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Anesthetic Management of Hepatic Resection in a Low-Resource Setting: First Bulletin from Africa

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Abstract

Introduction: General anesthesia and antisepsis have made intraperitoneal surgery safer. With the improvement of anesthetic techniques and the development of new surgical approaches, the liver, an organ with high haemorrhagic risks, has become the subject of many successful therapeutic indications. Although widely performed in high-income settings due to a better technical platform, the reverse is true for low-resource settings in Africa where there is little or no report on the anesthetic management of this dreadful surgery. Hence, this study is one of the first from Africa to report on the perioperative anesthetic management and outcome of hepatic resections. **Methods**: This was a retrospective case series study conducted over four years (2019-2022) through a chart review of all medical and anesthesia records of patients admitted to Douala General Hospital, Cameroon for hepatic resection. We collected socio-demographic, clinical, laboratory and intraoperative data, the estimated financial cost and patient outcomes. **Results**: Twelve open hepatic resections were performed mainly electively (11/12 cases) for localized hepatic tumours (7/12 cases) on ASA II patients (11/12 cases) with a mean age of 36.5 years and sex ratio of 1.2. Pre-anesthetic consultations were usually done within 24 days before the surgery. General anesthesia maintained with sevoflurane was the mainstay anesthetic technic. Continuous hemodynamic monitoring with an arterial catheter was done. The blood-sparing strategy was based on tranexamic acid, calcium gluconate and controlled hypotension with an

intraoperative transfusion rate of 33.33%. The cost of the procedures was well above the minimum wage in Cameroon but relatively cheap compared to the cost in high-income countries. No perioperative death was recorded. **Conclusion**: Our hepatic resections were managed with satisfactory blood savings, low morbidity and zero perioperative mortality. Overall, this study is the first to provide data on perioperative anesthetic management and outcomes of hepatic resection in Africa.

Keywords

Hepatectomy, Anaesthesia, Cost, Limited Income, Cameroon

1. Introduction

Surgery has evolved considerably, particularly in the field of hepato-biliary surgery which has become a specialty of its own [1] [2]. For a long time, the liver was considered a mystical organ, full of blood and dreaded performing surgery upon it [3]. Liver surgery has become more efficient, largely due to the segmental approach which enables hepatic resections via minimally invasive procedures such as laparoscopy in high-income countries [1] [2]. The first laparoscopic liver resection was reported in 1992. Since then, the application of laparoscopic hepatectomy has been considered controversial. It is now recognised that this technique has acceptable morbidity and mortality for both minor and major liver resections compared to open resections. However, like endoscopy in general, it is still very immature in low-income countries [4]. However, hepatic resections still performed via open surgery remain a challenge in low-and middle-income countries due to inadequate surgical skills, and surgical and anesthetic infrastructure [3]. The work aimed to present the perioperative anesthetic management and outcomes of hepatic resections in a resource-constraint setting of Africa where little or no previous report has been published in this regard. We report on the anesthetic management plan for a series of 12 open hepatic resections that were both successful and relatively financially affordable.

2. Study Methods

2.1. Study Design, Setting and Population

This was a retrospective case series study carried out by chart review of all cases of hepatic resections performed at the Douala General Hospital (DGH), Cameroon between 2019 and 2022. DGH is a major tertiary and university teaching hospital that has an avant-garde surgical and anesthesiology infrastructural platform compared to other low-middle-income countries, particularly those in the Central African sub-region. The geographical coordinates of DGH are 4˚03'55"North, 9˚45'31"East. Our study population consisted of all medical and anaesthesia records of patients who underwent liver resection surgery for any indication at the Dou-

ala General Hospital during the study period. All complete records containing the variables sought were included.

