



## Original Article

## Preoperative Cardiovascular Risk Analysis at the Region N°1 Military Hospital of Yaounde

### *Analyse du risque cardiovasculaire préopératoire à l'Hôpital Militaire Région N°1 de Yaoundé*

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#### ABSTRACT

**Objective.** Analyze the preoperative cardiovascular risk in patients undergoing surgery in anesthesia-resuscitation departments; surgery and operating room of the Military Hospital Region N°1 of Yaounde. **Methods.** A hospital-based analytical, descriptive, and prospective study was designed from 30 November 2020 to 30 March 2021. Were included in the study all patients over 18 years old scheduled for surgery, welcomed in the anesthesia consultation room, who have signed the informed consent form of participation in the study. All patients who have undergone surgery in an emergency were excluded. Data were collected through a structured questionnaire, whereas the correlation results tests were discriminated at a 5% level of significance. **Results.** 113 patients averagely 48.4 years old meeting our criteria were included in the study, of whom 54% were male at a 1.15 ratio. Spinal anesthesia was used in (50.7%) of the cases. ASA-3 and ASA-4 were represented by 2.7% each, whereas 10.6% and 7.1% of patients had Lee Index of class-3 and class-4 respectively. Cardiovascular complications occurred in 63 (55.7%) of patients and were dominated by low blood pressure (25.7%), hypertensive crises (24.8%), and cardiac arrhythmias (21.2%). According to the Clavien-Dindo classification, these complications were mainly of Grade-1, thus 85 (75.2%), and Grade-2, thus 21 (18.6%). Significant relationships ( $p < 0.05$ ) were observed between the preoperative cardiac risk indicators used (ASA scores, Lee's index, low functional capacity, Clavien-Dindo classification) and the occurrence of cardiovascular complications. **Conclusion.** Results from this research indicate that cardiovascular incidents are to be seriously taken into consideration in surgical settings.

#### RÉSUMÉ

**Objectif.** Analyser le risque cardiovasculaire préopératoire chez les patients devant subir une chirurgie au sein des services d'anesthésie-réanimation ; chirurgie et bloc opératoire de l'Hôpital Militaire Région N°1 de Yaoundé. **Méthodes.** Il s'agissait d'une étude prospective analytique et descriptive menée du 30 novembre 2020 au 30 mars 2021. Nous avons inclus dans l'étude tous les patients de plus de 18 ans programmés pour une chirurgie et vu en consultation pré-anesthésique et ayant signé la fiche de consentement éclairé de participation à l'étude. Etaient exclus les sujets de moins de 18 ans, ceux ayant eu une chirurgie non programmée et réalisée en urgence. À l'admission au bloc opératoire, les patients étaient accompagnés d'un questionnaire structuré, tandis que les tests des résultats de corrélation ont été discriminés à un niveau de signification de 5 %. **Résultats.** 113 patients âgés en moyenne de 48,4 ans et répondant à nos critères ont été inclus dans l'étude, dont 54 % étaient des hommes avec un ratio de 1,15. La rachianesthésie a été utilisée dans (50,7 %) des cas. ASA-3 et ASA-4 étaient représentées par 2,7 % respectivement, alors que 10,6 % et 7,1 % des patients avaient un indice de Lee de classe-3 et de classe-4 respectivement. Les complications cardiovasculaires sont survenues chez 63 (55,7 %) des patients et étaient dominées par l'hypotension artérielle (25,7 %), les poussées hypertensives (24,8 %) et les arythmies cardiaques (21,2 %). Selon la classification de Clavien-Dindo, ces complications étaient majoritairement de Grade-1 85(75,2 %), suivi du Grade-2 21(18,6 %). Des corrélations significatives ( $p < 0,05$ ) ont été observées entre les indicateurs de risque cardiaque préopératoire utilisés (score ASA, indice de Lee, la capacité fonctionnelle et la classification de Clavien-Dindo) et la survenue de complications cardiovasculaires. **Conclusion.** Les résultats de cette recherche indiquent que les incidents cardiovasculaires doivent être sérieusement pris en compte dans les contextes chirurgicaux.

