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Author Details Above below

## Enhanced recovery after elective visceral surgery in countries with limited resources: our experience at the centre médical diamant of Lubumbashi (CMDL)/Democratic Republic of the Congo

**David Mutombo Mwembo, Rivain Itéke Féfé, Augustin Kibonge Mukakala, Eric Wakunga Unen, Dimitri Kanyanda Nafatalewa, Donatien Polepole Kahiya, Patrick Mubinda Kiopin, Roger Munan Mwazaz, Vincent de Paul Kaoma Cabala, Lucien Somwa Muhemedi, David Mbayo Nyembo, Sandra Sagboze Zalambo, Sebastien Mbuyi Musanzayi and Willy Arung Kalau**

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### Abstract

**Introduction:** Enhanced recovery after surgery (ERAS) was introduced by H. Khelet and his team in colorectal surgery in 1990, with the aim of reducing the rate of postoperative complications and the length of stay. This illustration of evidence-based medicine is a multimodal management strategy aimed at minimizing the impact of perioperative stress on the patient and thus reducing postoperative risks. The aim of this study was to implement this program, to assess its impact on postoperative morbi-mortality and health care costs in order to popularize it among surgeons, anesthesiologists and their collaborators.

**Patients and methods:** This was a descriptive and interventional evaluative study conducted at the Centre Médical Diamant of Lubumbashi (CMDL) in the Democratic Republic of the Congo, from September 1, 2019 to October 30, 2020. The sample was for convenience, not probabilistic, including 49 operated for elective visceral surgery at Diamond Medical Center during our study period. Our data were entered and analyzed using the epi info 2011 software. The results are presented in the form of tables and sentences.

**Results:** The age of the patients ranged from 1 to 65 years with a mean of  $31 \pm 15$  years. The female sex was the most represented with a sex ratio of 1.27. 9.39% of patients were ASA I and 14 patients, or 28.57% ASA II. For gynecology and obstetrics, scheduled cesarean section was the most common intervention (7 out of 49), i.e. 14.29%. In general surgery, the inguinal hernia was operated on in 16.33%. General anesthesia was performed in 57.14% of cases versus 42.86% for spinal anesthesia. The evaluation of discharge from the operating room was made according to the modified Aldrete and Bromage score, respectively. Among the 21 items in our ERAS program, 19 were implemented in all patients, for an overall implementation rate of 90.48%. According to the Clavien Dindo classification, all patients operated on under the ERAS protocol in our series had no postoperative morbi-mortality. All the operated on in our series had no postoperative morbi-mortality according to the Clavien and Dindo classification. Analgesia extended from 1-5 days depending on the patient, with a mean duration of administration of  $3 \pm 1$  day. The duration and type of analgesia were assessed by quantifying pain using the virtual analog scale (VAS) in 100% of cases. All patients had undergone a post-hospitalization audit, systematically on the 3rd day of discharge by phone call. The average length of hospital stay was 4 days  $\pm 3.55$ . 10% of patients had a single day of postoperative hospitalization.

**Conclusion:** The Enhanced recovery after surgery (ERAS) can indeed be applied in our countries with limited resources with all the expected benefits.

**Keywords:** Enhanced recovery after surgery (ERAS), morbi-mortality, visceral surgery

### Introduction

The concept of Enhanced Recovery after Surgery (ERAS) was developed by H. Khelet and his team in colorectal surgery in the 1990s, with the goal of reducing the rate of postoperative complications and the length of stay [1].

There is indeed in this new mode of care (perfect illustration of evidence-based medicine), a multimodal strategy where anesthetic and surgical techniques seek to minimize the impact of perioperative stress on the patient and thus reduce postoperative risks.

### Corresponding Author:

**Augustin Kibonge Mukakala**

<sup>a)</sup> Department of Surgery,  
University Clinics of Lubumbashi,  
Faculty of Medicine, University of  
Lubumbashi, Democratic Republic  
of the Congo

<sup>b)</sup> Department of Surgery,  
University Clinics of Bukavu,  
Faculty of Medicine, Official  
University of Bukavu, Democratic  
Republic of the Congo

They have one single goal: faster improvement in patient recovery compared to conventional hospitalization practices. The originality also lies in a greater interdisciplinary collaboration of people in contact with the patient, from the stretcher bearer to the surgeon, including the caregiver, the nurse and the anesthetist, without forgetting to involve the patient himself even to its pre and postoperative clinical path [2].

