

**ANAESTHETIC PRACTICES IN AREAS WITH LIMITED RESOURCES AND PERSONNEL IN THE EASTERN PART OF THE DEMOCRATIC REPUBLIC OF THE CONGO (DRC)**

Joel Kambale Ketha<sup>\*1</sup>, Piet Bekaert<sup>2</sup>, Paulin Ruhato Banguti<sup>3</sup>, Esperance Kavira Kavota<sup>4</sup>, Samuel Kamate Masali<sup>4</sup>, Michel Kalongo Ilumbulumbu<sup>5</sup>, Moise Muhindo Valimungighe<sup>6</sup>, Tecla Katungu Kitamwivirirwa<sup>7</sup>, Sylvie Visavingi<sup>8</sup> and Franck Katembo Sikakulya<sup>9</sup>

<sup>1</sup>Department of Anaesthesia and Intensive Care, Beni General Referral Hospital-Beni and Junior Lecturer, Faculty of medicine, Université Catholique du Graben, Butembo, DRC.

<sup>2</sup>Department of Anaesthesia and Intensive Care, Université Catholique de Louvain, Consultant Anaesthesiologist, Belgium.

<sup>3</sup>Department of Anaesthesia, Critical Care and Emergency Medicine, Consultant Anaesthesiologist, King Faisal Hospital of Kigali, Senior Lecturer, School of Medicine and Pharmacy, College of Medicine and Pharmacy, University of Rwanda, Kigali, Rwanda.

<sup>4</sup>Department of Anaesthesia and Intensive Care, Beni General Referral Hospital, Beni-DRC.

<sup>5</sup>Department of Surgery, Eringeti Referral Health Center and Junior Lecturer, Institut Supérieur des Techniques Médicales de Beni, Beni, DRC.

<sup>6</sup>Department of Surgery, Cliniques Universitaires du Graben, Senior Lecturer, Université Catholique du Graben, Butembo, DRC.

<sup>7</sup>Department of General Medicine, La Joie Health Center, Beni, DRC.

<sup>8</sup>Department of General Medicine, General Referral Hospital of Beni, Beni, DRC.

<sup>9</sup>Department of Surgery, Matanda Hospital-Butembo and Junior Lecturer, Faculty of medicine, Université Catholique du Graben, Butembo, DRC.

**\*Corresponding Author: Joel Kambale Ketha**

Department of Anaesthesia and Intensive Care, Beni General Referral Hospital-Beni and Junior Lecturer, Faculty of medicine, Université Catholique du Graben, Butembo, DRC. Mail ID: [joelketha@gmail.com](mailto:joelketha@gmail.com)

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**ABSTRACT**

**Background:** Satisfactory anaesthesia makes the surgeon's intervention easier and more precise. Improvements in anaesthesia and intensive care during the last 30 years have enabled surgical procedures to be performed at the most extreme ages in life. This study describes the current anaesthetic practices at Beni General Referral Hospital in the DRC. **Methodology:** This was a retrospective study carried out from the 1<sup>st</sup> January to 31<sup>st</sup> December 2017 at Beni General Referral Hospital in the DRC. **Result:** Overall 1453 patients presented for surgery; women were represented in 63.4% of cases. The average age of patients was 24 +/- 0.9 years. The risk assessment showed that 97.2% of patients were ASA class I and II, surgical risk was shown to be intermediate in 66.3%, followed by minor surgical risk. Gynaecological and obstetric interventions were 43%, followed by traumatological and orthopaedic in 38.9% and abdominal in 10.6%. General anaesthesia with ketamine was most commonly used technique, followed by spinal anaesthesia and local anaesthesia respectively in 43%, 37.8% and 19.2%. Atropine and diazepam have increasingly been used in combination for premedication. Anaesthesia was administered by nurse anaesthetists with less than 10 years of experience. Adverse events in most cases were cardiovascular. No deaths were recorded during surgery or the recovery period in the hour after the surgery. **Conclusion:** Due to deficiencies in equipment, technical support and training acceptable standards of anaesthetic practice do not currently exist at the Beni General Referral Hospital. This remains a public health problem in this environment which requires urgent attention.

**KEYWORDS:** Practices, anaesthesia, Beni, DRC.

**INTRODUCTION**

Practicing safe anaesthesia requires adequate knowledge and skills. This is particularly important for those who work in environments without sufficient equipment or

qualified staff for the well-being and adequate treatment of patients.