2.2. Study Procedures and Variables Studied

An ethical authorization "N˚238 AR/MINSANTE/HGD/DM/08/22" from the Medical Directorate of the DGH was obtained. We retrieved from our archives all the medical files and anesthesia records of patients who had undergone at least one hepatic resection. We selected and reported information on temporal data, type of procedure, urgency of the surgery, socio-demographic data, comorbidities, pre-anesthesia clinical and biological parameters, technic of anesthesia, intra-operative monitoring techniques, mean intraoperative blood pressure, blood-sparing means, estimated postoperative blood loss and need of blood transfusion, perioperative drugs used, intra-operative adverse incidents, estimated financial cost of the procedure and patient outcome (discharged alive or dead).

2.3. Ethical Considerations and Statistical Analysis

In strict compliance with the fundamental and ethical principles of medical research, patient information collected will be kept confidential. The study protocol complies with the ethical guidelines of the 1975 Declaration of Helsinki. Data collection, compilation and analysis were performed using Office Excel 2016 and Epi info Version 3.5.1.

3. Results

3.1. General Characteristics of the Study Population

Between 2019 and 2022, we managed twelve cases of open hepatic resections all performed electively but one which was in an emergency setting. All procedures were partial resections, either lobectomies or segmentectomies of which 50% were associated with cholecystectomy. The time frame at which these hepatectomies were done can be distributed as follows: five cases in 2019, two in 2020, four in 2021 and one in 2022. The operative indications were for three quarters of liver tumours where the segmentectomy approach was preferred. There was only one repeat operation for haemostasis of a haemoperitoneum in the immediate postoperative period of a hepatic depacking in the case of closed abdominal trauma (Table 1). The majority of the patients were unemployed or working in the informal sector. Their mean age was 36.53 years with extremes between 08 months and 67 years, the majority being young adults. The sex ratio was 1.2. Anthropometric parameters were generally balanced with a mean weight of 67.27 kg, height of 170.66 cm and body mass index of 23.42 kg/m^2.

3.2. Preoperative Findings

Six out of eleven (excluding emergency revision) patients had at least one comorbidity, notably colon and breast cancer, the latter having metastasized to the

Table 1. Types of intervention with to indications and dates.

Case No.	Date of surgery	Types of hepatic resection	Indications
1	19/02/2019	Segmentectomy VI	Subcapsular nodule around 3 cm on segment VI
2	26/02/2019	Right hepatectomy + cholecystectomy for SV-VI	Hepatic metastasis of a primary cancer in the left breast
3	20/03/2019	Left hepatectomy + cholecystectomy	Large mass in the left liver
4	11/06/2019	Segmentectomy IV and V + cholecystectomy	Gallbladder cancer + IV and V infiltration
5	14/11/2019	Removal of a liver tumour	Liver tumour + suspected biliary atresia
6	19/05/2020	Hepatic cystectomy + left lobectomy	Cyst of the left lobe of the liver
7	27/10/2020	Left hepatectomy	Liver angioma
8	20/01/2021	Left hepatectomy + cholecystectomy	Tumour of the left lobe of liver
9	04/05/2021	Left hepatectomy + cholecystectomy	Adenocarcinoma of the gallbladder with liver metastases
10	17/11/2021	Liver depacking	Closed liver injury
11	29/11/2021	Liver hemostasis	Immediate postoperative hemoperitoneum
12	12/01/2022	Left hepatectomy + cholecystectomy	Known left hepatocellular carcinoma

liver; other digestive pathologies noted were gastritis and peptic ulcer. The same ratio had also never been operated on. Almost all of them, 10 patients (90.91%) had never had hepatic surgery before. Alcohol consumption was found in six cases (54.54%) and history of abuse of hepatotoxic drugs such as paracetamol, anti-inflammatory drugs and phytotherapy in four cases (36.36%). The pre-anesthetic consultation (PAC) was most often carried out within 24 days prior to the operation, with extremes ranging from less than one day for the lone emergency hepatic resection procedure to up to 90 days for elective hepatectomies. Preoperative general condition was preferably fair (WHO stage 1 to 2) in six out of 12 procedures (50%), good (WHO stage 0) in 33.33% of cases and poor (WHO

stage 3 to 4) in 16.67% of cases. Jaundice was present in one in twelve cases (8.33%).

