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Patient Blood Management During Major Orthopaedic and Traumatological Surgery at Renaissance University Hospital Center in Chad

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Abstract: ***Introduction: To determine "Patient Blood Management" intraoperatively in major orthopedic and trauma surgery at the Centre Hospitalier Universitaire la Renaissance (CHU - R). Patients and methods: This was a descriptive, cross - sectional study conducted over a period of seven (07) months from January 01 to July 30, 2023 in the operating theatre. All consenting patients undergoing major orthopaedic or traumatological surgery were included in the study. Variables aimed at reducing intraoperative blood loss were studied. Results: A total of 216 cases were collected, of which 50 met our criteria and 86% were male. The mean age was 52 years, and the 21 - 30 age group was the most affected (30%). Centromedullary nailing was the most frequent procedure in Traumatology (74%), including Gamma nailing 50%, and total hip replacement (THR) in Orthopedics (26%).82% of patients had intraoperative blood loss ≥1000 of which 28% had between 1501 and 2000ml. Among the strategies evaluated, the efficacy of ATX was demonstrated by the reduction in blood loss by ricocheting the hemoglobin level in the group who benefited from it (1025ml versus 1484ml). Other strategies, such as anesthesia and surgical techniques, did not show a significant difference in intraoperative blood loss. Intraoperative autotransfusion was not applied. Conclusion: Our study is part of a clinical audit to evaluate Patient Blood Management practices in orthopaedic and traumatological surgery. Only tranexamic acid showed significant efficacy in intraoperative blood conservation.***

Keywords: Patient Blood Management, orthopaedic and traumatological surgery and CHU La renaissance

1. Introduction

The term Patient Blood Management (PBM) was first used in 2005 by Professor James Isbister, an Australian haematologist, who realized that the focus of transfusion medicine needed to shift from blood products to patients [1].

PBM is a multimodal, multidisciplinary patient - centered strategy aimed at minimizing the use of homologous blood products and improving patient outcomes [2]. It is synonymous with homologous or allogeneic transfusion - sparing strategy. It is a proactive approach to improving the quality and safety of care, recommended by the Sociétés Savantes and the WHO. One of the aims of this approach is to reduce bleeding in surgical patients, so as to avoid as far as possible the need for homologous blood transfusion in regulated surgery [3]. One of the most important areas of application of PBM is in qualified hemorrhagic or potentially hemorrhagic surgery. These surgeries, involving arthroplasties of the spine and lower limbs, often result in enormous blood loss. The clinical implementation of this strategy rests on 3 pillars: optimizing the patient's blood mass, minimizing blood loss and increasing the patient's tolerance to anemia [4].

In emerging countries, the problems posed by blood transfusion in general are fourfold: infrastructure (blood transfusion establishments), the different techniques used (autologous transfusion, re - transfusion of recovered blood) and, above all, donors and other factors (cultural obstacles, habits and customs, even beliefs) [5].

In Chad, as in other developing countries, there is a serious problem in terms of voluntary blood donors, which means that even in emergency situations we have to rely on family donors. The 2021 report from the Centre National de Transfusion Sanguine (CNTS) shows a percentage of 07.13% for voluntary donations, compared with 92.87% for family or replacement donations [6]. Despite the difficulties of access to blood products, this study takes place in a context where the increased prevalence of ballistic trauma due to armed clashes, brawls, public road and traffic accidents and the prevalence of degenerative arthropathies of the hip continue to grow in our Chadian populations. We therefore set out to study "Intraoperative Patient Blood Management" in orthopaedic and traumatic surgery at the Centre Hospitalier Universitaire la Renaissance (CHU - R).

2. Materials and Methods

Patients and Methods

We conducted a descriptive, cross - sectional epidemiological study. It took place over a period of seven (07) months, from January 01 to July 30, 2023, in the operating theatre of the Centre Hospitalier Universitaire la Renaissance (CHU - R).

Our study included all patients who had undergone scheduled major orthopedic or traumatological surgery.