The practices of anaesthesia in developing countries carry a high risk.<sup>[1]</sup> It must be adapted to local conditions

including: a great variety of pathologies, lack of equipment and trained staff.<sup>[2,3,4]</sup>

First, there are cases where the condition of the patient and the urgency of the intervention are responsible for an unfavourable outcome, and where, in fact, more appropriate anaesthesia and intensive care could have avoided a poor result.

This accounts for approximately 14% of the early perioperative mortality. Improvement requires better preoperative assessment of the patient, pre-operative resuscitation, selection of the most appropriate anaesthetic technique and careful monitoring during the intraoperative and post-operative period.<sup>[5]</sup>

In wealthy countries, epidemiological studies which assessed the mortality linked to anaesthesia in the last 30 years have resulted in many improvements in anaesthesia safety.<sup>[6]</sup> In Europe and the United States of America (USA), major progress has been made in the anaesthetic management of more fragile patients, with serious health issues, with a significant reduction of mortality. This is thanks to the measures and recommendations by the health authorities.<sup>[7]</sup>

Mali, a developing country in West Africa is a good example, as are most of the countries in the African continent. Its health system is in a very poor condition, according to studies done by Samake B and collaborators.<sup>[8]</sup>

In some countries of the African continent, anaesthesia is not recognized as a separate medical specialty and therefore not assessed properly,<sup>[9]</sup> despite its role during operations as an essential support to the surgical team. Furthermore, in the Democratic Republic of Congo (DRC), in Lubumbashi specifically, a census in different sites concluded that there are only 15 graduated nurse anaesthetists, 4 interns specializing in anaesthesia, and one medically qualified anaesthetist.<sup>[10,11,2]</sup>

In the case of the DRC the shortage of qualified personnel lead to an inability to fulfil surgical and anaesthetic requirements when these suddenly increased due to the ongoing armed conflicts.<sup>[12]</sup>

From these observations, it can be seen that the provision of anaesthesia services presents a real public health problem in developing countries. This is why we have limited this research topic to the theme of: "Anaesthetic practices in areas with limited resources and personnel in the Eastern part of the Democratic Republic of the Congo, especially in Beni General Referral Hospital".

Data on anaesthetic practice are almost non-existent in the city of Beni. The object of this study is to establish the current state of the specialty and build a database in order to improve working conditions in this environment.

Each patient to be anaesthetized has his own individual medical history which will influence their response to anaesthesia; that is the reason why the outcome of any surgical procedure depends on the quality of the anaesthesia.

The aim of this study is to describe the current anaesthetic practices at Beni General Referral Hospital, in order to improve the working conditions in a precarious environment characterized by limited technical equipment and insufficiently competent staff.

## METHODOLOGY

The study was conducted in the surgery department and the operating room of Beni General Referral Hospital (GRH), in Beni City, North Kivu Province, Democratic Republic of the Congo. The operating room of this hospital has two operating tables, two operating lights, a single monitor indicating blood pressure, heart rate and oxygen saturation of the patient, a suction machine and an oxygen concentrator. The recovery room has three beds.

The hospital was selected because of the high turn-over of patients, its reputation concerning the management of surgical pathologies, and the quality of its organizational structure. It was a retrospective study carried out from January until December 2017.

Our study's population consisted of inpatients who had one or more surgical operations in the hospital. The information for each patient was obtained from the data registry used in the surgery department of Beni GRH.

The following parameters were recorded for each patient: age, sex, anaesthetic risk as classified by the American Society of Anaesthesiologist (ASA), surgical risk, type of surgical procedure, type of anaesthesia, drugs used in premedication and induction of anaesthesia, the number, qualification and experience of anaesthetists, adverse events related to anaesthesia induction and outcome of patients in the post-operative period.

Data entry and analysis was performed using the EPI-INFO software version 3.5.4. Data were presented as tables.

Ethical norms were respected in the realization of this work. Confidentiality was guaranteed by the use of a code instead of the name. The authorities of Beni health area and Beni General Referral Hospital gave their approval for this study. No individual consent was required as archived patient records were collected and no patient identification was used.

**RESULTS****1. Gender, age, classification according the ASA and surgical risk of the patients.**

The following table divided the patients according to their gender, age, classification according to the ASA and the surgical risk.