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**Mots clés :** Chirurgie, risque cardiovasculaire, complications cardiovasculaires, patients à risque

## INTRODUCTION

Surgery is a specialized medical discipline that treats traumatic diseases, consisting of manually practicing operations events on the human body using several instruments [1]. These operations whether conducted as emergency or scheduled on anybody's part expose the patients to the so-called surgery-related risks [2], with the complications being classified as lower than 1%; between 1-5%, higher than 5%, and corresponding respectively to minor, intermediate and major surgery risks [3]. In Europe around 19 million surgery events are evidenced, with a global complicated rate of 7-11%, a mortality rate of 0.8%, and cardiovascular complications of 42% [4], indicating a public health concern. These complications are among cardiovascular deaths, myocardium infarcts which are responsible for 15-25% of intrahospital mortality [5], as well as cardio-respiratory attacks [6]. Several studies have demonstrated the importance of the preoperative evaluation of the cardiovascular risks before surgery, to reduce complications in patients [7]. Previous research on cardiovascular complications during surgery in Africa has revealed a 72.7% rate at Lome in Togo [8] and 37.8% at Bamako in Mali [9]. In Cameroon, 12.6% of surgery complications were reported to be of heart origin [10], with a 63.2% rate [11]. Considering all these complications, it is more of a permanent challenge for an anesthetist than for a surgeon, since he is placed in the first front of cardiovascular complications leading to the patient's death. These complications are often not well known in practice, under-estimated, and wrongly evaluated due to inappropriate or lack of diagnostics. Despite the recommendations of European Societies on the evaluation of cardiac risks before surgery, the related complication rates remain incredibly high in several countries over the world, stimulating queries on the level of cardiovascular risks during surgery in Cameroon. Therefore, this research was undertaken to assess the preoperative cardiovascular risks in patients undergoing surgery, to be achieved under the following specific objectives: i) determine cardiovascular risk levels before a surgery event in patients consulting at the Region N°1 Military Hospital of Yaounde, ii) identify the main surgery complications observed in the studied population; iii) determine the relationship between the indicators of cardiovascular risks and the occurrence of cardiovascular complications.

## MATERIALS AND METHODS

### Study design, period, and setting

An analytical, prospective, and descriptive study was used. It was conducted in the Region N°1 Military Hospital of Yaounde, which covers anesthesia, operation block, surgery, and resuscitation services, between November 30<sup>th</sup>, 2020 to March 30<sup>th</sup> 2021. The probabilist consecutive and exhaustive sampling type was used since patients were recruited progressively as they fulfilled the selection criteria.

### Study population

The studied population was composed of patients admitted to the Region N°1 Military Hospital of Yaounde

for imminent surgery and consulted at trauma-orthopedic, vascular, urologic, visceral ORL, and ophthalmologic surgery services.

### Inclusion criteria

Were included in the study all patients admitted to the Region N°1 Military Hospital of Yaounde for an imminent surgery, older than 18 years, and having signed the informed consent form.

### Exclusion criteria

All patients who have performed surgery in an emergency were excluded.

### Study variables

The variables of the study were those associated with the socio-demographic profile such as age, sex, profession, preoperative stage of patients (ASA score), surgery risks, functional capacity, Lee's Index score, as well as variables related to the evolution of patient (operation complications, hospitalization duration). The preoperative patients were evaluated according to the five ASA scores [12] and the physical state of the patient known as ASA-1 Class (Healthy patient); ASA-2 Class (Patient presenting a slight systemic disease such as non-insulin-dependent diabetes, high blood pressure, obesity, moderate kidney failure, old infarcts); ASA-3 Class (Patient presenting a severe systemic disease including chest angina, insulin-dependent diabetes, morbid obesity, moderate respiratory failure, sleeping apnea syndrome); ASA-4 Class (Patient presenting a severe systemic disease involving vital prognostic such as dialysis patient, heart or heavy respiratory failures); ASA-5 Class (Patient with a life expectancy not exceeding 24 hours in the absence of a surgery event following hemorrhagic shock, broken cerebral aneurysm with coma).