Major scheduled orthopedic or traumatological surgery is defined as: Total Hip Replacement (THR), Total Knee Replacement (TKR) and centromedullary nailing osteosynthesis surgery (Gamma, Targon and universal nails).

Only patients who consented to the study were included.

Excluded were patients operated on for any major surgery other than traumatology or orthopedics, orthopedic surgery or minor traumatology, and any patient who had not given consent to be included in our sample.

Data were collected on synoptic charts from anesthesia records preoperatively and during surgery.

The parameters studied were socio - demographic, clinical, therapeutic and evolutionary. The variables under study were essentially

a) Hemorrhagic risk management, based on assessment of haemostasis parameters such as prothrombin rate (PT) and active partial thromboplastin time (APTT), as well as platelet count, and perioperative management of anticoagulants and antiplatelet agents, and maintenance of normothermia;
b) Surgical hemostasis techniques: electric scalpel, pneumatic tourniquet, surgeon dexterity, and to avoid confounding bias, procedures were performed by the same operators.
c) Medicinal techniques to limit blood effusion: tranexamic acid: 10 to 20 mg/ kg or 1g 30 minutes before incision and 10 to 15mg every 4 hours;
d) Anesthetic techniques:
   - Anesthésie General: propofol (3mg/kg), fentanyl (3µg/kg), atracurium: (0.5mg/kg) and isoflurane (1.5¨%). The aim is to achieve deep analgesia and a decrease in BP so that intraoperative blood flow can be reduced.
   - Rachianesthésie: Bupivacaine 0.5% (12.5 to 15 mg), fentanyl (25µg) and morphine (100 to 200µg).
   - Normothermie: the aim is to maintain the patient's basal temperature between 36.5 and 37 degrees Celsius.

Data were entered in Excel and analyzed using EPI - INFO software. Quantitative and qualitative variables were studied using the Chi2 or T - student test.

3. Results

A total of 216 cases were collected, of which 50 met our criteria, giving a hospital prevalence of 23.14%.86% were male, giving a sex ratio of 0.16. The mean age of our patients was 52 years, with extremes ranging from 18 to 86 years. The most common age range was 21 to 30 years, i. e.30%. Our patients were 76% American Society Anesthesiology class 1 (ASA 1), and hypertension was the most common comorbidity.

The most frequent surgical situation was trauma, accounting for 80% of cases. Osteosynthesis by centromedullary nailing was the most frequent procedure in Traumatology (74%), including Gamma nailing (50%) and Targon nailing (24%), and total hip replacement (THR) in Orthopedics (26%) (figure 1).

Regarding assessment of preoperative hemoglobin levels, 32 patients (64%) had preoperative anemia with hemoglobin levels ranging from 10 to 12g/dl. With regard to bleeding risk management, 83.7% of patients underwent hemostasis and 38% discontinued bleeding - risk drugs (table 1).

Intraoperative blood loss was between 1000 and 1500ml in 54% of patients, and between 1500 and 2000ml in 28%. There was no significant difference in intraoperative blood loss according to the type of anesthesia (General Anesthesia and Spinal Anesthesia), although there was a significant difference in blood loss between the two types of anesthesia.

There was a correlation between duration of surgery and blood loss: after 3 hours, 18% of patients had lost between 1502 ml and 2000 ml.

Compared with the use of antifibrinolytics, blood loss was greater in the group that did not receive tranexamic acid (ATX), i. e.60% of bleeds exceeding 1500 ml, and mean blood loss was 1025 ml in the groups of patients who received tranexamic acid versus 1584 ml in the group that did not (table 9).

Mean postoperative hemoglobin levels ranged from 10 to 13g/dl in the ATX group (Figure 3).

12 out of 17 patients transfused had not received ATX (table 5).