The average mean arterial pressure (MAP) of the 12 cases at the PAC was 91.27 mmHg. The cardiopulmonary examination was unremarkable. All had a Glasgow score of 15/15, a satisfactory neurological examination without criteria suggesting hepatic encephalopathy. Preoperative blood tests revealed patients with moderate anaemia (9 - 11 g/dL) 7 times out of 12 (58.33%) for a mean haemoglobin level of 10.36 g/dL. No thrombocytopenia with a mean platelet count of 318,750/mm^3. The prothrombin (PT) level was low in only one subject at 19.3%; worth mentioning, this was labelled as cholestasis-related and corrected preoperatively by administration of vitamin K 10 mg per 8 h for 10 days. Hepatocellular insufficiency was unlikely in our subjects given a mean PT of 77.01%; limited by our technical platform, factor V was not measured. The mean total bilirubin level was about 8.54 mg/L, below our reference level of 12 mg/L. On the other hand, the mean albumin level was about 30.42 g/L, lower than the local normal range of 40 to 50 g/L, for mostly malnourished subjects. Creatinine levels were normal with an average of 11.6 mg/L and 9.36 mg/L in men (9 - 13 mg/L) and women (7 - 10 mg/L) respectively. At the end of the PAC, the ASA classification was mostly class II, including one IIu for emergency revision of a hepatectomy indicated for haemostasis and one ASA IV for breast cancer metastasized to the liver. The Altemeier classification was 2 for all surgeries. We also chose to associate clinical and clinico-biological prognostic scores with the anesthetic risk, namely the Rapid Emergency Medicine Score (REMS) with a mean of 1.5 and the IGS II with a mean of 10.9 and a predicted mortality rate of 0.25% and 1.54% respectively. The induction technique chosen was general anaesthesia with orotracheal intubation for all 12 hepatic resections. Epidural Analgesia (EPA) was almost always used, two times out of three. Clinical monitoring was carried out on a hemodynamic level with continuous invasive blood pressure measurement via an arterial catheter, heart rate, and diuresis; on a respiratory level with capnography, ventilatory parameters and pulsed oxygen saturation.

3.3. Intraoperative Findings

Knowing on the one hand that the liver is the main site of drug metabolism and on the other hand that, as Target Control Infusion (TCI) is not technology available in Cameroon, an important point on pharmacology, notably the dosage of drugs used had to be reported. The drug classes used intraoperatively were: antibiotic, haemostatic, analgesic, local anaesthetic, hypnotic, neuromuscular bloking agents. Amoxicillin and clavulanic acid was the most used antibiotic for preoperative prophylaxis. No transfusion was initiated before surgery. A blood-sparing strategy based on haemostatic product including calcium gluconate and tranexamic acid, alone or in combination. Moreover, controlled hypotension with MAP fluctuating between 60 - 70 mmHg was preferred. The intraoperative transfusion rate was 33.33% for an excess of authorised blood loss (target haemoglobin 8 g/dL) ac-

cording to the simplified formula. The estimated blood loss was around 400 mL on average. At its upper induction limit (≥3 μg/kg), fentanyl was the preferred analgesic intraoperatively in association with Peridural Analgesia (PDA), indicated two out of three times for longer analgesia than morphine. Similarly, propofol and ketamine were often combined. Maintenance was done with sevoflurane 1.5 Minimum Alveolar Concentration (MAC). Vecuronium was the most commonly used neuromuscular bloking agents. Only four surgeries were marked by hemodynamic instability managed with atropine and/or ephedrine and continuous norepinephrine pump syringe (Table 2).

