British Journal of Healthcare and Medical Research - Vol. 12, No. 04
Publication Date: July 8, 2025
DOI:10.14738/bjhr.1204.19065.
Segura, C. A. S., Medina, M. S. H., Sixtos, J. R. L., Ruiz, C. A., & Sánchez, M. A. G. (2025). Bleeding in Surgery. *British Journal of Healthcare and Medical Research*, Vol - 12(04). 12-30.

Bleeding in Surgery

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ABSTACT

Introduction: the main specialized functions of blood as tissue are transport, defense, coagulation, barometric and temperature regulation. Objective: to describe the experience of patients bleeding in surgical diseases. Method: a multicenter study with a retrospective, longitudinal, observational and descriptive design of the Surgery and Coloproctology Service in five second and third level health care hospitals. Results: of 241 patients with complete files where bleeding will be specified by phases of surgical treatment, 162 women (67%) and 79 men (33%). Range 18 to 97 years. Two surgical pathologies present preoperative hemorrhage: blunt trauma/projectile by firearm/sharp instrument both in the chest, abdomen, extremities or mixed, quantifying 25 /2,650 milliliters and the second the ruptured ectopic pregnancy. Discussion: hypovolemic shock due to hemorrhage is one of the main causes of death in trauma patients in prehospital settings. In cases of traumatic shock, early control of bleeding and effective volume replacement with blood products are strategies to save lives. Conclusions: the hemorrhage of patients in surgery in public surgical practice in Mexico is an object of oblivion for the administrative area of hospitals, due to the extreme lack of

supplies or resources, as well as the lack of competence of the personnel of the rest of the surgical team, which determine practically heroic behaviors of the surgeon responsible for saving the patient's life.

Keywords: Hypovolemic shock, Hemorrhage in surgery, Surgery, Trauma, Blood, Bleeding.

INTRODUCTION

A blood is an organ composed of thick, liquid, red connective tissue with continuous movement in the circulatory system of the human body, quantifying 8% of body weight with a total average of 5 liters; blood is produced in the bone marrow and is made up of two main elements, the blood elements formed by red blood cells (95%), white blood cells, platelets and plasma which is made up of 95% water and the remaining 5% of various substances. [1] The main specialized functions of this tissue are transport, defense, coagulation, barometric and temperature regulation. [2] Another fundamental aspect of blood is antigens, which are marker proteins typing each human being, there are 34 systems with more than 300 known variants, however the two main groups are ABO and rhesus positive or negative. [3]

Historically, the control of hemorrhage is documented by the Greeks, who perfected the use of ligatures, while the Egyptian pharaohs had a "hemostatic man" for hemostasis with only his presence, in the trepanations to which they underwent. However, it was not until the Middle Ages that a significant advance was observed, with the use of cautery and boiling oil, which acculturated Arab medicine. [4] Williams Harvey in 1628 published in his book "De Motu Cordis", where he describes that blood circulated pumped through the heart. [5] On June 15, 1667, Jean-Baptiste Denys performed the first blood transfusion from a sheep to a human, apparently successful. But it was not until 1818, in London, that James Blundell performed the first human-to-human transfusion. [6]

Hemorrhage is defined as bleeding from the damaged circulatory system, physical, biochemical, or disease, inside or outside the body; it can be internal, non-externalized, or externalized, or from the anatomical site of capillary, venous, arterial, or from the heart itself. [7] In most cases, the amount of blood loss determines the severity of patients, where the classification of hemorrhagic shock in advanced life support in trauma and its modifications have corroborated that its poor applicability in the field and its theoretical and practical uselessness has diverted attention to the physiology underlying the clinic and has reduced the opportunities for advancement in the subject. [8] It has been confirmed that in certain pathologies or factors of the specific patient, minimal or scant bleeding can be catastrophic. [9] An example is cerebral vasospasm, where it is a common and serious complication following non-traumatic subarachnoid hemorrhage, which often worsens outcomes, especially when associated with late cerebral ischemia. [10] Or as in the case of internal bleeding, which may be the main targets of primary treatment in patients with closed pelvic fractures, or where mortality rates from open pelvic fractures remain high, due to uncontrolled bleeding. [11]

The symptoms and signs in a syndromatic diagnosis of hemorrhage of any etiology or disease can be very varied and that in surgery it is essential to conclude a surgical cause with the aim of obtaining at any cost its resilience in the patient; the above will depend on the etiology that causes the hemorrhage, the physical/psychic conditions of the subject and other factors such

URL: http://dx.doi.org/10.14738/bjhr.1204.19065.

as that conditions complications in patients such as surgical time of more than 4 hours, intraoperative blood loss of more than 50 ml and preoperative albumin less than 3.5 mg/dl. [12] Underlying surgical pathology should be planned as spinal hemangioblastomas, which are rare and highly vascularized tumors of the central nervous system, with a high risk of major bleeding. [13] It has been found that blood loss is much lower with the laparoscopic approach than with the conventional approach, however, in the long term there is no tacit difference. [14]

It should be noted that non-compressible hemorrhage, resulting from penetrating trauma to the chest, abdomen or pelvis, exposes patients to a high risk of death, where despite perfect logistics, with supplies, resources, with a competent and experienced medical team, it does not achieve a difference in prognosis. [15] It should be noted that a major surgery such as a distal pancreatectomy or a multivisceral resection due to malignancy is to be expected to have a certain high level of blood loss due to complexity and vascularity, considering risk factors such as age where the patient is over 75 years of age, infection, fistulas or postoperative perforations, however, non-predetermined complications from massive incoercible hemorrhage put the patient's life at risk and its prognosis can be fatal. [16]

OBJECTIVE

To describe the experience presented of patients who have hemorrhage in surgical diseases, in the preoperative, trans operative and postoperative periods, in the public hospitals of the Ministry of Health and the Mexican Institute of Social Security of Mexico City and the Ministry of Health of the State of Mexico, with the indications in patients of emergency surgical interventions, of scheduled surgeries, reinterventions and priority surgeries.