**Table 1: Gender, age, classification according the ASA and surgical risk of the patients.**

<b>Gender, age, classification according the ASA and surgical risk of the patients.</b>	<b>Number n=1453</b>	<b>% 100</b>
<b>Gender</b>		
Female	921	63.4
Male	532	36.6
<b>Age range (in years)</b>		
0-15	195	13.4
16-30	687	47.3
30-45	325	22.4
46-60	161	11
60 old and above	85	5.9
<b>Classification according the ASA</b>		
ASA I	1257	86.5
ASA II	156	10.7
ASA III	35	2.5
ASA IV	5	0.3
ASA V	0	0
<b>Surgical risk</b>		
Minor	396	27.3
Intermediate	964	66.3
Major	93	6.4

**2. Distribution of patients according the type of surgery procedure**

The table below lists the patients according to the type of surgical procedure.

**Table 2: Type of surgical procedure.**

<b>Type of surgical procedure</b>	<b>Number n = 1453</b>	<b>% 100</b>
<b>Gynaecological and Obstetric</b>	<b>625</b>	<b>43</b>
-Caesarean section	548	
-Hysterectomy	36	
-Myomectomy	19	
-Ovarian cystectomy	11	
-Ectopic pregnancy	8	
-Fistula repair	3	
<b>Traumatological and Orthopaedic</b>	<b>566</b>	<b>38.9</b>
-Secondary suture of wounds	212	
-Plastic Suture wounds	134	
-Osteosynthesis	145	
-Knee genu varum	46	
-Knee genu valgus	16	
-Correction of congenital foot anomalies	10	
-Amputation	3	
<b>Gastro-intestinal</b>	<b>155</b>	<b>10.6</b>
-Laparotomy (for cases of peritonitis, intestinal obstruction and other)	67	
-Hernia repair	57	
-Appendicectomy	31	
<b>Other types of surgery</b>	<b>81</b>	<b>5.6</b>
-Circumcision	28	
-Lipectomy	25	
-Urology	15	
-Foreign object extraction	8	
-Hydrocelectomy	5	

<b>ENT surgery</b>	<b>26</b>	<b>1.9</b>
-Thyroidectomy	23	
-Nasal polypectomy	3	

### 3. Distribution of patients according the type of anaesthesia and drugs used in premedication and induction of anaesthesia.

The table below lists patients according to the type of anaesthesia and drugs used in premedication and induction of anaesthesia.

**Table 3: Type of anaesthesia and drugs used in premedication and induction of anaesthesia.**

Type of anaesthesia, premedication, drugs used in premedication and induction of anaesthesia.	Number n= 1453	% 100
<b>Type of anaesthesia</b>		
<b>-General anaesthesia</b>	<b>624</b>	<b>43</b>
<b>-Regional anaesthesia</b>	<b>550</b>	<b>37.8</b>
-Spinal anaesthesia	543	(98.7)
-Regional block	7	(1,3)
<b>-Local anaesthesia</b>	<b>279</b>	<b>19.2</b>
<b>Products used in premedication</b>		
Atropine + Diazepam	741	51
Atropine	222	15.3
Diazepam	177	12.2
Metoclopramide	148	10.2
Promethazine	95	6.5
Cimetidine	70	4.8
<b>Products used in administration of anaesthesia</b>		
<b>-General anaesthesia</b>	<b>624</b>	<b>43</b>
-Ketamine	491	(78.7)
-Propofol	61	(9.8)
-Halothane	37	(6)
-Thiopentone	31	(5)
-Isoflurane	4	(0.6)
<b>Regional anaesthesia</b>	<b>550</b>	<b>37.7</b>
-Bupivacaine	550	(37.7)
<b>Local anaesthesia</b>	<b>279</b>	<b>19.2</b>
- Lignocaine + Adrenaline	279	(19.2)

### 4. The number, qualification and experience of anaesthetists

The Table below lists the number, qualification and experience of anaesthetists at the General Referral Hospital of Beni.

**Table 4: Number, qualification and experience of anaesthetists at GRH Beni.**

Number, qualification and experience of anaesthetists	Number	%
<b>Number</b>	<b>2</b>	<b>100</b>
<b>Qualification of anaesthetists</b>		
Nurse graduated in Anaesthesia	2	100
Consultant anaesthetist	0	0
<b>Work experience</b>		
5 years	1	50
7 years	1	50

### 5. Accidents and incidents related to anaesthesia and post-operative period

The table below divides the patients according complications related to anaesthesia, the outcome of their surgery and post-operative follow up.