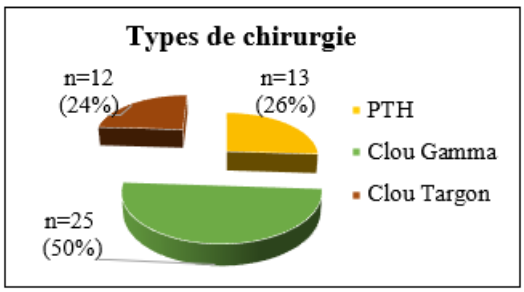

Figure 1: Breakdown by type of surgery

Gamma - type centromedullary nailing is performed in 50% of cases.

Table 1: Preoperative anemia and bleeding risk management

Preoperative haemoglobin	Frequency	Percentage
≥ 13g/dl	18	36%
10 à 12g/dl	32	64%
TOTAL	**50**	**100, 00 %**
Investigation of haemostasis disorders	Frequency	Percentage
Platelets	7	14, 00 %
TP + Platelets	7	14, 00 %
PT+ APTT+ Platelets	36	72, 00 %
TOTAL	**50**	**100, 00 %**
Discontinuation of bleeding - risk drugs	Frequency	Percentage
Antihypertensives	1	2, 00 %
None	28	56, 00 %
Others	2	4, 00 %
Heparin	19	38, 00 %
TOTAL	**50**	**100, 00 %**

This table shows that 64% of patients were anemic preoperatively, and 83.77% and 38.00%, respectively, had undergone hemostasis workup and discontinued bleeding - risk drugs.

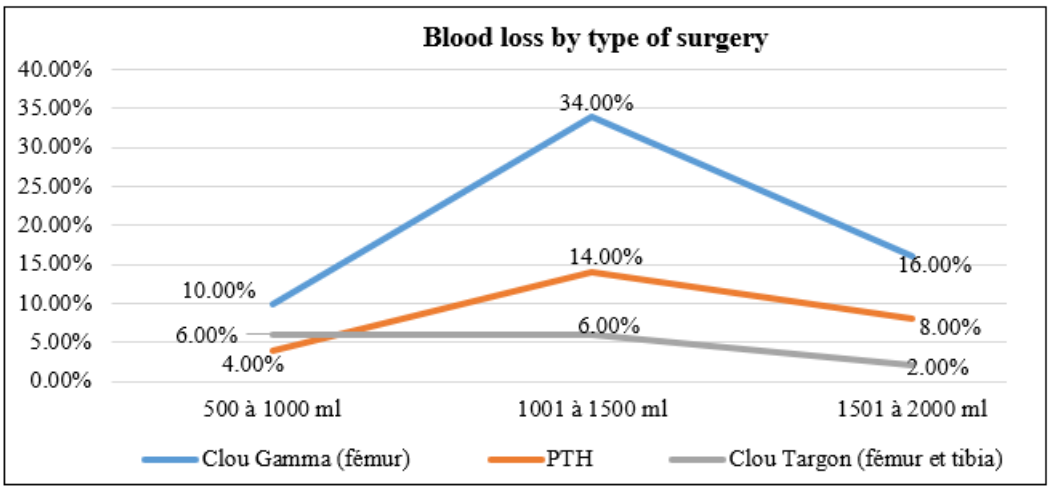

Figure 2: intraoperative blood loss by type of surgery

We noted that 54% of patients had intraoperative blood loss between 1000 and 1500ml and 28% had more than 1500ml;

Table 2: Surgical technique reducing intraoperative blood loss

Surgeon's actions	Assessment of intraoperative blood loss			
	500 to 1000ml	1001 to 1500 ml	1501 to 2000 ml	Total
Electric scalpel	6	24	9	39
	12, 00%	48, 00 %	18, 00 %	78, 00 %
Pneumatic tourniquet + electric scalpel	8	1	2	11
	16, 00%	2, 00%	4, 00%	22, 00 %
Total	14	25	11	50
	28, 00%	50, 00 %	22, 00 %	100, 00 %
Chi - square	Df	Probability		
2, 5217	4	0, 6408		

The findings in this table demonstrate that the use of pneumatic tourniquets in conjunction with electric scalpels significantly reduces intraoperative blood loss by surgical means.