METHOD

This is a multicenter study with a retrospective, longitudinal, observational and descriptive design of the Surgery and Coloproctology services of a research in five second and third level health care hospitals, in Mexico City and the State of Mexico:

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2. "Las Américas" General Hospital. Institute of Health of the State of Mexico. Municipality of Ecatepec de Morelos, State of Mexico. Country: Mexico. 2nd level.
3. "Dr. Belisario Domínguez" Specialty Hospital of Mexico City of the Ministry of Health. Mexico City. Country: Mexico. 3rd level.
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In a study period that spanned from December 2014 to December 2024, with indications in patients for emergency surgical interventions, scheduled surgeries, staged reinterventions and priority surgeries. For each patient with a complete file/file, age, sex, pathological history, etiology of the surgical pathology, surgical risk according to the ASA classification, surgical time, quantification of preoperative and transoperative bleeding, by surgical and postoperative piece, products of transfused blood derivatives, days of hospital stay, morbidity and mortality were obtained. With a follow-up of patients at one week, one month, three months, six months

and one year depending on the case. The study of the results was carried out using descriptive statistical procedures.

RESULTS

More than 3,467 cases were reviewed, where a total of 241 patients were brought together with complete files where bleeding will be specified by phases or periods of the surgical treatment process of the underlying pathology, of which 162 are women (67%) and 79 men (33%). With an age range of 18 to 97 years, with an average of 53 years, at a bimodal value of 27 and 59 years. In this study group, it was detected in 29 patients with 43 pathologies that represent 18%, and where it is noted that the same case can occur with two or more diseases and where diabetes mellitus is the most frequent chronic degenerative disease, in a second-place systemic arterial hypertension, in third place chronic lung disease. Review table 1.

Table 1: Associated morbidity in patients by number and percentage

Diseases	No. Patients	Percentage %
Diabetes Mellitus	26	10.78 %
High blood pressure	17	7.05 %
Hypothyroidism	2	0.41 %
Cardiopathy	1	0.41 %
Dyslipidemia	4	1.65 %
Hyperuricemia	1	0.41 %
Chronic kidney failure	1	0.41 %
Chronic obstructive pulmonary disease	7	2.90 %
Psychiatric pathology	1	0.41 %

The diagnostic etiology of surgical pathology was very varied, both from scheduled surgeries and from urgent surgery or surgical reintervention or to a double surgical procedure or, finally, if this was a priority. Of the 241 individuals, 43% were emergency surgeries (104 cases), of these 29 (12.03%) were priority (elective surgeries that could not be scheduled due to administrative problems) and the rest were scheduled with 137 patients representing 57%. With 14 elective reinterventions (5.80%). The most frequent surgical pathology program was inguinal hernia, acute cholecystitis, anal fistula, hemorrhoidal disease, among others. Of the emergency surgeries, the most common were supracondylar amputation of the lower pelvic limb or some portion of this limb, acute appendicitis, intestinal occlusion, abdominal trauma by a firearm projectile or by a sharp instrument, etc. Some etiologies of surgical pathologies are listed in table 2 and graph 1. It is observed that due to the inaccurate and incomplete data of the rest of the files/files reviewed (exclusion criterion variable) it is not possible to be determinant of what are or what are the most frequent surgical etiological diagnoses

Table 2: Diverse diagnostic etiology with surgical indication, in number and percentage

Diagnosis	Number	%
Intestinal Occlusion	9	03.73
Abdominal Hernia	11	04.56
Hemorrhoidal disease	29	12.03
Amputation for diabetic pathology	26	10.78
Chronic cholecystitis	22	09.41
Acute appendicitis	13	05.39

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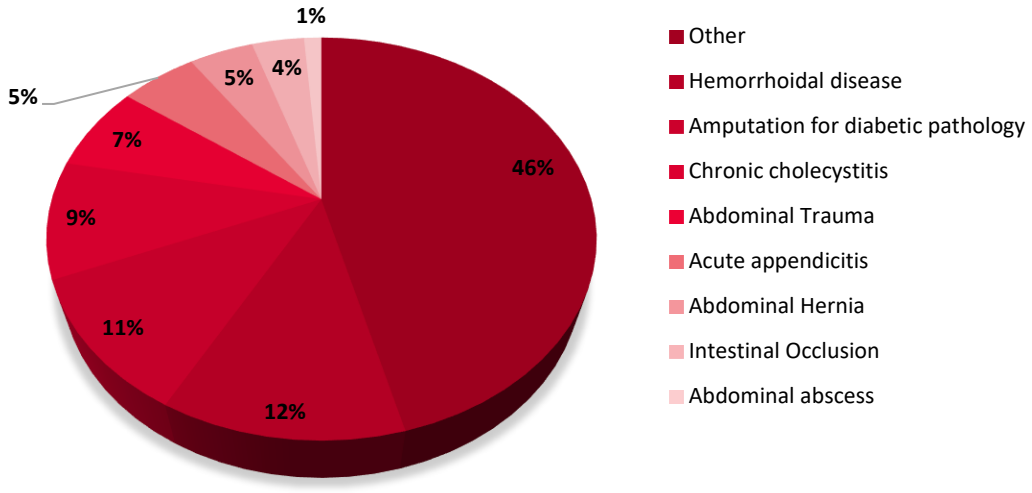
Abdominal abscess	3	01.24
Abdominal Trauma	17	07.05
Other	111	46.05
Total	241	100