**Table 5: Accidents and incidents related to anaesthesia and wake up issue.**

Adverse events related to anaesthesia	Number n = 1453	% 100
<b>Adverse events related to anaesthesia</b>		
None	1300	89.5
Hypotension	64	4.4
Tachycardia	47	3.2
Hypertension	22	1.6
Failed spinal anaesthesia	12	0.8
Allergic reactions	3	0.2
Laryngeal oedema	2	0.12
Lignocaine toxicity	2	0.12
Laryngeal spasm	1	0.06
<b>Outcome</b>		
Favourable	1453	100
Deceased	0	0
<b>Recovery of consciousness</b>		
0-1 hour	276	44.2
More than 1 hour	348	55.8

## DISCUSSION

During this study period, females were in the majority with 63.4% with the sex ratio of 1.7:1 in favour of women. This higher proportion of female patients in this study is due to the high incidence of gynaecological and obstetrical interventions in women of child bearing age. In addition, this age group is one in which people are more exposed to road traffic accidents because of their daily activities in our environment including ambulatory businesses and motorcycling.

The results found in this study do not differ from those found by Kabey AK and his collaborators in a study conducted on anaesthetic practices in Lubumbashi in the DRC where 81.5% of operated were aged between 11 and 50 years and among them, 67.3% of surgical patients were female.<sup>[13]</sup> In an Italian study, Peduto V and his collaborators had observed 54% of surgical patients were female.<sup>[14]</sup> and Sabate S and his collaborators in Spain have found that 58% of operated patients were female.<sup>[15]</sup>

In this study, evaluation of anaesthetic risk showed that 86.5% of patients were ASA class I, 10.5% ASA class II, 2.5% were ASA class III and 0.5% were ASA class IV.

Surgical risk was classified as intermediate (66.3%), minor (27.3%) and major (6.4%). These results are explained by the fact that in our area there are no specialized surgical interventions due to the lack of qualified staff and equipment in anaesthesia and surgery. Any interventions that require specialized care are referred to an appropriate centre outside the country, if time allows. Those presenting with high surgical and anaesthetic risks were urgent interventions requiring immediate management. Those specialized interventions related to major surgery that was undertaken at GRH of Beni, performed by visiting humanitarian surgeons who came on their mission, complete with equipment for anaesthesia and surgery and a team of qualified personnel including a surgeon, a physician anaesthetist, qualified nurses as well as an instrumentalist. In a study

conducted by Kabey AK and his collaborators on anaesthetic practices in Lubumbashi, DRC, the type of surgery that is frequently performed in Lubumbashi is major surgery.<sup>[13]</sup>

In France, one study indicates 88% of patients were in the ASA class I and II. In Italy, they account for 79% of cases compared with 21% for ASA III to V classes.<sup>[14,16]</sup> Ibrahima G and his collaborators, in a study carried out on the perioperative management of abdominal surgical emergencies in adults at the University Hospital Aristide Le Dantec in 2016, found that the ASA class I patients were found in 49.1%, those in the ASA II were found in 39.1%, 14 patients (8.7%) in the ASA class III, 4 patients (2.5%) in the ASA class IV and 1 patient classified ASA V (0.6%).<sup>[17]</sup> Djomkoué M, in her study conducted at the Gabriel Toure University Hospital Center in Bamako, found that 57.9% of patients were classified as ASA class I. This is probably related to the young age of the majority of patients.<sup>[18]</sup> Gravot B.<sup>[19]</sup> and B Samake and his collaborators.<sup>[20]</sup> observed respectively 47.9% and 59.5% of patients of the ASA class I. Mahoungou KC and his collaborators in their study carried out on the anaesthetic practice during surgical emergencies at the University Hospital Center of Brazzaville, in 2011, found that the majority of emergency anaesthetics were performed on ASA class I (89%) and II (9%) patients; 2% of patients were ASA class III.<sup>[21]</sup> A study carried out by Brouh Y and his collaborators on the anaesthetic practices in Ivory Coast found that the patients were classified as follows: ASA I (52.96%), ASA II (36.21%), ASA III (9.61%), ASA IV (2.15%) and ASA V (0.07%).<sup>[22]</sup>

In relation to the type of surgery procedure performed, this study shows that gynaecological and obstetric interventions were the most common, followed by trauma and orthopaedic interventions, abdominal, other types (circumcision, lipectomy, urological surgery, foreign object extraction, hydrocelectomy) and the ENT surgery (goitre and nasal polyps) respectively in 43%,