Table 3: Effects of tranexamic acid on intraoperative blood loss

Use of antifibrinolytics 30 minutes before incision				
Blood loss	Number	Percentage	Mean blood loss	Standard deviation
ATX (+)	18	36%	925 ml	± ml
ATX (-)	32	74%	1484 ml	± ml

Analysis of this table shows that blood loss was greater in the non - ATX group (60% of bleeds greater than 1000 ml), and mean blood loss was 1025 ml in the tranexamic acid groups and 1584 ml in the non - ATX group.

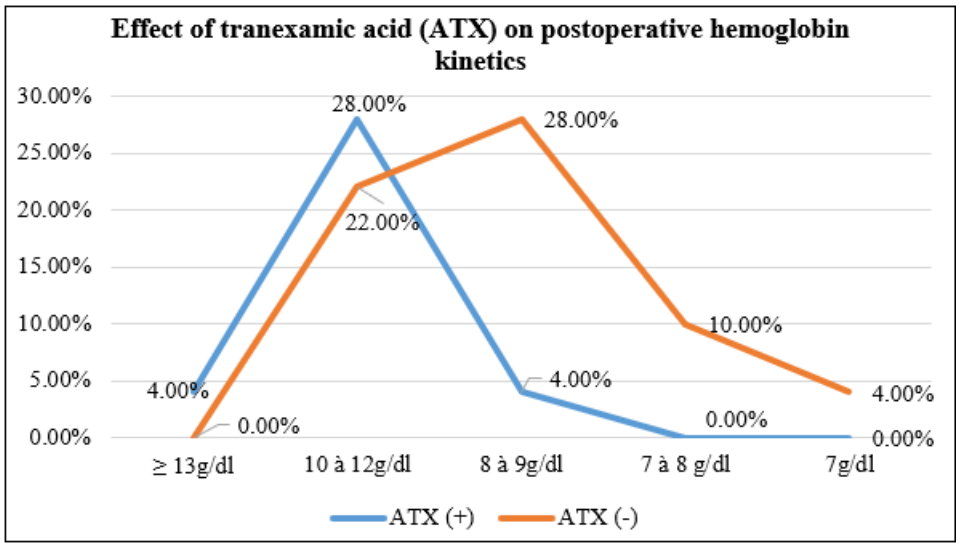

Figure 3: Influence of tranexamic acid (ATX) on postoperative hemoglobin kinetics.

From this figure we note that of 36% of patients who received tranexamic acid, 28% had retained hemoglobin levels ≥ 10 g/dl; whereas of 74% of patients who did not receive tranexamic acid, 42% had their hemoglobin levels lowered between 07 and 9g/dl.

Table 5: Use of homologous blood transfusion

Homologous blood transfusion	ATX (-)	ATX (+)	Total
Peropérative	5	3	8
	10, 00%	6, 00%	16, 00%
Postopérative	3	2	5
	6, 00%	4, 00%	10, 00%
Peropérative + postopérativre	4	0	4
	8, 00%	0, 00%	8, 00%
TOTAL	12	5	17
	24, 00%	10, 00%	34, 00%

34% des patients ont été transfusés dont 24% du groupe n'ayant pas reçu de l'acide tranexamique.

4. Discussion

Perioperative Patient Blood Management (PBM) is a major public health issue, as its successful implementation is associated with a reduction in hospital mortality, postoperative morbidity and average length of stay [7]. They reduce intraoperative blood loss, the transfusion rate, the proportion of patients transfused, the number of blood products used, and the proportion of anemic patients discharged from hospital [8]. A similar study in Cameroon also reported a male predominance of 86.4%, and 74.6% of cases were in the 20 - 40 age bracket [9].

In our sample, 76% had no particular history, and the most common comorbidity was arterial hypertension (14%). According to the results of the study carried out in Madagascar, 96.28% of its patients had no particular history, and arterial hypertension was also the comorbidity encountered (2.38%) [10]. Our data were in line with most regional studies, reflecting the youthfulness of the African population. These young people constitute the most active segment of the population, and are exposed to the risk of road trauma, which is a major cause of death.