Diverse diagnostic etiology with surgical indication, in number and percentage



Graph 1

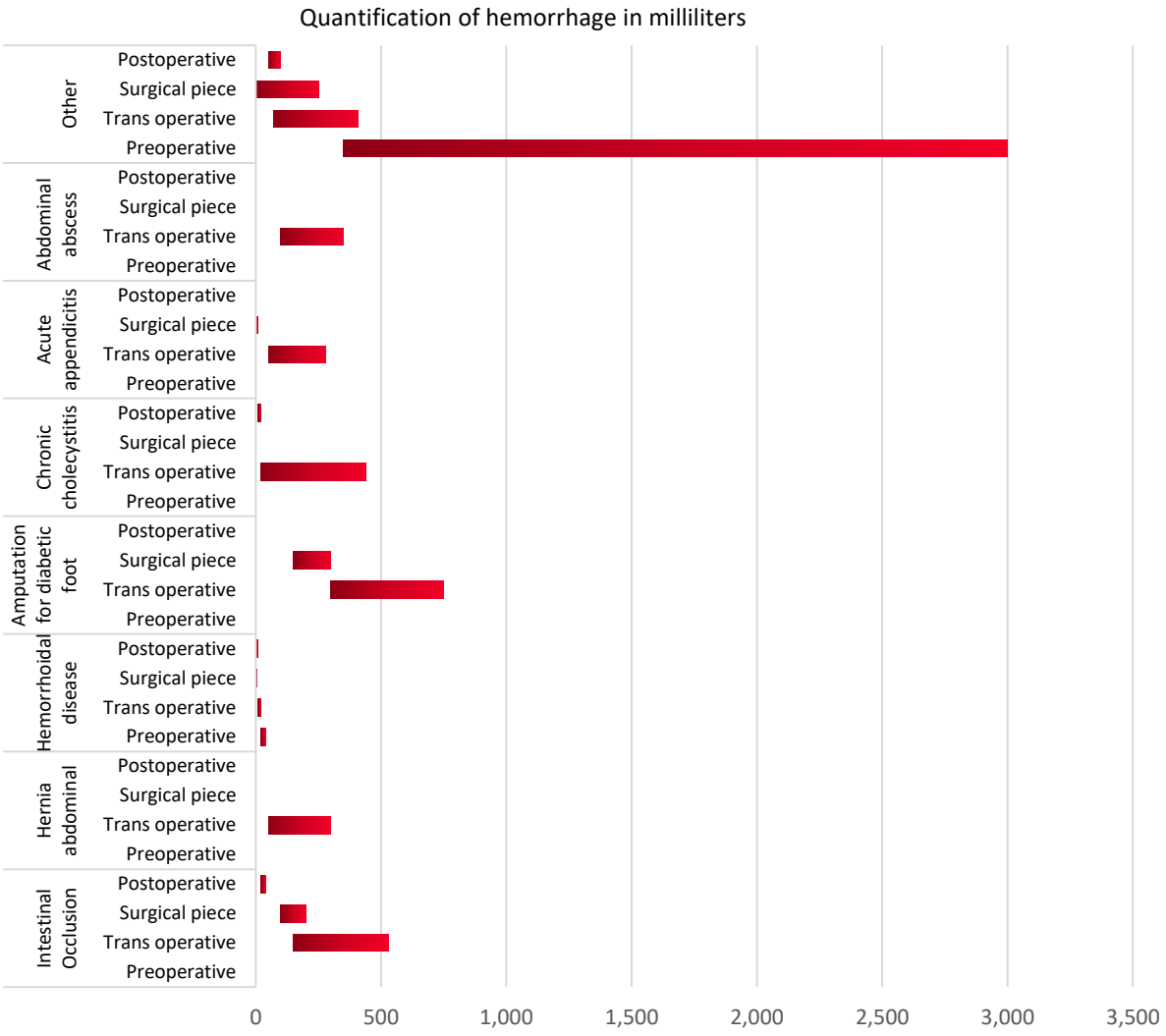
In this select group of surgical pathology that stands out are hemorrhoidal disease, amputation due to diabetic disease of lower limbs at any level and chronic lithiasis cholecystitis, which represent 42% totaling 77 patients; this provides a sketch that points to suspected expected surgical bleeding to unsuspected bleeding. Where scheduled surgery becomes the star actor and therefore its projection of resources and supplies that statistically must be planned or planned. Regarding surgical risk, ASA I was documented in 28 (11.61%) patients, ASA II with 97 (40.24) cases, ASA III 83 (34.85%), ASA IV were 29 (12.03%) individuals and finally ASA V with 4 (01.65%) patients. Regarding surgical time, the average was 49 minutes with ranges from 17 minutes to 300 minutes.