Hepatic protection in our context was summarized pre-operatively by the proscription of hepatotoxic drugs and the intraoperative administration of glucocorticoids to reduce the local inflammatory reaction. The technique used was general anesthesia with controlled assisted ventilation and a minimum positive end-expiratory pressure (PEEP) of 4 cm H_2O. Chronologically, the preparation time, defined as the time between the patient's admission to the operating room and the start of anesthesia induction, and corresponding to the conditioning of the patient, was 53 minutes on average. Our subjects stayed in the operating room for approximately five hours. The procedure highlights were their immediate preparation with conditioning by positioning (proclive), tubing (central venous line, arterial catheter, EDA), administration of hemostatics, limitation of vascular expansion (strict correction of fasting and then vein guarding) and close pre-anesthetic close monitoring with MAP between 60 and 70 mmHg before resection and recovery of vascular expansion once the specimen had been resected. The anesthesia itself lasted an average of 4 hours, except for of our second and third hepatectomies which lasted approximately 7 hours.

3.4. Postoperative Findings

Immediate post-operative follow-up of all 12 hepatic resection was in the post-anesthesia care unit followed by the intensive care unit under appropriate conditions and with continuous arterial monitoring. Postoperative pain evaluated on the Numerical Rating scale was low to moderate and was relieved with multimodal analgesia (intravenous and epidural analgesia). No post-operative blood transfusion was needed. No postoperative complication (hemorrhage from the operative site, ileus, post-operative nausea and vomiting, hypoxemia, surgical site infection) occurred with no need for re-operation. No peri-operative deaths were recorded.

Lastly, taking into account the Guaranteed Inter-professional Salary (GIS) in Cameroon, which is $54.73, hepatectomies performed between 2019 and 2022 cost an average of $573.01, with extremes between $152.8 and $797.98 for the gross cost of the procedure (fees for the anesthesia and surgical teams and operating theatre costs) (see Table 3). This average amount represents ten times the monthly salary of the average Cameroonian, not counting the cost of hospital stay and pre- and/or post-hospital care. None of our patients had health insurance.

Table 2. Average dosage and frequency of use of intraoperative drugs.

Drugs	Frequency of use over 12 procedures	Average bolus dosage	Average dosage in dose/weight
Antibiotic prophylaxis			
Amoxicillin + clavulanic acid	6	2.53 g	33.60 mg/kg
Ceftriaxone	4	2.5 g	40.85 mg/kg
Hemostatics drugs			
Tranexamic acid	10	2.05 g	43.71 mg/kg
Calcium gluconate	7	2.92 g	59.16 mg/kg
Furosemide	1	5 mg	0.54 mg/kg
Anti-inflammatory			
Methylprednisolone	3	120 mg	1.97 mg/kg
Analgesics			
Fentanyl	12	201.25 µg	3.03 µg/kg
Morphine	5	3.5 mg (EDA)	0.06 mg/kg
Tramadol	7	100 mg	1.36 mg/kg
Nefopam	7	20 mg	0.30 mg/kg
Paracetamol	7	1 g	15.73 mg/kg
Local anaesthetics			
Bupivacaine	3	6.58 mg (EDA)	0/15 mg/kg
Hypnotics			
Propofol	11	232.73 mg	3.81 mg/kg
Ketamine	9	139.44 mg	2.17 mg/kg
Hypnomidate	1	14 mg	0.31 mg/kg
Neuromuscular blocking agents			
Vecuronium	11	5.82 mg	0.09 mg/kg
Neuromuscular blocking agents			
Succinylcholine	2	80 mg	1.23 mg/kg
Cisatracurium	1	80 mg	0.91 mg/kg
Emergency drugs			
Atropine	4	0.49 mg	0.01 mg/kg
Ephedrine	4	23.75 mg	0.28 mg/kg
Norepinephrine	3	3 µg/kg/min	3 µg/kg/min

EDA: Epidural Anesthesia.

Table 3. Distribution of operating costs according to the type of liver resection.