In our study, trauma to the femoral neck, femoral diaphysis and tibia was the main indication for centromedullary nailing (traumatology) (74%), while PTH was the main indication for orthopedics (26%). Jean Baptiste Ramampisendrahova, Andriamanantsialonina Andrianony et al, also reported that femoral trauma and PTH were the main procedures performed in orthopaedics and traumatology respectively [11]. Our results corroborate those of El Houari et al in Morocco, who reported that 40% of patients underwent orthopaedic surgery, including 22% hip replacement and 18% knee replacement, and 46% trauma surgery [12].

In terms of hemorrhagic risk management, 83.77% of patients underwent a hemostasis check - up and 38% discontinued bleeding - risk drugs. The Société Française d'Anesthésie et de Réanimation (SFAR) (French Society for Anesthesia and Intensive Care) states that "an unrecognized hemostasis anomaly can lead to excessive or prolonged bleeding, increasing morbidity and mortality; preoperative assessment of the risk of bleeding during the anaesthesia consultation is therefore essential to identify subjects with an increased peri - interventional risk of bleeding", and continues that it is recommended to "stop anticoagulants and at least P2Y12 receptor inhibitor - type antiplatelet agents" [13].

Out of 50 patients, 64% presented with preoperative anemia (10 ≥ Hb <12). This result is comparable to the data obtained by PINEAU Florian & RABET Jean who had proved a prevalence of anemia at 42.6% with a mean hemoglobin value of 11.2 ± 1.4 g/dl [14]. However, transferrin saturation assay (≤ 20%) and/or Ferritin (≤ 100 µg/l) were not performed, despite the fact that martial deficiency is the leading cause of preoperative anemia worldwide [15].

Orthopedic and traumatological surgery is often accompanied by perioperative blood loss, but the amount depends on the type of surgery, the type of anesthesia and the duration of the procedure. We chose to measure the amount of intraoperative blood loss by the sum of the amount of blood aspirated into the suction bottle and the blood in the compresses. Although inaccuracies could occur, we used this approach as it is a more practical tool.

In the present study, in orthopedics as in traumatology blood loss ≥ 1000 ml is observed in 80%, but prosthetic surgery and Gamma nail placement had the greatest amount of blood loss (44% and 20% respectively). Our results are comparable to the Madagascar study, which found 56.35% of patients with significant bleeding greater than 500 ml blood loss [9].

There was no significant difference in intraoperative blood loss between the two types of anesthesia, although there was a slight reduction in blood loss in the AR group compared with the GA group (1297ml versus 1302ml).

The use of a pneumatic tourniquet in conjunction with an electric scalpel significantly reduced intraoperative blood loss (16% = 500 to 1000ml). The use of a tourniquet in orthopedic surgery reduced intraoperative bleeding and total blood loss in a meta - analysis of 10 randomized controlled trials [7].

In the ATX group, mean blood loss was lower: 925 ml (36%) versus 1584 ml (64%) in the non - ATX group. Over the past ten years, several meta - analyses have explored the use of ATX to minimize blood loss in various potentially hemorrhagic surgeries, notably orthopedic/traumatological and spinal surgery. The efficacy of ATX has been well demonstrated by two network meta - analyses of hip and knee arthroplasty [16, 17, 18]. These studies showed that ATX significantly ($P < 0.05$) reduced blood loss and transfusion.

Our results demonstrated the influence of tranexamic acid on the reduction of intraoperative blood loss: 28% of the 20 patients who received tranexamic acid retained hemoglobin levels ≥ 10 g/dl; while 42% of the 30 patients who did not receive tranexamic acid had hemoglobin levels reduced to between 07 and 9g/dl. Herve Hourlier, Pierre Fennema, Emmanuel et al found that mean postoperative hemoglobinemia at D+7 was 11.9g/dl in the ATX group and 10.8 g/dl in the control group (p <+ 0.001) [18]. Furthermore, a recent systematic review and meta - analysis of five RCTs (457 enrolled patients undergoing total hip arthroplasty) concluded that combined intravenous and topical ATX is more effective than ATX alone in terms of reducing blood loss, hemoglobin decline [19].