On the other hand, the quantification of preoperative, trans operative, surgical and postsurgical bleeding is performed on average by scheduled surgery and emergency surgery, concatenated with the etiological surgical diagnosis. See table 3 and graph 2.

Table 3: Average quantification of preoperative, trans operative, surgical and postoperative hemorrhage correlated with the surgical etiological diagnosis in milliliters.

Etiologic surgical diagnosis	Preoperative	Trans operative	Surgical piece	Postsurgical
Intestinal Occlusion	0	150/380	100	20
Hernia abdominal	0	50/250	0	0
Hemorrhoidal disease	20	10	3	5
Amputation for diabetic foot	0	300/450	150	0
Chronic cholecystitis	0	20/420	0	100

Acute appendicitis	0	50 a 230	5	0
Abdominal abscess Trauma abdominal	0 100/1500	100 a 250 250 a 500	0 0/200	0 150
Other	350/2650	70 a 340	0/250	50



Graph 2

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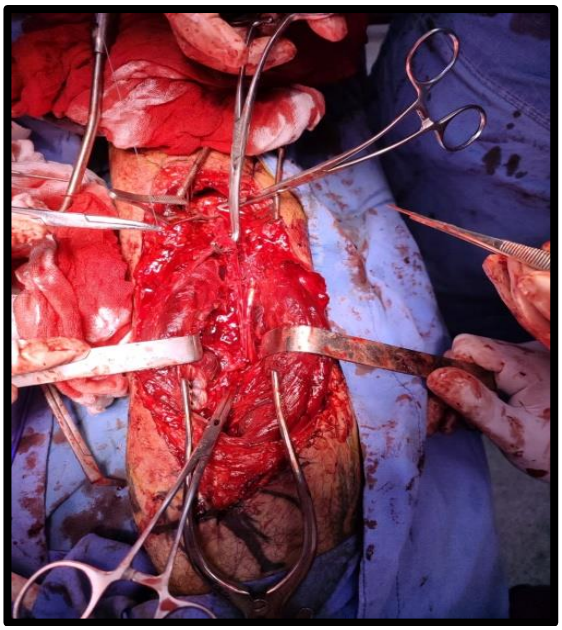


Figure 1: Femoral artery trauma from a sharp weapon

Only in two surgical pathologies was preoperative hemorrhage detected in this group, the most frequent is in blunt trauma or direct injury by a projectile by a firearm or by a sharp instrument in the thorax, abdomen and extremities or mixed, (see figure 1) with bleeding ranges ranging from 25 to 2,650 milliliters and the second with less frequency is ruptured ectopic pregnancy.

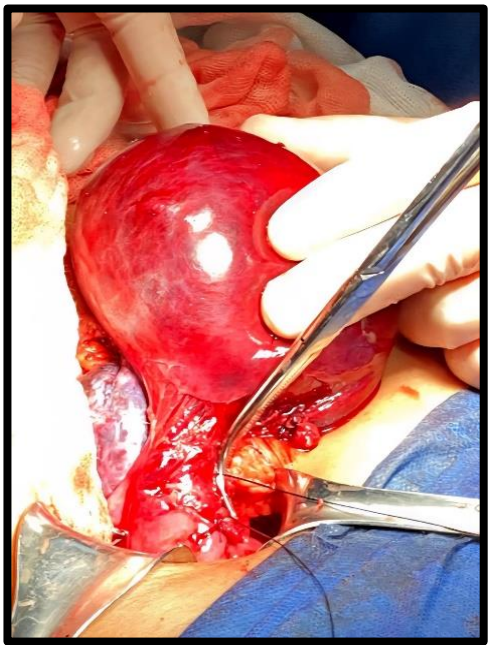


Figure 2: Unruptured ectopic pregnancy of the right ovary.

In the trans operative category that it is (the surgical intervention) it goes with the range of a minimum bleeding up to 500 milliliters. Regarding the surgical piece, intestinal resection, splenectomy, or lower extremity at different levels due to diabetic pathology range from 10 to 200 milliliters. Finally, in the postoperative period, it ranges from 10 to 150 milliliters.

It is evident that in preoperative hemorrhage, it is mostly due to injury and sometimes the quantification of previous or preoperative bleeding is unknown and cannot be assessed. Hemorrhages in surgery are a basic/priority principle with control in the operating room, so they are tried and contained in any way and at any cost. Regarding the surgical specimen, its estimated hemorrhage is extremely empirical and imprecise, however, absolute values are given in the surgical records. In the postoperative period, it is also imprecise because surgical lavage is performed, natural/physiological reactive peritoneal/pleural fluid, which sometimes emulates bleeding, making it difficult to quantify it in a timely manner. See figure 3.