### Ethics

Research authorizations were delivered by the Biomedical Sciences Department of the University of Ngaoundere and the Military Region N°1 Hospital of Yaounde. Participation in the study was made free and informed, whereas the confidentiality of patients' data was strictly respected all over the study period.

### Limitations

The relatively short duration of the study has reduced enough the chances of including a maximum number of participants.

### Statistical data analysis

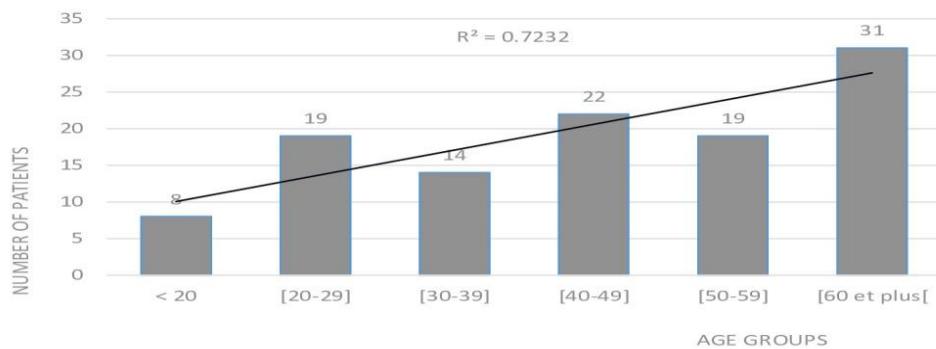
Data were statistically analyzed using a Sphinx-V5 plus software after registration with Microsoft Excel 2016. To investigate for connections between the chi<sup>2</sup> test was used to establish relationships between risk indicators and cardiovascular complications, on one hand, the anesthesia and the cardiovascular complications on the other. Results were considered significant at  $p < 0.05$ , with data expressed under tables and figures representing means or frequencies.

## RESULTS

Among the 113 patients who fulfilled our different selected criteria, 63 showed cardiovascular signs during surgery, corresponding to a 55.75% prevalence.

### Distribution of patients based on their age

The average age of patients was around 48.38 years (Figure 1). Young patients were 19, against 89 for the elder. The most affected patients were between [60-more [. The determination R<sup>2</sup> coefficient =0.72 indicated an increase in the number of patients as the age group was higher.



**Figure 1.** Age groups

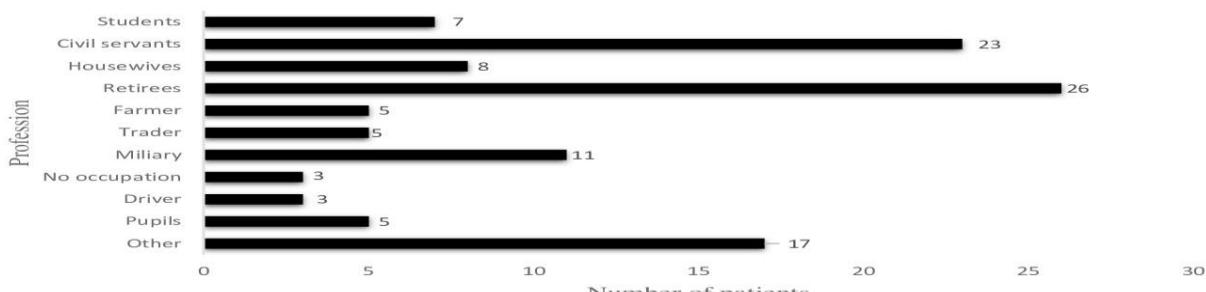
### Sex and socio-professional activities of patients

There were 61 male (54%) and 52 female patients (46%) giving a sex ratio F/M of 0.85 (Table 1).

**Table 1. Distribution of patients according to sex**

Sex	Number	Percentage
Male	61	54
Female	52	46
<b>Total</b>	<b>113</b>	<b>100</b>

Patients on retirement were the most represented social group, thus 26(23%) as revealed by Figure 2, followed by employees 23(20.4%).