Improved recovery is the subject of increasing research and publication in recent years with a gradual increase in the level of evidence from studies [2, 3]. Several players (learned societies, organizations, groups of institutions) are committed at the international or national level to the deployment of improved recovery: the GRACE group (French speaking group for improved recovery after surgery), the ERAS® Society, the CAPIO group, etc.

These players have each developed a global approach that can range from the development of best practice recommendations to the development of protocols, team training, to the deployment and audit process [3].

On the other hand, until now there is any documented research on the subject in our countries with limited resources.

Operative morbidity and mortality are very frequently used as performance measures of the quality of surgical care. Data on this varies considerably across the world [4].

Digestive surgical pathologies are very common and worrying about the severity of their prognosis. The performance of diagnostic means, the evolution of therapeutic concepts, the training of qualified personnel and the improvement of anesthesia-resuscitation techniques have given surgery new impetus. Consequently, post-operative morbidity and mortality will drop considerably in industrialized countries. In developing countries, the under-equipment of health facilities and the glaring lack of qualified personnel constitute a real handicap in the approach to surgery, especially digestive surgery. In these regions, the early postoperative evolution of surgical digestive pathologies has benefited from a case-by-case study and is generally poorly appreciated [5].

According to a report by the World Health Organization (WHO), in industrialized countries serious complications are recorded in 3 to 16% of hospital surgeries, with permanent disability or death rates of around 0.4 to 0.8 %. In developing countries, some studies suggest mortality rates of 5-10% during major surgeries. Mortality from general anesthesia alone is reported as high as one in 150 in parts of sub-Saharan Africa. Infections and other post-operative complications are also of serious concern around the world. Each year, at least seven million patients suffer from surgical complications, including at least one million who die during or immediately after surgery [6]. The lack of knowledge of the ERAS concept by health personnel in our area is a handicap to its implementation, while it is a set of good practices that are relatively simple to apply, with documented positive results on the postoperative outcome of patients, in particular the reduction in morbidity and mortality, hospital stays and the overall cost of care [1].

In Lubumbashi, a study conducted at the University Clinics of Lubumbashi (C.U.L.) by Kibonge A *et al.* in 2020 found a

frequency of early postoperative complications in abdominal surgery of around 32.2% [7]. And from January 1, 2012 to December 31, 2013, Saleh U *et al.* had conducted a study on early relaparotomies at Lubumbashi university hospitals: 304 laparotomies at C.U.L. and in Sendwe, with 248 normal evolutions and 56 (18.4 operated) relaparotomies 68 times [8].

Therefore, postoperative morbidity and mortality in visceral surgery is a real problem in our environment to which solutions must be proposed.

But we should know that the rate of complications and death are not as dependent on each other as one might assume. Hence the importance of the notion of the mortality index lowered by efficient management of complications [9].

It is therefore appropriate, in our surgical centers in particular, to carry out this type of study. On this subject, Flammand Y. *et al.* have alleged: "if the surgeons do not have the competence, the interest or more generally the time to be involved in these analyzes, others will do it in their place and will impose their methodologies and their results" [10].

This study aims to contribute to the reduction of postoperative morbidity and mortality in visceral surgery in our resource-limited settings by implementing a ERAS program in elective visceral surgery adapted to our conditions, and to assess its impact on postoperative morbidity and mortality and the costs of Health care.

## Patients and Method

This was a descriptive and interventional evaluative study conducted at the Centre Médical Diamant of Lubumbashi (CMDL) in the Democratic Republic of the Congo, from September 1, 2019 to October 31, 2020. The sample was of convenience, not probabilistic, including 49 operated of elective visceral surgery and having benefited from the ERAS program at CMDL during our study period. Postoperative morbidity and mortality was assessed according to the Clavien and Dindo classification [11].

Our data was entered and analyzed using the Excel 2007 and Epi Info 7.2.1 software. The results are presented in the form of tables and sentences.

## Results

### Sociodemographic data

The ages of the patients ranged from 1 to 65 years with a mean of 31 years and a standard deviation of 15. The female sex was the most represented with a sex ratio of 1.27. In our series, 31 patients, or 63.27% had financed their own medical care. (Without insurance)

### Clinical therapeutic data

Our work shows that 69.39% of patients were ASA I and 14 patients, or 28.57% ASA II [12]. General anesthesia was performed in 57.14% of cases versus 42.86% for spinal anesthesia. And the evaluation of discharge from the operating room was made according to modified Aldrete and Bromage, respectively [13].