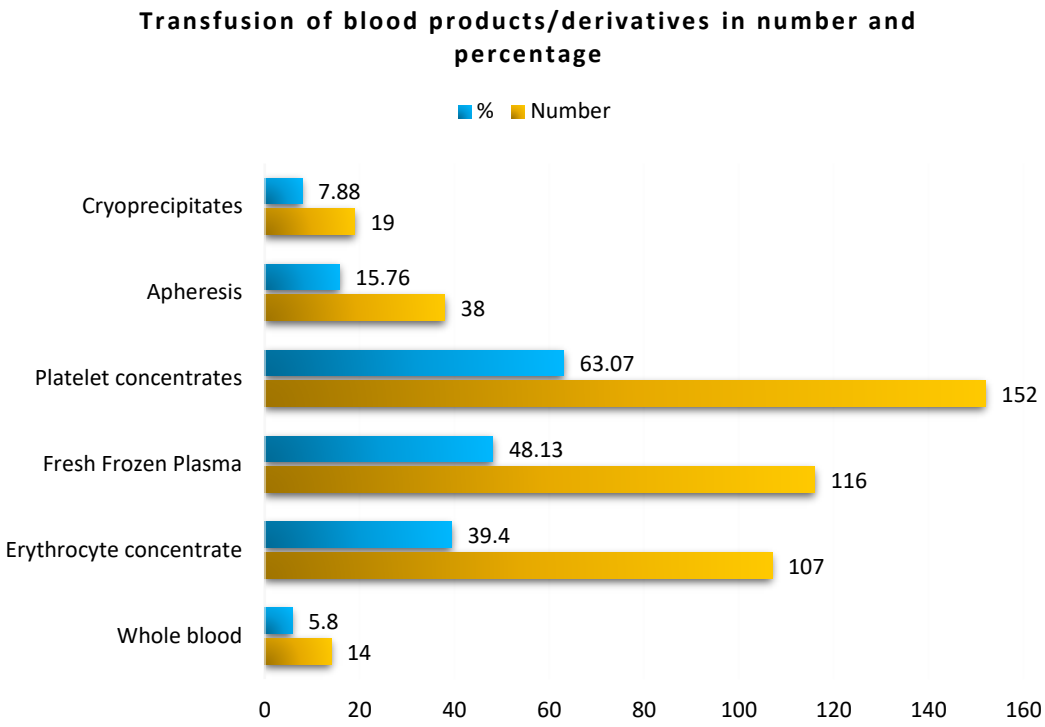
Figure 3: Textiles from a massive trans operative hemorrhage, greater than 3,000 milliliters

Morbidity was estimated in the first place with surgical wound infection in 16 (6.63%), urinary tract infection 4 (1.65%) cases, and in third place pneumonia associated with health care 2 (0.82%) patients, concluding 9.20% in 18 individuals, warning that the same patient may present more than one morbidity at the same time. Mortality was presented in 3 patients (1.24%), in the category of being an emergency surgery, one of these patients due to abdominal and thoracic trauma, the second and third due to vascular injury due to abdominal trauma. The three patients had an incoercible hypovolemic shock and despite extreme measures they were not successful in avoiding it. The transfusion of blood products is specified in table 4 and graph 3.

Table 4: Transfusion of blood products/derivatives in number and percentage in patients with bleeding due to surgical disease from 2014 to 2024: multicenter study

Derivatives of blood products	Number/%/patient
Whole blood	14/05.80/4
Erythrocyte concentrate	107/39.41/48
Fresh Frozen Plasma	116/48.13/37
Platelet concentrates	152/63.07/14
Apheresis	38/15.76
Cryoprecipitates	19/07.88/2
Total	434

URL: http://dx.doi.org/10.14738/bjhr.1204.19065.



Graphic 3

The use of 434 blood products was carried out in only 241 surgeries in this select group. The blood product with the highest numerary are platelet concentrates for the minimum amount used in surgery per patient, ranging from 10 to 20 units per patient, which in this case were 11 patients. The second most frequently used blood product was fresh frozen plasma, in most cases to avoid bleeding in the trans operative period, correcting coagulation times in elective surgeries or in emergency surgery such as volume or in a massive transfusion; it is also carried out when more than two units of erythrocyte concentrate are applied: and the third is a plasma- this action was carried out in only 37 cases (15.35%).

The third blood product that used you the most was the erythrocyte concentrate in total relative number, but in number of patients it was in first place with 48 patients, with an average of 1 to 2 units and a range of 1 to 5 per patient. The rest of the blood resources were obtained and used anecdotally, such as cryoprecipitates or whole blood, used only in 6 individuals. All the above was collected from the transfusion sheets of the clinical file.

In the analysis of the above, erythrocyte concentrate is the most frequently used blood resource, with the greatest impact, reliability, availability and with some ease in its indication and/or implementation. This allows us to contribute to or complement the management of the patient in most cases, especially in hypovolemic shock and chronic anemia with priority surgery. In trauma surgery, the opportunity was used for whole blood in 4 patients, a relevant blood product in surgeries with massive bleeding, but not available in a usual or routine way. cryoprecipitates were used in two patients with hemophilia A.

The length of hospital stay ranged from 16 hours to 37 days with an average of 3 days. The longest time was for complicated cases with reoperation or for complicated complex pathology. Individuals who had outpatient surgery are those who had scheduled surgery. 3 patients were in intensive care with an average of 6 days and ranges from 3 to 11 days.