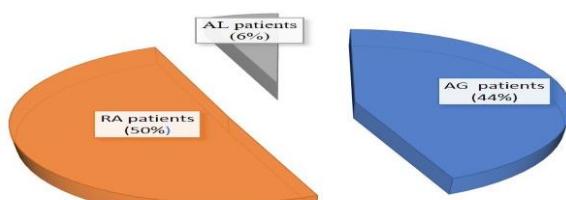


**Figure 2.** Socio-professional activities

### Surgery risks of patients

#### Surgery types and anesthesia types as discrimination factors among patients

Rachianesthesia (RA) was the most practiced anesthesia type with 50% of patients, followed by general anesthesia (AG) represented by 44% of the patients, whereas local anesthesia (AL), thus 6% within the studied population (Figure 3).



**Figure 3.** Patients according to anesthesia types  
AG: General anesthesia, RA: Rachianesthesia, AL: Local anesthesia

113 patients were grouped based on the surgery types to which they were subjected traumatology (35.4%), vascular (19.5%) visceral (17.7%), urologic (8.8%), gynecologic (7%), neurologic (8.8%), and ENT (0.9%) as observed on Table 2.

**Table 2. Type of surgery**

Surgery types	Number	Percentage
Traumatology	40	35.4
Vascular	22	19.5
Visceral	20	17.7
Urologic	10	8.8
Gynecologic	9	8.08
Neurologic	10	8.8
Ophthalmology	1	0.9
ENT	1	0.9
<b>Total</b>	<b>113</b>	<b>100</b>

ENT: Ear – nose - Throat

### Surgical risks level of patients

According to figure 4, patients with higher risk levels were the most represented (44.2%), followed by those with intermediate (41.6%) and minor (14.2%) risk levels.

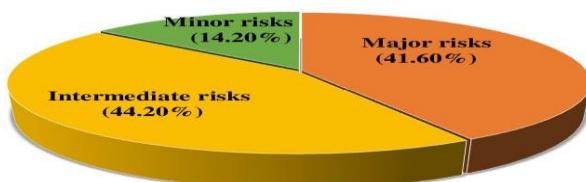


Figure 4. type of surgery

### Analysis of data relative to cardiovascular risks of patients

#### ASA score and the functional capacities of patients

The ASA-1 class was the most represented with a 71.7% frequency against the ASA-1 class (23%), while ASA-3 and ASA-4 classes were the less represented avec with a frequency of 2.7% (Table 3). As far as the functional capacity is concerned 87 patients (77%) had a good functional capacity which was expressed only at (23%) in 26 patients.

Table 3. Distribution of patients based on the physical preoperative state (ASA score) and functional capacity

Variables	Modalities	Number	Percentag e
ASA Score	ASA-1	81	71.7
	ASA-2	26	23
	ASA-3	3	2.7
	ASA-4	3	2.7
<b>Total</b>		<b>113</b>	<b>100</b>
Functional Capacity	Good	87	77
	Weak	26	23
<b>Total</b>		<b>113</b>	<b>100</b>

ASA-1: Patient in good health status; ASA-2: Patient presenting a slight systemic disease well compensated (diabetes non-insulin-dependent, high blood pressure, obesity, moderated kidney failure, old infarcts) ASA-3: Patient presenting a severe systemic disease (chest angina, insulin-dependent diabetes, morbid obesity, moderated breath failure, sleepy apnea syndrome); ASA-4: Patient presenting a severe systemic disease involving a vital prognostic (dialyzed patient, heart or heavy breath failures)

### Clinical history of patients to cardiovascular risk factors

Table 4. Clinical history vs cardiovascular risk factors.