Case No.	Type of operation	K. anesthesia	K. surgery	K. operating room	Total ($)
1	Segmentectomy VI	160 × k	310 × k	235 × k	804
2	Right hepatectomy + cholecystectomy for SV-VI	130 × k	250 × k	190 × k	650
3	Left hepatectomy + cholecystectomy	160 × k	310 × k	235 × k	804
4	Segmentectomy IV and V + cholecystectomy	180 × k	310 × k	245 × k	838
5	Removal of a liver tumour	10 × k	80 × k	60 × k	171
6	Hepatic cystectomy + left lobectomy	110 × k	200 × k	155 × k	530
7	Left hepatectomy	60 × k	150 × k	105 × k	359
8	Left hepatectomy + cholecystectomy	160 × k	310 × k	235 × k	804
9	Left hepatectomy + cholecystectomy	160 × k	310 × k	235 × k	804
10	Liver depacking	40 × k	80 × k	60 × k	205
11	Liver hemostasis	30 × k	60 × k	45 × k	154
12	Left hepatectomy + cholecystectomy	160 × k	310 × k	235 × k	804

k: calculation factor = $1.14.

4. Discussion

Overall, this study is the first to provide data on perioperative anesthetic management and perioperative outcome of hepatic resection in Africa.

4.1. Blood-Saving Strategy

With regards to limiting blood loss during liver surgery, a meta-analysis has shown that there is scarce high-level evidence to support the efficacy of blood-sparing techniques, the transfusion requirements and the mortality associated with this highly bleeding surgery [5]. In contrast, several observational studies have indicated that maintenance of a CVP < 5 mmHg was associated with reduced bleeding, length of stay, morbidity and mortality [6] [7] [8] [9] [10]. However, monitoring with invasive blood pressure is not often available in most anesthesiology units in low- and middle-income settings. Nevertheless, emulating the same principle, we can achieve a low CVP in line with local practices and the individuality of each case. The elements we used were: reverse Trendelenburg position at 15˚ [10], fluid restriction at 1 mL/kg/h, EDA, administration of 5 - 15 µg/min glyceryl trinitrate [11], minimal PEEP or reduced ventilation, depletion with mannitol 0.5 g/kg or furosemide 10 mg. Also, prophylactic tranexamic acid may be considered to reduce bleeding and transfusion rates as used in our series. A randomized controlled trial of over 200 hepatic resections done after tranexamic acid versus placebo administration showed a reduction in blood loss and transfusion rates in the treated group [12]. To this can be added calcium gluconate, which has a proven role in primary haemostasis. This may explain our low intraoperative blood transfusion rate.

4.2. Hepatic Protection

Intraoperative glucocorticoids can be used to protect the liver, even though the evidence is contradictory from two meta-analyses with divergent conclusions [13] [14].

Reductions in interleukin-6 and bilirubin levels were statistically significant on the first postoperative day and non-significant trends towards a decrease in PT; all of this suggests that this intervention certainly reduces inflammation in the short term but with limited clinical benefit [13] [14] [15].

4.3. The Gross Cost of the Intervention

Compared to the DGH, and taking into account the different surgical modalities of liver resection, the average financial cost of hepatic resections in the current series was halved lower than in Japan; one-fifth lower than in Canada and the Netherlands; 4 to 13 times lower in the UK and 12 to 54 times less costly in the USA (**Table 4**) [16]. The relative low cost of hepatic resections in our series can be explained by the limited resources which hinder the resort to expensive or sophisticated therapeutic means such as laparoscopic and robotic hepatic resections, intraoperative monitoring by central venous pressure (CVP) or bispectral index (BIS) measurement or the use of TCI, thus drastically reducing the cost of the procedure, in a Cameroon where there is no national health insurance policy, most patients cannot afford to subscribe to a private health insurance and majority pay the cost of health care out of pocket.