DISCUSSION

Conventional orthognathic surgery involves long operative hours with intraoperative blood loss and a prolonged postoperative stay. The mean intraoperative blood loss reported was 436.11 ml, with a standard deviation of 207.89 ml. [17] In other cases, for example, placenta accreta spectrum is a significant obstetric complication characterized by abnormal invasion of the placenta into the uterine wall. It often requires a peripartum hysterectomy to prevent life-threatening bleeding because of the imposing and incoercible bleeding. [18] Hemorrhage is one of the main causes of preventable mortality in trauma, the ultra-massive blood transfusion strategy; defined as ≥20 units of red blood cells in 24 hours and determine if there is a threshold beyond which additional transfusion efforts should be discontinued. [19] Hemorrhage hypovolemic shock is a leading cause of death in trauma patients in prehospital settings. In cases of traumatic shock, early control of bleeding and effective volume replacement with blood products should be available, which are essential strategic interventions to save lives. An early transfusion not only contributes to volume expansion but also plays a key role in the timely treatment of hemorrhagic shock and trauma-induced coagulopathy. [20, 21] In addition, it is necessary to specify the permitted or permissible bleeding, in order to predict the permissible blood losses in patients in whom it is assumed that they will suffer losses of this type -for example, intraoperatively, and simultaneously that they will receive intravenous fluids (crystalloids or colloids), keeping the volume, approximately, constant but not the concentration; [22] In patients, 20% of whole blood loss is the so-called "permissible", which practically does not merit management with transfusion of blood products, however, the concentration of blood is altered in both hemoglobin and hematocrit and is not real after "linear" management with fluids such as crystalloids, colloids, and poorly quantified trans operative blood loss. A huge mistake is made, underestimating or overestimating the patient's actual bleeding in surgery, and consequently the management or treatment. [23]

Hemorrhage in surgery has been classified according to the American College of Surgeons into four classes or grades and is detailed in table 5. [24]

Table 5: Classification of Blood Loss According to American College of Surgeons

Parameters	Class I	Class II	Class III	Class IV
Blood loss(ml)	<=750	750-1500	1500-2000	>=2000
Blood loss (% total blood volume)	<=15%	15-30%	30-40%	>=40%
Heart rate (lpm)	>100	>100	>120	>=140
Arteral pressure	Normal	Normal	Decreased	Decreased
Pulse pressure	Normal or high	Decreased	Decreased	Decreased
Hair Filler	Normal	Retarded	Retarded	Retarded
Respiratory rate (rpm)	14-20	20-30	30-40	>35
Urine output (ml/h)	>=30	20-30	5-10	<5

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Mental state	Discreet anxiety	Anxious	Anxiety, confusion	Confusion, lethargy
Fluid replacement	Crystalloids	Crystalloids	Crystalloids + blood	Crystalloids + blood

It is necessary to highlight the operational definitions and obtain a better context of hemorrhage in surgery, as it is massive/critical hemorrhage is defined in several ways as:

1. Blood loss is greater than circulating blood volume within 24 hours.
2. Blood loss equals to or greater than 50% of a circulating blood volume within three hours.
3. Blood loss greater than 150 ml/minute.
4. Blood loss requiring transfusion of plasma and platelets." [25]

This means that the volume and speed of the blood transfusion is always considered to save the patient's life. It should be mentioned that the guidelines for transfusion of blood products in patients with hypovolemic shock, managed in the intensive care unit published by the European Society of Intensive Care Medicine in 2021, are mainly based on low-quality evidence, including recommendations for fibrinogen infusion, for which there is currently no recommendation. [26]

Deficiency of coagulation factors are a major cause of coagulopathy in massive transfusion, fibrinogen, the final component of the coagulation cascade, binds to platelets and promotes their aggregation, with a blood loss of 20%, the activity of other unstable coagulation factors decreases to 25%. [26, 27, 28] At the same time, massive obstetric hemorrhage must be defined. Where the average postpartum hemorrhage greater than 500 ml and 1,000 ml were significantly higher in the group with hereditary bleeding disorders and defining a postpartum hemorrhage greater than 1,500 ml., it is already cataloged as massive. [29]

Massive bleeding protocols improve outcomes for adults with severe bleeding with resuscitation for damage control and were developed to decrease bleeding mortality in adults with trauma by optimizing blood transfusion processes and mitigating complications related to bleeding or transfusion. [30] Another diagnostic definition to clarify is that of disseminated intravascular coagulation as "an acquired and life-threatening intravascular disorder characterized by systemic activation of coagulation, dysregulated fibrinolysis, and endothelial injury, resulting in micro thrombosis.” Disseminated intravascular coagulation arises from various underlying etiologies and progresses from an early phase that is potentially asymptomatic, to an advanced phase with hemorrhage and/or organ dysfunction." [31]

Quantifying preoperative, trans operative and postoperative bleeding is to date a joke, and it is only conjecture to carry it out; in Mexico it is calculated by habit or dogma by the physician specialized in Anesthesiology empirically at his criteria, emotion and/or experience. All the above observations yield values of suspicion or relative quantifications in terms of truth, since it is only a visual evaluation, by color and/or extension. [32] In the ideal world, the best method is to weigh the textiles that absorb the blood content and the aspirate vessels, subtracting the fluids administered to the surgical field for a more accurate estimate and closer to reality. Methods have been catalogued to quantify bleeding in the trans operative period by the anesthesia service:

1. Visual
2. Estimation by calculation [33]
3. Gravimetric estimation [34]
4. Photometric estimation [35]
5. Automated quantification [36]

The visual method has remained due to the ease of use, availability and above all its zero cost when carrying it out, the estimates of the observers and the fact that there is no consensus among them represents a strong disadvantage in decision-making among the participants (medical and paramedical team) during a surgical procedure, since the inaccuracy has a direct impact on the patient. [37]

In a complex surgical procedure associated with morbidity and blood loss, which often requires blood transfusion, the goal of reducing blood transfusion volume and exposures is sought by strategies such as preoperative iron supplementation, intraoperative use of cell retrieval and tranexamic acid, maintenance of normothermia, and restrictive transfusion protocols. [38, 39] When humans lose 40% of their blood volume they fall into hypovolemic shock and their replacement of the lost volume with both resuscitation fluids and blood products leads to further dilution. The high mortality rate in severe bleeding justifies the so-called "Damage Control Resuscitation". [40] It should be considered that prehospital resuscitation with blood products, such as whole blood or dry plasma, has the potential to improve the prognosis in patients with hemorrhagic shock, due to storage, transport and administration problems in field settings; the functional and structural properties of lyophilized plasma is a viable alternative to conventional plasma, with logistical and storage advantages in prehospital and remote applications, especially in scenarios where whole blood is not available. [41]

Nowadays it is well pointed out that a minimum administration of crystalloids must be used, the use of large volumes is fatal, since the lack of blood products is proven to cause: intestinal edema, retroperitoneal edema, abdominal compartment syndrome, acute respiratory syndrome, intensified hemorrhage due to alteration of the clot, coagulopathy established by over dilution of the plasma, terminal organ dysfunction, electrolyte alteration and increased mortality. [42] Importantly, traditional tests for assessing coagulation status are limited by slow retrieval of results, which do not assess all phases of coagulation and are not predictive in nature. [43] With the above, in a massive bleeding it is advisable to make a specific regulation for the use of whole blood, by protocol and that then the patients do not develop traumatic coagulopathy, and the most appropriate conduct or measure is to replace blood by blood in euvolemic resuscitation. [44] Mass transfusion is defined as administering 10 units ≥of red blood cells to the patient in 24 hours, published in a study of 1,029 patients, in which 63.3% of patients were transfused. [45]

In regards to the management or treatment of surgical bleeding that is initiated in the basic hemostasis principles of stopping bleeding, such as the placement of pre-hospital tourniquets, which is not a mandatory criterion for standard activation of trauma equipment, as recommended by the American College of Surgeons Committee on Trauma. However, it should be considered for use assertively and routinely, because it does improve the patient's prognosis. [46, 47] Trauma is a major global public health problem in many countries, and there is a lack of adequate work to reduce preventable deaths; so, the mortality rate remains very

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high to its target, indicating the need for continued development in health care, including further improvements across the system. In the pre-hospital phase, the primary focus is on early and intensive hemorrhage control using techniques such as tourniquet application, wound tamponade, and permissive hypotension as standard practices, or intraosseous vascular access, tranexamic acid administration, which have improved patient outcomes. [48]

The use of prehospital plasma in injured patients is associated with survival, mainly in cases of blunt trauma, with an improvement in prognosis. [49] Massive bleeding during obstetric surgeries, such as obstetric hysterectomy, is a major cause of maternal mortality and morbidity worldwide, where fluid resuscitation is imperative. However, intraoperative regimens and fluid requirements cannot be universally standardized, they must be tailored to each patient, with the debate between restrictive and liberal fluid resuscitation during massive intraoperative bleeding has persisted for a long time. [50] On another note, the use of vasopressors during acute resuscitation of severely traumatized patients has long been controversial, but moving on to the concept of permissive hypotension, resuscitation for damage control focuses on hemostatic transfusion of blood products to maintain perfusion pressures. [51] The "permissive hypotension" component was first introduced in 1994 by Bickell et al., explaining that increased blood pressure prior to definitive hemodynamic control disrupted natural clot formation, leading to worse outcomes in over-resuscitated patients; [52] unlike high-dose vasopressors, they have gained momentum as a means of achieving rapid hemodynamic stability in critically ill patients, although this is contrary to the view of European guidelines. [53, 54]

Research demonstrates that hemorrhage and trauma-induced coagulopathy are reversible components of traumatic injuries, if identified and treated early, however, the evidence from this published study where differences between blood transfusion strategies in terms of mortality or thromboembolic events was little or none. [55] In addition, health services in the United Kingdom offer blood products and calcium replacement therapy, but the use of calcium replacement therapy at the point of care is not widespread. Ionized hypocalcemia can occur due to calcium chelation of citrate-containing blood products or in response to traumatic injury. There are no national guidelines for calcium replacement. [56]