Variables	Modality	N	%
Clinical history of FRCV	Yes	36	31.9
	No	77	68.1
	<b>Total</b>	<b>113</b>	<b>100</b>
Typology of Clinical history	Coronaropathia	13	11.5
	AVC-I	1	0.9
	ACV-IT	2	1.8
	Diabetes	11	9.7
	IRC	13	11.5
	IC	10	8.9
<b>Total</b>		<b>50</b>	<b>44.3</b>

FRCV: cardiovascular risk factors, IRC: Chronic kidney failure, AVC-I: Ischemic stroke, ACV-IT: Transient Ischemic stroke, IC: Heart failure

From Table 4, a total of 77 patients 36(31.9%) present a clinical history of cardiovascular risk factors (FRCV), against (68.1%). The clinical histories of coronaropathy and chronic kidney failure were the most represented (11.5%) (Table 4).

### Lee index

76(67.3%) of patients had a Lee Index of Class-1 and an incidence of cardiovascular complications occurrence of around 0.4% (Table 5).

Table 5. Differentiation of patients through the Lee Index and the occurrence of cardiovascular complications index

Variables	Modalit ies	Number	Percentag e
Lee Index	Class-1	76	67.3
	Class-2	17	15
	Class-3	12	10.6
	Class-4	8	7.1
<b>Total</b>		<b>113</b>	<b>100</b>
Occurrence of cardiovascular complications index	[0.4]	76	67.3
	[0.7]	17	15
	[0.9]	12	10.6
	[11]	8	7.1
<b>Total</b>		<b>113</b>	<b>100</b>

Class-1: Patients without clinical risk factors; Class-2: Patients with 1 clinical risk factor; Class-3: Patients with 2 clinical risk factors; Class-4: Patients with 3 or more clinical risk factors.

### Data related to the evolution of patients

#### Classification of patients based on Glasgow score

Averagely 81 patients presented a Glasgow class between [14-10], which is considered a model class in this study (Figure 5).

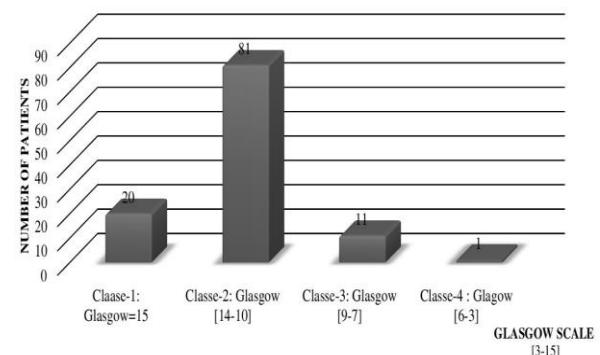


Figure 5. Glasgow Score

### Classification of patients based on post-operative cardiovascular complications

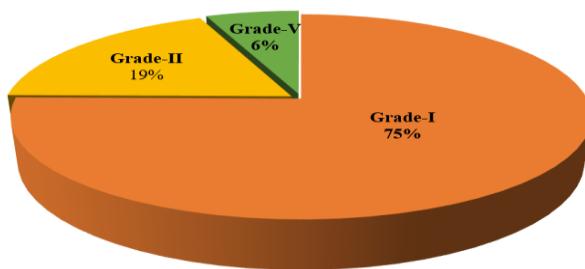
94 postoperative cardiovascular complications were present in each of the 63 patients, for an average of 1.49 postoperative cardiovascular complications. Low blood pressure was the most represented de 25.7% as frequency, against 24.8% high blood pressure (Table 6).

**Table 6.** Classification of patients based on the occurrence and nature of cardiovascular complications

Variables	Modalities	N	%
Occurrence of CV complications	Oui	63	55.7
	Non	50	44.3
	Total	133	100
Typology of CV complications	Hypertensive flare-up	28	24.3
	Low blood pressure	29	25.7
	arrhythmia	24	21.2
	Heart failure	2	1.8
	Heart infarcts	1	0.9
	Hypovolemia	7	6.2
	Heart arrest	3	2.7

**Clavien-Dindo classification of patients**

Grade-I (75%), and Grade-II (19%), whereas Grade-V complications were only represented at a frequency of 6% (Fig 6).