**Table 1:** Distribution of patients by procedure and diagnosis

Procedure and diagnosis	Effective	Percentage
Gyneco-obstetrics		
Tubo-ovarian abcess drainage	1	2.04
Hysterectomy for cervical cancer	1	2.04
Elective cesarean	3	6.12
Scheduled Cesarean	7	14.29

Unruptured Ectopic pregnancy resection by laparoscopy	1	2.04
Adhesiolysis for desire of maternity by laparoscopy	1	2.04
Right ovarian cyst excision	1	2.04
Myomectomy for endocavitary myoma	1	2.04
Myomectomy for polymyomatous uterus	4	8.16
<b>Surgical</b>		
Laparoscopic appendectomy	5	10.20
Laparoscopic cholecystectomy	1	2.04
Hemorrhoid cure	1	2.04
Epigastric hernia cure	2	4.08
Evisceration cure	1	2.04
White line hernia cure	2	4.08
Inguinal hernia cure	9	18.37
Left Spiegel hernia cure	2	4.08
Appendicular plastron drainage	2	4.08
Thyroidectomy for diffuse goiter	1	2.04
Hydrocele cure	1	2.04
Bladder polyp resection	1	2.04
Orchidopexy for right cryptorchidism	1	2.04
<b>Total</b>	<b>49</b>	<b>100.00</b>

For gynecology and obstetrics, scheduled cesarean section was the most common intervention (7 out of 49), ie 14.29%. In general surgery, the inguinal hernia was operated on more than

16.33% of all operated. We performed 9 laparoscopies, or 18.37% of operated cases. The remaining patients benefited from adherence to the principles of Halsted (Table 1).

**Table 2:** Compliance with the ERAS program implemented in our study

ITEM	Implementation	Level of evidence/force
<b>Preoperative phase</b>		
Dedicated consultation	100%	Low/ strong
Co-morbidity assessment and Management	100%	Moderate/ Low
Smoking cessation	12.24%	Moderate/ strong
Fasting limitation (6 hours solid – 2 hours clear liquid)	100%	Strong(liquids), Low (solids) / Strong
Infections prevention	100%	High/ strong
Thromboembolic prophylaxis	40.82%	High/ strong
No systematic anxiolytic premedication	100%	Moderate/ Low
<b>Intraoperative phase</b>		
Optimization of vascular filling	100%	High/ strong
Prevention of hypothermia	100%	High/ strong
Analgesia with morphine sparing	100%	Moderate/ strong
Prevention of postoperative nausea and vomiting	100%	Low/ strong
Anesthetic titration	100%	Strong/ strong
Neurovegetative protection	100%	
Laparoscopy	16.33%	
Observance of Halsted principles	100%	Not documented
Drastic reduction in the use of drains and probes	100%	High/ strong
<b>Postoperative phase</b>		
Analgesia with morphine savings	100%	High/ strong
Early rise and mobilization	100%	Very low/ High
Early reloading in stages (liquid, semi-liquid, solid)	100%	Moderate/ Low
Thromboembolic prophylaxis	40.82%	High/Strong
Proximology	100%	Not documented
Preparing for the trip	100%	Not documented
Audit and feedback on experience after exit	100%	Low/ High

For our work, 19 out of 21 items from our ERAS program were implemented in all patients, for an overall implementation rate of 90.48%. The level of evidence in the literature and the strength of each recommendation were taken from the report of the French health authority working group on ERAS (Table 2) [14].

It emerges from the Clavien and dindo classification that all the patients operated on using the RACC protocol in our series had no postoperative morbidity and mortality (regardless of the diagnosis, the ASA score and the type of surgery).

The mean length of hospital stay was 4 days with a standard deviation of 3 days, it ranged from 1-6 days. 38 out of 49

patients (77.55%) had spent less than 4 days in hospital (1 day of preoperative stay included). 89.29% of patients operated on in general surgery (25 out of 28) had one day of postoperative hospitalization.

Analgesia extended from 1-5 days depending on the patient, with a mean duration of administration of 3 days  $\pm$  1 day. In 69.39% of cases it was administered less than 3 days in the operated ones. The duration and type of analgesia were assessed by quantifying pain using the visual analog scale (VAS) [15], which was performed in 100% of the patients in our series. 100.00% of our patients have benefited from an audit after hospitalization, systematically on the 3rd day of discharge by

phone call. And depending on the case, either on the 7th or 10th post-operative day by post-operative check-up consultation (face-to-face).