4.4. Strengths and Limitations of the Study

Study strengths include a case series study of 12 successful cases of a perceived

Table 4. Operative cost of open liver resection according to authors and countries.

Authors	Country	Cost ($)	Difference ($)	Coefficient
Ndom et al. (our study)	*Cameroon*	*573*	*Ref**	*Ref*
Bhojani *et al.*	Canada	2985	2412	5.21
Tsinberg *et al.*	United States	28,023	27,450	48.90
Canon *et al.*	United States	31,400	30,827	54.80
Medbery *et al.*	United States	10,410	9737	18.17
Kawaguchi *et al.*	Japan	1054	481	1.84
Stoot *et al.*	Netherlands	2987	2414	5.21
Polignano *et al.*	United Kingdom	7583	7010	13.23
Abu Hilal *et al.*, LLS	United Kingdom	5562	4989	9.71
Abu Hilal *et al.*, RH	United Kingdom	6846	6273	11.95
Bell *et al.*	United Kingdom	2236	1663	3.90

Difference: corresponds to the subtraction of the cost of the other authors with that of Ndom *et al.*; Coefficient: corresponds to the multiplication factor to reach the cost of Ndom *et al.*; Ref: references.

difficult and dreadful type of surgery, liver resection, rarely performed in Cameroon because of an inadequate surgical-anesthesiological infrastructure but also several perceived or expected post-operatory complications which are potentially fatal. The above blood-sparing strategy (using tranexamic acid, calcium gluconate and controlled hypotension) goes a long way to formulating blood-sparing recommendations for similar potentially hemorrhagic surgeries. In addition, an assessment of the average cost of liver resection alone or in combination with cholecystectomy has been made as another study's strength. Study limitations were the absence of intraoperative hemodynamic monitoring means (the CVP in particular) to help perfect the blood-sparing strategy and equipment to carry out TCI useful to favour hepatic protection.

5. Conclusion

Hepatic resection is considered major surgery with a high risk of haemorrhage. Performing this type of surgery in a developing country without the full and ideal anesthesia arsenal has been a challenge successfully performed for twelve cases between 2019 and 2022, with satisfactory blood savings, low morbidity and zero perioperative mortality. This was also due to the multidisciplinary collaborative approach between the anesthetic and surgical teams in preparing these patients to enter the operating room with a prognosis score most often favourable.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

References

[1] Felekouras, E.S., Kaparelos, D.C. and Papalampros, E. (2010) The History of Liver Surgery, Hepatectomy and Hemostasis. *Hellenic Journal of Surgery*, **82**, 280-296. https://doi.org/10.1007/s13126-010-0046-2

[2] Bismuth, H. and Majno, P.E. (2000) Hepatobiliary Surgery. *Journal of Hepatology*, **32**, 208-224. https://doi.org/10.1016/S0168-8278(00)80427-4

[3] Hardy, K.J. (1990) Liver Surgery: The Last 2000 Years. *ANZ Journal of Surgery*, **60**, 811-817. https://doi.org/10.1111/j.1445-2197.1990.tb07479.x

[4] Sotiropoulos, GC., Prodromidou, A., Kostakis, I.D., *et al.* (2017) Meta-Analysis of Laparoscopic vs Open Liver Resection for Hepatocellular Carcinoma. *Updates in Surgery*, **69**, 291-311. https://doi.org/10.1007/s13304-017-0421-4

[5] Sean, P.C., Ho-Seong, H., Masakazu, H., *et al.* (2016) The Comparative Costs of La-

paroscopic and Open Liver Resection: A Report for the 2nd International Consensus Conference on Laparoscopic Liver Resection. *Surgical Endoscopy*, **30**, 4691-4696. https://doi.org/10.1007/s00464-016-4801-5

[6] Moggia, E., Rousse, B., Simillis, C., *et al.* (2016) Methods to Decrease Blood Loss during Liver Resection: A Network Meta-Analysis. *Cochrane Database of Systematic Reviews*, **10**, CD010683. https://doi.org/10.1002/14651858.CD010683.pub3