**Cardiovascular risk indicators and post-operative cardiovascular complications**

the preoperative status of patients (ASA score), implying patients of class ASA-3 ( $p = 0.02$ ); the cardiovascular risks linked to the surgery implying major risks ( $p = 0.04$ ). There was a significant difference ( $p = 0.03$ ) between patients with Class-4 Lee Index and patients with weak functional capacity. No significant ( $p = 0.1$ ) was observed between ASA-4 Class and the post-operative cardiovascular complications (Table 7).

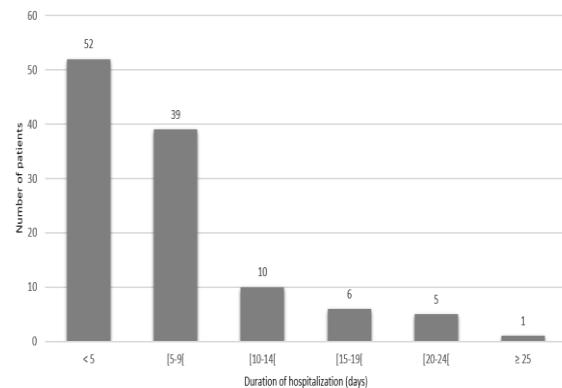
**Table 7.** Relationship between cardiovascular risk indicators and the post-operative cardiovascular complications

Post-operative cardiovascular complications								p-value	
CV risk factors	Modalities	PH	HV	AC	IC	INC	ARC	HT	
Anesthesia types	AG	13	0	14	1	1	2	12	0.71
	RA	15	7	9	1	0	1	15	0.86
	AL	4	0	0	1	0	0	2	0.87
Heart surgery risks	Minor	7	2	6	0	0	0	13	0.66
	Intermediate	16	0	10	0	1	1	8	0.5
ASA Score	Major	5	5	8	2	0	0	8	<b>0.04</b>
	ASA-1	14	4	9	1	0	0	18	0.66
	ASA-2	9	2	10	0	1	0	8	0.5
	ASA-3	2	0	3	0	0	2	2	<b>0.02</b>
Lee Index	ASA-4	3	1	2	1	0	1	1	<b>0.1</b>
	Class-1	16	2	8	0	0	0	1	0.27
	Class-2	5	1	4	0	0	1	15	0.98
	Class-3	2	1	7	0	1	0	5	0.18
Functional capacity	Class-4	5	3	5	2	0	2	4	<b>0.02</b>
	Good	18	4	12	0	0	0	7	0.39
	Weak	10	3	12	2	0	3	12	<b>0.03</b>

AG: General anesthesia; RA: Rachianesthesia; AL: Local anesthesia; CV: Cardiovascular PH: Hypertensive flare-up; HV: Hypovolemia; AC: cardiac arrhythmia; IC: heart failure; INC: Heart infarcts; AR: Heart arrest; HT: low blood pressure; ASA-1: Patient in good health status; ASA-2: Patient presenting a slight systemic disease well compensated (diabetes non-insulin-dependent, high blood pressure, obesity, moderated kidney failure, old infarcts) ASA-3: Patient presenting a severe systemic disease (chest angina, insulin-dependent diabetes, morbid obesity, moderated breath failure, sleepy apnea syndrome); ASA-4: Patient presenting a severe systemic disease involving a vital prognostic (dialyzed patient, heart or heavy breath failures); Class-1: Patients without clinical risk factors; Class-2: Patients with 1 clinical risk factors; Class-3: Patients with 2 clinical risk factors; Class-4: Patients with 3 or more clinical risk factors.

**Figure 6.** complication grade of patients

**Variation of the duration of hospitalization of patients**  
The mean duration of hospitalization of patients was 6.69 with a minimum of < 1 day while a maximum of 27 days was noticed (Figure 7).