Tranexamic acid is a synthetic antifibrinolytic agent developed for hemostasis, which is currently widely used in cosmetic and reconstructive surgery. Its application in facial cosmetic procedures seeks to reduce bleeding, inflammation and bruising, as well as reducing intraoperative bleeding, surgical time and postoperative sequelae, such as edema and ecchymosis safely and effectively. [57] The use of tranexamic acid significantly reduced the need for blood transfusion in patients undergoing surgery for hip fracture, no significant changes in thromboembolic events were observed, its intervention seems to be promising in terms of the need for transfusion in the target population. [58] Tranexamic acid has also become a mainstay in blood-saving strategies for cardiac surgery, reducing blood loss and the need for transfusions in a variety of cardiac surgeries, including coronary artery bypass surgery, valve procedures, and aortic surgery. Special attention is paid to its use in pediatric cardiac surgery. We address current debates about optimal dosing strategies, timing of administration, and integration with other hemostatic interventions. [59] Oral and intravenous tranexamic acid are effective in reducing blood loss and the need for transfusions, with similar

safety profiles. Given its comparable efficacy, possible lower cost and easier administration, oral presentation represents a viable alternative to intravenous. [60]

There are several strategies for controlling or treating bleeding in surgery, whether scheduled or emergency, such as preoperative autologous blood donation (tolerable pre-donation anemia and sufficient time for regeneration appear to be crucial for subsequent erythropoiesis in elective surgery) and intraoperative blood recovery are established blood conservation measures. [61] Hemostatic agents effective in junctional hemorrhage may slow blood loss and improve survival; there is a new starch and chitosan hemostatic foam that would improve hemostasis and thus increase survival in a femoral artery hemorrhage model, compared to the CombatGauze. [62] Or rapid hemostatic composite sponges by incorporating kaolin into carboxymethylchitosan/sodium alginate with the combination of methods such as ion crosslinking, polyelectrolytic action, and freeze-drying. [63] In addition, hemostatic foam gives excellent biocompatibility, degradability, hemostasis, and antibacterial properties, with a high rate of fluid absorption and priority aggregation of blood cells/platelets that achieves rapid hemostasis. [64] For arterial pseudoaneurysms, which are a life-threatening complication secondary to vascular intervention or trauma, a minimally invasive treatment modality is percutaneous ultrasound-guided thrombin injection combined with balloon occlusion, which is highly technically successful and avoids distal thromboembolism, and is safe and effective. [65] On the other hand, gastric varices present a potential risk of massive bleeding. Real-time delivery of endoscopy-guided adhesives and devices has become a therapeutic modality, but its generalization has been limited due to the lack of availability and experience in linear echoendoscopy. Therefore, the mini-probe with greater availability that facilitates the injection of cyanoacrylate is used, evidencing superior effectiveness and safety to direct endoscopic injection, while the use of the dual-channel gastroscope further improved accuracy and efficiency. [66]

Another way to obtain hemostasis is by supraselective direct embolization, as is the example of acute hemorrhagic rectal ulcer, although it is a relatively rare etiology of lower gastrointestinal bleeding, it represents a critical clinical emergency characterized by sudden, painless, massive and recent rectal bleeding. Endoscopic hemostasis remains a prominent therapy, its efficacy is limited in emergency situations due to poor bowel preparation and obscured visualization, arteriography is then with complete embolization of rectal arterial supplies showed great potential to reduce the risk of rebleeding. [67] It has been shown that hem coagulase has an action like that of thrombin and thromboplastin in blood coagulation; it is an enzyme complex that has been synthesized based mainly on the coagulant and antihemorrhagic properties of isolated fractions of the venom of Bothrops Jararaca or Bothrops Atrox. It is a safe, effective, and cost-effective adjunct to tonsillectomy, offering significant advantages in surgical efficiency and postoperative recovery. [68] There are many tried/known options, including laser coagulation, radiofrequency electrocoagulation, and more; however, having the resource or input is critical. [69, 70]

En Mexico still in use and in controversy the hemostatic agent that is ethamsylate synthesized in the year 1959; the evaluation to reduce bleeding in total hip replacement surgery has been published, which in this study did not demonstrate an effect on the reduction of bleeding in patients undergoing total hip replacement with the use of the hemostatic agent. [71] Contradictorily in another publication, the administration of ethamsylate reduces bleeding in

URL: http://dx.doi.org/10.14738/bjhr.1204.19065.

adenotonsillectomy surgery in pediatric patients. [72] It should be noted that the publications found are only in Mexico, at the international level there have been no publications of this agent since 1973.

CONCLUSIONS

In public surgical practice in Mexico, patients who have hemorrhages in surgery are an object of oblivion for the administrative area of hospitals, due to the extreme lack of supplies or resources, as well as the lack of competence of the personnel of the rest of the surgical team, which determine practically heroic behaviors of the surgeon responsible for saving the patient's life.

There is an erroneous quantification of bleeding in surgery in the patient, both preoperatively, trans operatively and postoperatively; since in the first order, the total of the three items is not combined or added and in the second place in the operating room only the quantification is very subjective. In Mexico, it is calculated by habit or dogma by the doctor specializing in Anesthesiology empirically according to his criteria, emotion and/or experience. All this results in an overestimation or underestimation in the totally erroneous management/treatment, with excess in blood transfusion, excess in the use of intravenous fluids and vasoactive drugs/amines; contradictorily with an excessive, useless and wasteful use of the few existing resources.

For decades, in Mexico, this problem of patients with hemorrhage in surgical pathology has been real and without hope of improvement, so it will continue in agony and continuous decline.

Conflict of Interest

The authors stated that they had no potential conflicts of interest regarding the research, authorship, and/or publication of this article.

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