[7] Jones, R., Moulton, C.E. and Hardy, K.J. (1998) Central Venous Pressure and Its Effect on Blood Loss during Liver Resection. *British Journal of Surgery*, **85**, 1058-1060. https://doi.org/10.1046/j.1365-2168.1998.00795.x

[8] Bhattacharya, S., Jackson, D.J., Beard, C.I., *et al.* (1999) Central Venous Pressure and Its Effects on Blood Loss during Liver Resection. *British Journal of Surgery*, **86**, 282-283. https://doi.org/10.1046/j.1365-2168.1999.0999g.x

[9] Chen, H., Merchant, N.B. and Didolkar, M.S. (2000) Hepatic Resection Using Intermittent Vascular Inflow Occlusion and Low Central Venous Pressure Anesthesia Improves Morbidity and Mortality. *Journal of Gastrointestinal Surgery*, **4**, 162-167. https://doi.org/10.1016/S1091-255X(00)80052-9

[10] Smyrniotis, V., Kostopanagiotou, G., Theodoraki, K., *et al.* (2004) The Role of Central Venous Pressure and Type of Vascular Control in Blood Loss during Major Liver Resections. *The American Journal of Surgery*, **187**, 398-402. https://doi.org/10.1016/j.amjsurg.2003.12.001

[11] Soonawalla, Z.F., Stratopoulos, C., Stoneham, M., *et al.* (2008) Role of the Reverse-Trendelenberg Patient Position in Maintaining Low-CVP Anaesthesia during Liver Resections. *Langenbeck's Archives of Surgery*, **393**, 195-198. https://doi.org/10.1007/s00423-007-0222-1

[12] Sand, L., Lundin, S., Rizell, M., *et al.* (2014) Effect of Nitroglycerin and Patient Position on Central, Hepatic and Portal Venous Pressures during Liver Surgery. *Acta Anaesthesiologica Scandinavica*, **58**, 961-967. https://doi.org/10.1111/aas.12349

[13] Wu, C.-C., Ho, W.-M., Cheng, S.-B., *et al.* (2006) Perioperative Parenteral Tranexamic Acid in Liver Tumor Resection. *Annals of Surgery*, **243**, 173-180. https://doi.org/10.1097/01.sla.0000197561.70972.73

[14] Richardson, A.J., Laurence, J.M. and Lam, V.W.T. (2014) Use of Preoperative Steroid in Liver Resection: A Systematic Review and Meta-Analysis. *HPB* (*Oxford*), **16**, 12-19. https://doi.org/10.1111/hpb.12066

[15] Li, N., Gu, W., Weng, J., *et al.* (2015) Short-Term Steroid Administration Does Not Affect Postoperative Complications after Liver Resection: Evidence from a Meta-Analysis of Randomized Controlled Trials. *Hepatology Research*, **45**, 201-209. https://doi.org/10.1111/hepr.12332

[16] Allocation Personnalisée d'Autonomie APA (2016) Cameroon, the SMIG Officially Increases to 36270 FCFA. http://www.fr.starafrica.com/actualites/cameroun-le-smig-passe-officiellement-a-36-270-fcfa.html

Abbreviations

ASA: American Society of Anesthesiologists;
BIS: Bispectral Index;
CVP: Central Venous Pressure;
DGH: Douala General Hospital;
GIS: Guaranteed Interprofessional Salary;
IGS II: Index de Gravité Simplifié II;
MAC: Minimum Alveolar Concentration;
MAP: Mean Arterial Pressure;
PAC: Pre-Anaesthetic Consultation;
EDA: Epidural Analgesia;
PEEP: Positive End-Expiratory Pressure;
PT: Prothrombin Time;
REMS: Rapid Emergency Medicine Score;
TCI: Target Control Infusion;
WHO: World Health Organisation.