**Figure 7.** duration of hospitalization of patients

## DISCUSSION

Patients participating in the study were mostly older than 60 years, with an average of 48.38 years, close to other results reported by Aslanger *et al.* [13], Groot *et al.* [14], Dongan *et al.* [15], Katz *et al.* [16], who revealed 63.5, 65, 65.4, and 67.8 as the respective ages of patients, but higher than averagely 61.33 pointed out by Pancha *et al.* [17]. Within the studied population, patients admitted for imminent surgery and subjected to pre-anesthesia evaluation were mostly male 54%, against 46% of females findings are in agreement with those of Groot *et al.* [14], who found 54.3%, 54%, 53.8% and 52.7% as the respective percentages of male in the studied population. In contrast, a very high percentage of male (91.40%) against a very low percentage of female (8.60%) patients were recorded by Pancha *et al.* [17]. The increased age was a positive correlation with the intervention type as well as the number of pre-anesthesia consultations. This suggests that age is a natural risk factor for the occurrence of comorbidity and explains the fact that aged patients are the most subjected to cardiovascular troubles. The most socio-professional represented groups in this study were retired patients 26(23%) and workers 23(20.35%), and this could not be explained by the literature.

Rachis-anesthesia was more practice in 50% of cases, against 44% and 6% for general and local anesthesia respectively, in contradiction with recent results by Bengono *et al.* [18], who indicated 71% frequency in favor of general anesthesia, or Kabey *et al.* [19], who obtained 86.7% for general anesthesia against 11.8% for locoregional anesthesia. However, several studies on mortality due to surgery did not take into consideration anesthesia as a possible factor of postoperative mortality [20]. The highest rachis-anesthesia frequency in this study indicates that personnel of the anesthesia service of the N°1 Military Regional Hospital of Yaounde master the locoregional anesthesia techniques, since the working kits are available, thus, contributing to the reduction of mortality of undergone patients, and diminution of cardiovascular risks after surgery [21].

Our samples belong to intermediate surgery and major risk groups with respectively 51% and 7% frequencies. For similar research by Peretto *et al.* [22], a high frequency of 86% was obtained from intermediate surgery risk. The most practiced surgery types on patients were trauma-orthopedic 40 (35.4%) and vascular surgery 22 (19.5%). These findings are different from those listed in the literature with a frequency of 25.5% [15], 18.15% [16], and 1.49% for thoracic and vascular surgeries. The predominance of trauma-orthopedic and vascular surgeries in this study are correlated to the level of elevated intermediate surgery risk and can be explained by frequent public road accidents and cardiopathy which are the main causes of deaths in our weak-income countries according to WHO [23], in addition to coronary pathologies noticed in half of the patients oriented toward vascular surgery [24].

Patients were mostly of ASA-1 (71.7%) and ASA-2 (23%) classes, opposite to other findings by Dogan [15]

with 17.20% for ASA 1 class and 50.60% for ASA-2 class, by Katz *et al.* [16] with 1.45% and 34.78% respectively for ASA 1 and ASA-2 classes. However, our results are close to those of Kabey *et al.* [19] with 91.9% for ASA-1 and for ASA-2 classes, or those of Bengono *et al.* [18] with 74.2% for ASA-2 classes. The frequency of ASA-1 and ASA-2 classes in this study indicates that at the N°1 Military Regional Hospital of Yaounde, patients who were consulted before surgery had a good general state than those from other researchers Dogan [15] in Turkey; Katz *et al.* [16] in the USA, which is developed countries where aging and increased life expectancy of the population often predispose older persons to organic failures dues to age. In the present study, 26 patients (23%) had a weak functional capacity, whereas relatively 23% had elevated cardiovascular events, in collaboration with other results by Xu *et al.* [25] where 13.6% of patients were of weak functional capacity or Davenport *et al.* [26] who reported the same indicator in 17% of patients. The difference can be attributed to the fact that our studied population was aged and old and not compatible with physical activity. The Lee index determined from 113 patients, indicated that 76 patients (67.3%) were of class-1, while 17(15%) were of class-2, compared to 12 (10.6%) and 8(7.1%) respectively of class-3 and 4. This elevated Lee index of classes 1 and 2 was equally noticed by Pancha *et al.* [17], with frequencies of 85% for class- 1 and 15% for class-2, and could be explained by the presence of a significant relationship ( $p = 0.0001$ ) between elevated ASA score (ASA-3, ASA-4) and the elevated Lee index.