The technique of intraoperative autotransfusion (Cell saver) is not applied in our center due to a lack of technical facilities. However, Ahmed ABBES and Adrien BOUGLÉ confirmed that the ultimate objective of autologous blood recovery and transfusion is to reduce allogeneic transfusion and its complications. The most significant result was observed in orthopedic surgery patients (OR 0.46; 95% CI [0.37 - 0.57]) [20].

Concerning the use of homologous blood transfusion, 34% of patients were transfused, including 24% in the group that did not receive tranexamic acid. DIALLO Moussa, DJEMA Issa, DIANGO Djibo et al, in their series of 38th patients, found that intraoperative blood transfusion was performed in 17.6% of these patients (68 cases). Of these, 47% underwent emergency surgery [21].

5. Conclusion

Our study is part of a clinical audit to evaluate Patient Blood Management (PBM) practices in orthopaedic and traumatological surgery. More specifically, the aim was to identify intraoperative blood - sparing strategies.

Our study showed that, among the strategies evaluated, 83.77% of patients underwent hemorrhagic risk management: hemostasis assessment and discontinuation of bleeding - risk drugs. The use of tranexamic acid was shown to be an effective technique for reducing blood loss, and the safest for managing significant intraoperative bleeding. Other strategies, such as anesthesia techniques and electrosurgery, have shown little difference in intraoperative blood loss. The technique of intraoperative autotransfusion has not been applied due to the lack of technical facilities available at CHU - R.

Authors' contributions

Beufoutcham Kacharé C: principal investigator, drafting of the manuscript.
Kader NDIAYE,: patient inclusion and follow - up.
Adamou ABBASSI: patient inclusion and follow - up.
Fandebnet SINIKI: patient inclusion and follow - up.
Bonté ADJOUGOULTA KOBOY: patient inclusion and follow - up.
Yannick Canton KESSELY: surgeon, patient inclusion and follow - up.
Mahamat Abderraman Guillaume ZALBA: reading, supervised, framed and final approval of the manuscript.

Agreement

a) All authors of the manuscript have read and accepted its contents and are responsible for all aspects of the accuracy and integrity of the manuscript;
b) This submitted article is an original work not considered or reviewed by any other publication and has not been published elsewhere in the same or similar form.

Conflicts of interest

The authors declare no conflict of interest regarding this work.

References

[1] Massimo Franchini, Giuseppe Marano, Eva Veropalumbo, Francesca Masiello, Ilaria Pati, Fabio Candura, 1 Samantha Profili et al. Patient Blood Management: a revolutionary approach to transfusion medicine; Blood Transfusion. Volume 17 (3); 2019 May National Librery of Medicine [Pubmed Central].
[2] Franchini M and Muñoz M. Towards the implementation of patient blood management across Europe. Blood Transfusion.2017; 15: 292 - 3. [ArticlePM free] [PubMed] [Google Scholar].
[3] Thomas BUBENDORFF. Evaluation du Patients Blood Management en chirurgie orthopédique aux Hôpitaux Universitaires de Strasbourg: étude retrospective, 2020;
[4] lexandre PITARD and Pierre GABACH: Gestion du capital sanguin en pré, per et post opératoire; SFAR, HAS, 2020;