## Bivariate analyzes

**Table 3:** Distribution of patients by age and area of intervention

Age	Area of intervention								
	General Surgery		Gynecology		Obstetrics				
	n	%	N	%	n	%	P	OR	IC à 95%
0 – 15	7	25	2	25	0	0			
16 – 35	12	42,86	0	0	11	84,62	0,004	0,3	[1,62 - 4,30]
36 – 55	7	25,	6	75	2	15,38	0,05	1	[0,42 – 3,75]
≥56	2	7,14	0	0,	0	0,00	0,003	2	[3,10 – 9,40]
Total	28	100	8	100	13	100			

In this distribution, we observe that the age groups corresponded to the areas of surgery; patients between 16-35 years old had 0.3 times the risk of undergoing general surgery and obstetrics, while patients over 56 years old had 2 times the risk to undergo

an intervention in gynecology than in other departments; the comparison between different age groups in relation to the areas of surgical intervention is statistically significant.

**Table 4:** Distribution of patients by area of intervention and length of stay

Area of intervention	Duration of stay					
	< 4 days		≥4 days		p	OR
	n	%	n	%		
General surgery	25	65,79	3	27,27	0,06	0,1
Gynecology	4	10,53	4	36,36	0,05	0,06
Obstetrics	9	23,68	4	36,36	0,04	0,2
Total	38	100,00	11	100,00		

By comparing the length of stay in this distribution with respect to the area of intervention, it was observed that general surgery

resulted in less than 4 days of postoperative stay, ie 65.79% of cases, a statistically significant association.

**Table 5:** Distribution of patients by area of intervention and ASA

Area of intervention	ASA							
	I		II		III		P	OR
	n	%	n	%	n	%		
General surgery	20	58,82	7	50,00	1	100,00	0,08	0,001
Gynecology	3	8,82	5	35,71	0	0,00	0,07	0,001
Obstetrics	11	32,35	2	14,29	0	0,00	0,06	0
Total	34	100,00	14	100,00	1	100,00		

There is no statistically significant correlation between the pre-anesthesia assessment and the type of intervention compared to the postoperative outcome. So all the operated patients who responded to the protocol had a favorable outcome regardless of the ASA and the area of intervention.

## Discussion

### Sociodemographic data

The age of the patients in our series was 1 to 65 years with a mean of  $31 \pm 15$  years. The age group from 1 to 65 years of our series agrees with the literature which says that age is not an obstacle to the implementation of ERAS programs: Apart from adults, seniors [16, 17] or children [18] are also eligible.

The female sex was dominant with 73.47% of cases, or a sex ratio of 1.27. The sex ratio of 1.27 in favor of the female sex can be explained by the inclusion in our study of surgical procedures in gynecology and obstetrics.

In our study, 63.27% were paid for by equity (without insurance: this clears up any ambiguity about the costly nature of the implementation of an ERAS program, with on the contrary a proven economic benefit.

In this regard, a Swiss study shows that the application of improved rehabilitation protocols in colorectal surgery reduced

costs by around 1600 euros per patient [19]. These results were confirmed by an international meta-analysis [20]. A 2016 Canadian publication [21] reported that implementing the ERAS program saved patients between \$ 2,806 and \$ 5,898 per patient.

### Clinical, therapeutic and evolutive data

Comorbidities likely to interfere with postoperative outcome were found in 37.50% of patients (either alone or in combination): These were mainly hypertension, diabetes, heart disease, anemia, and under nutrition. They were taken into account and corrected before surgery as recommended by several authors, with a good level of evidence on the positive postoperative result [22].

The average length of hospital stay in all operated on was 4 days with a standard deviation of 3 days. 27 patients out of 49 (55.10%), ie 25 in general surgery and 2 in gynecology-obstetrics (laparoscopic ablation of tubal pregnancy) remained in hospital for a single day after surgery. Referring to our schools of general surgery and gynecology-obstetrics at the University of Lubumbashi who recommend an average of 5 days of post-operative stay for our usual procedures (appendectomies, hernia cures, cesarean sections, etc.), we carried out a huge gain (especially in general surgery). This meets one of the major

objectives of ERAS programs in reducing the overall length of stay and therefore has a positive impact on reducing health care costs <sup>[19]</sup>.

The prevention of postoperative infections was achieved by antibiotic prophylaxis adapted to each operating procedure according to the recommendations of the MAPAR 2019 protocols <sup>[23]</sup>. We had also systematically administered to all our patients pre-oxygenation (6 liters per minute) which, in addition to its first expected and known benefit in the prevention of hypoxia during the period of apnea of tracheal intubation, would also act, according to Greif R *et al.* <sup>[24]</sup> in the prevention of surgical site infections.