The Glasgow score was evaluated in patients and was organized into 4 classes. Most of the patients were of classes 1 and 2, with 71.68% and 17.69% frequencies respectively. The great number of patients with elevated Glasgow scores in this study testify that surged patients out of the surgery block of the hospital and during this period were of good conscientious state favorable to the postoperative event, and were the most conserved for rachis-anesthesia surgery. A significant ( $p = 0.0001$ ) relationship was observed between the anesthesia type and the Glasgow score. The cardiovascular complications were revealed in 63 patients out of 113, for a frequency of 55.75%, dominated by low blood pressure (25.7%), and Hypertensive flare-up (24.3%). The elevated frequencies of cardiovascular manifestations after surgery have been revealed by several studies, including those of Assenouwe *et al.* [10], who pointed out 59.30% frequency for low blood pressure, 8.72% for hypertensives flare-up, Diango *et al.* [9], who reported 37.8% frequency of post-operative cardiovascular manifestation dominated by low blood pressure (27.4%), Nyah *et al.* [11], who indicated 40.8% and 30.6% frequencies for low blood pressure and hypertensives flare-up. The justification lies in the fact that the population was mostly composed of old people aged  $\geq 60$  years, aging being a non-modified cardiovascular risk factor and occurrence of cardiovascular complications in surgery on one hand, and on the other elevated intermediate risk surgery practiced. This study noticed a significant ( $p = 0.017$ ) dependence between aging and the occurrence of cardiovascular

complications, as well as between the surgery risks and the occurrence of cardiovascular complications ( $p = 0.002$ ) The high frequencies of complications in Grade-I of 75.2% (n = 85), and the representativity of Grade-II 21(18.6%) were also mentioned in other studies such as those of Pancha *et al.* [17] with 86.2% for Grade-I, against 1.72% for Grade-II, or those of Kwon *et al.*, [27], with 95% for Grade-I and 5% for Grade-II. These results can be sustained by the fact that patients were subjected to several surgeries (traumatology, vascular) with invasive techniques, and the long-lasting interventions exposing patients to additive risks. Grade-III, IV, and V were not represented as the result of urologic surgery linked to minor or intermediate risks.

## CONCLUSION

The occurrence of perioperative cardiovascular complications during surgery constitutes an important cause of morbidity and mortality. Up-to-date recommendations involve individual stratification of the cardiovascular risks of the patient before surgery, taking into consideration the risk factors linked to patients, in addition to functional capacities and risks associated with the scheduled surgery. This research has revealed that the tools, stratification scales, as well as recommendations, and international guidelines on the evaluation of these risks were equally applicable in our context. Hence, the cardiovascular risks were high enough in the surgery environment, as well as a highly significant association between the risk indicators used (Lee score, surgery with high risks, weak functional capacity, ASA-3, and 4 scores) and the cardiovascular complications history for which the most often encountered were low blood pressure, hypertensive flare-up and heart arrhythmia. Therefore, the results of this work reinforce the important place occupied by the preoperative analysis of cardiovascular risks in the prevention strategies of cardiovascular incidents during surgery.

## Abbreviations

**ESC** : European Society of Cardiologie ; **FRCV** : FRCV: cardiovascular risk factors, **IRC**: Chronic kidney failure, **AVC-I**: Ischemic stroke, **ACV-IT**: Transient Ischemic stroke, **IC**: Heart failure; **ASA-1**: Patient in good health status; **ASA-2**: Patient presenting a slight systemic disease well compensated; **ASA-3**: Patient presenting a severe systemic disease; **ASA-4**: Patient presenting a severe systemic disease involving a vital prognostic; **Class-1**: Patients without clinical risk factors; **Class-2**: Patients with 1 clinical risk factor; **Class-3**: Patients with 2 clinical risk factors; **Class-4**: Patients with 3 or more clinical risk factors

## AUTHOR CONTRIBUTIONS

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## CONFLICTS OF INTEREST

The authors are hereby declaring no conflicts of interest regarding the publication of this manuscript.

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