[5] Rakotoarison R. C. N, Rakotomavo F, Velomora A, Raveloson N. E, Solofomalala G. Transfusion Sanguine en Orthopédie, Revue de Chirurgie Orthopédique et de Traumatologie Malgache, Volume 5 (2015);
[6] National Blood Transfusion Center report presented in January 2022.
[7] Haute Autorité de santé (HAS). Gestion du capital sanguin en pré, per et post opératoire et en obstétrique July 21, 2022.
[8] Haute Autorité de santé (HAS). Améliorer la gestion du sang des patients pour une meilleure qualité de prise en charge lors de chirurgies majeures; July 2020
[9] Ngaroua D, Mbo J, Aidego N, Djibrilla Y, Eloundou J. Fractures due to public road accidents at Ngaoundere Regional Hospital. Health Sci Dis [Online] 2016 [Accessed 02/08/2023]; 17 (3). Available at URL: http: //hsd - fmsb. org/index. php/hsd/article/view/564Jean
[10] Rakototiana Sitrakiniaina. Evaluation of blood loss in orthopedic and trauma surgery at CHU ANOSIALA. Thesis Presented and publicly defended on June 23, 2021 in Antananarivo.
[11] Baptiste Ramampisendrahova, Andriamanantsialonina Andrianony, Andrianina Ismaël Razaka, Rado Razafimahatratra, Gaëtan Duval Solofomalala (2020). Evaluation of blood loss during the perioperative period in orthopedic and trauma surgery; International Journal of Medical and Health Science ISSN (Online): 2456 - 6063 Volume 06 Issue 04 December 2020. Email: ramampisendra[at]gmail.com.
[12] El Houari O. Bleeding management in trauma and orthopedic surgery prospective series of 210 cases [Thesis]. Anesthésie réanimation: Fès; 2017.106p
[13] Fanny Bonhomme. Preoperative management of bleeding risk Service d'Anesthésiologie, Hôpitaux Universitaires de Genève, Rue Gabrielle - Perret - Gentil 4, 1211 Genève 14, Switzerland Tel: +41 22 372 74 03 Fax: +41 22 372 76 90 Email: Fanny. Bonhomme[at]hcuge. ch. Le Congrès Conférence d'Essentiel © 2017, SFAR, Paris.
[14] PINEAU Florian & RABET Jean. Prevalence of preoperative anemia in Angevins surgical patients. Thèse pour le diplôme d'état de docteur en médecine qualification en Anesthésie - réanimation; 2021, P 08.
[15] 15 Sigismond Lasocki and Emmanuel Rineau. Detection and correction of preoperative anemia Département Anesthésie - Réanimation, CHU Angers, 4 rue Larrey, 49933 Angers Cedex 9, France. E - mail: silasocki[at]chu - angers. f; MAPAR 2016 p82.
[16] Fillingham Y A, Ramkumar D B, Jevsevar DS, et al. The efficacy of tranexamic acid in total hip arthroplasty: a network meta - analysis. J Arthroplasty 2018; 33 (3083 - 9): e4.
[17] Gianakos A L, Hurley E T, Haring RS, Yoon RS, Liporace FA. Reduction of blood loss by tranexamic acid after total hip and knee arthroplasty unmeta - analysis. JBJSRev 2018 https: //doi. org/10.2106/JBJS. RVW.17.00103.
[18] Jean Wong, Ronald B. George, Ciara M. Hanley, Chadi Saliba, Doreen A. Yee and Angela Jerath. Tranexamic acid: current use in obstetrics, major orthopedic surgery and trauma; Canadian Journal of Anesthesia/ Journal canadien d'anesthésie volume 68, pages894 - 917 (2021).
[19] Herve Hourlier, Pierre Fennema, Emmanuel Fricault, Didier Verstring. Tranexamic acid reduces hemoglobin fall during primary total hip arthroplasty in patients on long - term VKA. Journal of Surgery and Traumatology. Volume 100, number 7, supplement, November 2014. P5259.
[20] Ahmed ABBES, Adrien BOUGLÉ. Techniques and indications of intraoperative autotransfusion. Heart Institute, La Pitié - Salpêtrière University Hospital, Sorbonne Université, GRC 29, AP - HP, DMU DREAM, Department of Anesthesia and Intensive Care, Paris, France; Version of Record: https: //www.sciencedirect. com/science/article/pii/S1279796022000250. Manuscript_d0b2ee28734d51206d1d3a0d9b69bf39
[21] Diallo M, Djema I, Diango D, Kanikomo D, Sogoba Y, Diallo O. Transfusion sanguine en milieu neurochirurgical: notre expérience Hôpital du Bamako, Mali. . Remapath 2019; 4: 9 - 14.