrease		Total
	> 1.1 g	< 1 g	
> 500 ml	7	4	11
< 499 ml	23	86	109
Total	30	90	120
Association measure	**Estimated value**	**95% CI**	
		Minimum	**Maximum**
RR	3.01	1.69	5.36
Risk difference	42.43	13.09	71.97

Table 3. Risk association between blood tissue loss by gravimetry and hematocrit decrease

Blood tissue loss	Hematocrit decrease		Total
	> 6%	< 5.9%	
> 500 ml	3	8	11
< 499 ml	10	99	109
Total	13	107	120
Association measure	**Estimated value**	**95% CI**	
		Minimum	**Maximum**
RR	2.97	0.95	9.21
Risk difference	18.09	–8.77	44.96

Table 4. χ^2 test for blood tissue loss by gravimetry vs. hematocrit decrease

Pearson's χ^2	Critical value	χ^2 value	Degree of freedom	p-value
	3.84	17.87	1	0.05

was found in 27.9% of patients with abdominal surgery, in 45.45% of patients with vaginal surgery and in 4.3% of patients with breast surgery.

There was a drop in hematocrit higher than 6% when blood loss was greater than 500 ml in 10 patients with abdominal surgery and in 3 with vaginal surgery, but in none with breast surgery.

Blood tissue loss calculation was divided into 3 groups: visual estimation by the anesthesiologist, with a mean of 269.28 ml; visual estimation by the surgeon, with a mean of 278.41 ml, estimation by the weight of textile materials, with a mean of 314.61 ml.

With regard to the type of surgical procedure, there was blood tissue loss higher than 500 ml in 10 patients with abdominal surgery, in one with vaginal surgery and in none with breast surgery.

As for blood tissue loss and hemoglobin decrease, a RR of 3.01 was observed (95% CI: 1.69-5.36) (Table 2).

In addition, the association between blood tissue loss and hematocrit decrease was established. The obtained RR was 2.97 (95% CI: 0.95-9.21) (Table 3), with a χ^2 value of 17.87, a reference value of 3.83 and p = 0.05 (Table 4, Fig. 1).

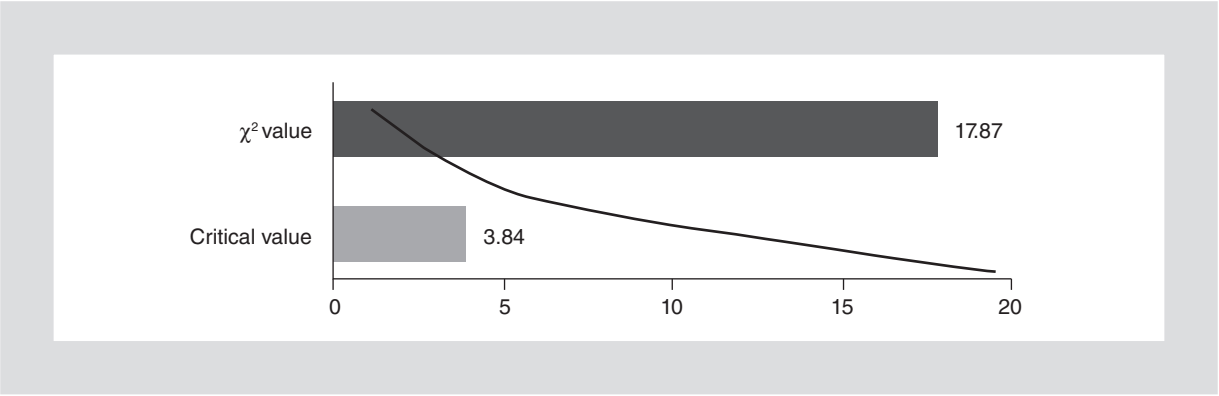

Figure 1. *Association between critical value and χ^2 value in the relationship between blood tissue loss by gravimetry and hematocrit decrease.*

Discussion

Unlike the study carried out at the University of Cartagena, where a discrepancy was observed between mean estimated values and the amount of real blood in compresses and gauzes, with a tendency to bleeding overestimation, in our study we were able to establish that the loss by physicians' visual estimation and the loss estimated by the weight of textile materials had a minimum error range[4].

In 2012, the Association of Anesthetists of Great Britain published a technique to evaluate perioperative bleeding and concluded that there was no gold standard for the measurement of blood loss, referring different limitations[6]. However, in this investigation, we have managed to demonstrate that blood tissue loss does have a direct relationship with hemoglobin and hematocrit postsurgical values decrease, and we have found statistically significant results able to demonstrate dependence between these variables.

Unfortunately, the relationship of the loss with volumes larger than 1,000 ml cannot be determined, since only one patient had such reference value in this study. A new study, with patients undergoing surgeries where the loss of more than 1,000 ml is considered the main objective would be required in order to clarify this fact.

In view of the importance of trans-surgical bleeding quantification and its impact on both trans- and postoperative management of patients, the need to have a veracious bleeding quantification method and assessing its relationship with postsurgical hemoglobin measurements is imperative in order to reduce unnecessary transfusion procedures and hence decrease infectious-contagious and allergic risks and hospital length of stay for our patients[6].

In conclusion, in our study we found that bleeding estimation by the weight of surgical textiles is a useful and objective tool for the assessment of blood loss, which has a direct relationship with postsurgical hemoglobin and hematocrit decrease, and should be considered for its assessment in order to decrease the number unnecessary procedures in our patients.

References

1. Lyndon A, Miller S, Huwe V, et al. Blood loss: Cinical techniques for ongoing quantitative measurement. CMQCC obstetric hemorrhage care guidelines and compendium of best practice. [Internet]. Consultado el 1 marzo de 2015. Disponible en: https://www.cmqcc.org/resources/916/download.
2. Pacagnella RC, Souza JP, Durocher J, et al. A Systematic Review of the relationship between blood loss and clinical signs. PLoS ONE. 2013;8(3):e57594.
3. Al Kadri HM, Al Anazi BK, Tamim HM. Visual estimation vs gravimetric measurement of postpartum bloodloss: a prospective cohort study. Arch Gynecol Obstet. 2011;283(6):1207-13.
4. De La Peña-Martinez A, Perez-Delgado R, Yepes-Barreto I, De La Peña-Martinez M. Is visual estimation useful in determining the extent por perioperative haemorrhage? A study of correlation among anesthetists of intermediate and high complexity hospitals in Cartagena, Colombia. Rev Colomb Anestesiol. 2014;42(4):247-54. [Internet] Consultado el 3 marzo de 2015. Disponible en: www.revcolanest.com
5. Zuckerwise L, Pettker C, Illuzzi J, Raab C, Lipkind H. Use of a novel visual aid to improve estimation of obstetric bloodloss. Obstet Gynecol. 2014;123(5):982-6.
6. Stahl DL, Groeben H, Kroepfl D, Gautam S, Eikermann M. Development and validation of a novel tool to estimate peri-operative blood loss. Anaesthesia. 2012;67(5):479-86.
7. Schorn MN. Measurement of blood loss: review of the literatura. J Midwifery Womens Health. 2010;55(1):20-7.
8. Association of Women's Health, Obstetric and Neonatal Nurses. Quantification of Blood Loss: AWHONN Practice Brief Number 1. Estados Unidos: AWHONN; 2014. [Internet] Consultado el 2 de marzo de 2015. Disponible enhttp://www.AWHONN.org.