**Prevention of hypothermia:** Classically 50-65% of general surgery patients operated on under general or spinal anesthesia develop unintentional hypothermia, defined as moderate (34°C) (mild hypothermia by Anglo-Saxon authors) <sup>[25]</sup>. This being a factor of postoperative morbidity and mortality <sup>[26]</sup>, it was important, within the framework of our ERAS protocol, to prevent it preoperatively: by keeping the operating room at average temperature around 25 °C and by keeping the patient at all times covered (except when disinfecting the operating site). In addition, maintaining normothermia has a proven benefit in preventing surgical site infections <sup>[27]</sup> and preoperative bleeding <sup>[28]</sup>.

**Analgesia with morphic sparing:** Intraoperatively, apart from the anesthetic induction drugs used for each patient, anesthetic maintenance for analgesia was systematically performed with Perfalgan. This saved us from the intraoperative use of opioids and its derivatives which are deleterious for ERAS <sup>[29]</sup>. In this regard, several authors better recommend thoracic epidural analgesia (offering several advantages) <sup>[30]</sup> which was not applied in our series; the intravenous multimodal analgesia in our series is also documented with good results <sup>[31]</sup>. In the postoperative period, analgesia was performed in patients taking into account the analogical assessment of pain (VAS): Perfalgan alone from VAS 0 to VAS 1 for prevention. Perfalgan + Acupan ± Profenid from EVA 2 to EVA 4.

Perfalgan + Tramadol ± Profenid EVA 4 and more. Tramadol, in view of its many advantages in the management of postoperative pain <sup>[32]</sup>, was introduced into our protocol despite its contraindication in ERAS: And its mode of administration by slow infusion over 30 minutes <sup>[33]</sup> significantly reduced its many side effects.

The prevention of nausea and vomiting in our study was made by administering dexamethasone 8 mg intravenously as a single dose, before induction of anesthesia <sup>[34]</sup>. For general intravenous anesthesia, the Propofol used in all our patients also potentiated the antiemetic effect <sup>[35]</sup>, beyond its anesthetic properties. All the same, it must be said that for Lopez-Olandao L *et al.* <sup>[36]</sup>, the combination Ondansetron and Dexamethasone is more effective than using one of these two molecules separately. The choice of Dexamethasone alone was motivated by the low risk of the occurrence in our patients of postoperative nausea and vomiting according to the Apfel score <sup>[34]</sup>.

**Laparoscopy:** Only 16.3% of the patients in our series had access to it: This being motivated by the surgical indications and the current limit of our surgical teams to extend the technique to other indications such as hernia cures <sup>[37]</sup>. The importance of laparoscopy in ERAS is well established in terms of reducing pain, ileus and length of postoperative stay <sup>[38]</sup>.

Regarding adherence to Halsted's principles: This is a recommendation that is not clearly found in the literature for ERAS protocols in visceral surgery. It therefore seemed important to us to implement it for our work in our countries

with limited resources where access to laparoscopy is still very precarious. Indeed, the application of all or part of Halsted's recommendations would offer a large number of benefits expected by laparoscopy: prevention of postoperative ileus, the risk of infection, significant tissue damage... <sup>[39]</sup>.

**Drastic reduction in the use of drains and probes:** Abdominal drainages were performed (absolute indications) in 3 patients (6.12%) in our series and all removed on the 2nd postoperative day. In patients having benefited from nasogastric and / or bladder tubes, they were removed as soon as they woke up from anesthetic or when the sensory motor block was lifted for spinal anesthesia. This is in line with the recommendations in this area, with a good level of proof and a high level of force. Getting up and mobilizing early (just after waking up from anesthetic or lifting the motor block), rapid resumption of food in stages (not necessarily waiting for the return of intestinal transit) are as many recommendations of good practice applied in our work <sup>[1, 3, 14]</sup>.

We associated with the classic ERAS recommendations a particular concept: proximology <sup>[40]</sup>. It aimed to further strengthen the link in terms of information exchange between our patients and their close entourage. This had all its interest in the acceptance by our operated patients of certain concepts such as early resumption of food, rapid resumption of physical and / or professional activity. And to achieve this goal, the team (surgeon, anesthetists, nurses), supported by a medical psychologist, had a detailed communication with the patients and their relatives (pre and postoperative) on the merits of the program, with a view to optimal support. Overall, 19 recommendations of our ERAS protocol out of 21, or 90.48%, were implemented in our study and had made it possible to prevent all postoperative complications according to Clavien and Dindo. This is in line with the expectations of the literature which says that a beneficial effect of ERAS on more severe morbidity (Clavien-Dindo  $\geq 3$ ) is observed when the programs are implemented optimally ( $\geq 90\%$  of the measures) <sup>[41]</sup>. The benefits of ERAS are primarily a reduction in the morbidity of Clavien-Dindo Grade 1 or 2 <sup>[42]</sup> (moderate morbidity), such as urinary, respiratory or ileus complications <sup>[1]</sup>.

## Conclusion

Enhanced recovery after surgery (illustration of evidence-based medicine) is a multimodal management strategy that reduces postoperative morbidity and mortality, length of stay and therefore health costs. Its implementation in the health structures of our countries with limited resources is possible and easy. It is therefore important that surgeons, anesthetists and their collaborators get actively involved in the application of these best practice recommendations; this also in areas other than visceral surgery, and why not set up protocols for emergency surgeries.

**Author contribution:** All authors made substantial contributions to the development of this article

**Conflict of Interest:** The authors report no conflict of interest

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#### Authors Details

##### David Mutombo Mwembo

- a) Department of Surgery, University Clinics of Lubumbashi, Faculty of Medicine, University of Lubumbashi, Democratic Republic of the Congo
- b) Centre Médical Diamant of Lubumbashi, Democratic Republic of the Congo

##### Rivain Itéke Féfé

- a) Department of anesthesia, resuscitation and emergencies, Jason Sendwe Provincial General Hospital, Democratic Republic of the Congo
- b) Centre Médical Diamant of Lubumbashi, Democratic Republic of the Congo

##### Augustin Kibonge Mukakala

- a) Department of Surgery, University Clinics of Lubumbashi, Faculty of Medicine, University of Lubumbashi, Democratic Republic of the Congo
- b) Department of Surgery, University Clinics of Bukavu, Faculty of Medicine, Official University of Bukavu, Democratic Republic of the Congo

##### Eric Wakunga Unen

- a) Department of Surgery, University Clinics of Lubumbashi, Faculty of Medicine, University of Lubumbashi, Democratic Republic of the Congo
- b) Centre Médical Diamant of Lubumbashi, Democratic Republic of the Congo

##### Dimitri Kanyanda Nafatalewa

Department of Surgery, University Clinics of Lubumbashi, Faculty of Medicine, University of Lubumbashi, Democratic Republic of the Congo

##### Donatien Polepole Kahiya

Department of obstetrics gynecology, University Clinics of Lubumbashi, Faculty of Medicine, University of Lubumbashi, Democratic Republic of the Congo

##### Patrick Mubinda Kiopin

- a) Department of obstetrics gynecology, University Clinics of Lubumbashi, Faculty of Medicine, University of Lubumbashi, Democratic Republic of the Congo
- b) Centre Médical Diamant of Lubumbashi, Democratic Republic of the Congo

##### Roger Munan Mwazaz

- a) Department of obstetrics gynecology, University Clinics of Lubumbashi, Faculty of Medicine, University of Lubumbashi,

Democratic Republic of the Congo

- b) Centre Médical Diamant of Lubumbashi, Democratic Republic of the Congo

##### Vincent de Paul Kaoma Cabala

Department of Surgery, University Clinics of Lubumbashi, Faculty of Medicine, University of Lubumbashi, Democratic Republic of the Congo

##### Lucien Somwa Muhemedi

- a) Department of anesthesia, resuscitation and emergencies, Jason Sendwe Provincial General Hospital, Democratic Republic of the Congo
- b) Centre Médical Diamant of Lubumbashi, Democratic Republic of the Congo

##### David Mbayo Nyembo

- a) Department of anesthesia, resuscitation and emergencies, University Clinics of Lubumbashi, Faculty of Medicine, University of Lubumbashi, Democratic Republic of the Congo.
- b) Centre Médical Diamant of Lubumbashi, Democratic Republic of the Congo

##### Sandra Sagboze Zalambo

Department of anesthesia, resuscitation and emergencies, University Clinics of Lubumbashi, Faculty of Medicine, University of Lubumbashi, Democratic Republic of the Congo

##### Sebastien Mbuyi Musanzayi

Department of Surgery, University Clinics of Lubumbashi, Faculty of Medicine, University of Lubumbashi, Democratic Republic of the Congo

##### Willy Arung Kalau

Department of Surgery, University Clinics of Lubumbashi, Faculty of Medicine, University of Lubumbashi, Democratic Republic of the Congo