38.9%, 10.6%, 5.6% and 1.9%. This reflects the high number of caesarean sections performed in our study because the General Hospital of Beni is a referral centre, receiving all the referred cases of the health centres of the city and rural areas nearby. Apart from the high frequency of caesarean sections, we also note the high frequency of injuries due to road traffic accidents in the city of Beni, which is a major cause of trauma that is treated surgically. The specialized interventions, including thyroid surgery, nasal polypectomy, urology and others, were carried out by the team of specialist doctors coming solely in their humanitarian mission. The low rate of specialized intervention in this study is due to the lack of equipment and skills, which forced the transfer of patients to the better equipped centres, sometimes outside the country. In the DRC, specifically in Lubumbashi, Kabey AK and his collaborators in a study on anaesthetic practices found that the most frequently performed surgery was abdominal (46.7%) followed by gynaecological and obstetric surgery (29.2%).<sup>[13]</sup> In Ivory Coast, surgical specialties were dominated by gynaecological and obstetric surgery (40.05%), abdominal surgery (37.97%), traumatology (5.28%), paediatric surgery (4.69%), neurosurgery (0.95%), thoracic surgery (0.12%), cardiac surgery (0.05%) and other surgeries (0.05%).<sup>[22]</sup>

In France, obstetrical surgery is the most common first (33%) followed by abdominal surgery with 18.5% of cases.<sup>[16]</sup> For Sabaté and his collaborator.<sup>[23]</sup> in Spain, trauma surgery was predominant; on the other hand, gynaecological and obstetric surgery was found by other authors to be more common.<sup>[23-25]</sup> In Brazzaville, abdominal surgery was the most common (65% of cases), followed by trauma surgery (29% of cases) and urological surgery (2% of cases).

Regarding the type of anaesthesia and drugs used in the premedication and induction of anaesthesia, it emerges from this study that general anaesthesia was used more (43% of cases), followed by regional anaesthesia (37.8%), and local anaesthesia (19.2%) of cases with lignocaine. The atropine and diazepam combination was the most used premedication, followed by atropine, diazepam and other products such as metoclopramide, promethazine and cimetidine respectively in 51%, 15.3%, 12.2%, 10, 2%, 6.5% and 4.8%.

In 78.7% of cases, general anaesthesia based on ketamine was the most commonly used technique at Beni General Referral Hospital. This is because it is the only suitable product available in our local hospitals, where there is insufficient qualified personnel and equipment for anaesthesia. Other agents used for general inhalation anaesthesia were brought by the team of visiting doctors who came on their humanitarian mission with their complete equipment. According to Guegen G., anaesthesia exclusively with ketamine is more suitable to our working conditions in Africa.<sup>[26]</sup> Ketamine induces a state of dissociative anaesthesia which can be very useful.

The patient is unconscious, amnesic and deeply analgesic and the patency of the airways is remarkably preserved, regardless of the position of the head.<sup>[27]</sup>

The atropine and diazepam combination was the most commonly used for premedication with a frequency of 40.5% in the study carried out by Djomkoué M. at the Gabriel Touré University Hospital Center in Bamako, causing anxiolysis and a decrease of the side effects of anaesthesia.<sup>[18]</sup> The work of Co Tui, Standard S,<sup>[28]</sup> had shown that the use of atropine in the premedication of regional anaesthesia caused a reduction in the incidence of hypotension from 76% to 52% but at the cost of tachycardia.

Regarding regional anaesthesia, spinal anaesthesia was the most used technique at GRH of Beni with bupivacaine 0.5% in 100% of cases. It was used more frequently in sub-umbilical procedures such as inguino-scrotal hernia repair, gynaecological, obstetric procedures, and urological procedures. Regional blocks were used in only 1.3% of cases. This was due to the lack of qualified personnel to perform this technique and was used only by the anaesthetist doctor who came on a humanitarian mission.

In a study conducted by Djomkoué M. at the Gabriel Touré University Hospital Center in Bamako, the types of anaesthesia identified during her work were general anaesthesia (67.1%); epidural anaesthesia (3%); spinal anaesthesia (29.8%) and peripheral nerve blocks. The latter accounted for only 0.1% because of the lack of technical skills.<sup>[18]</sup>

According to Guegen G., spinal anaesthesia is characterized by the preservation of consciousness, its simplicity of execution and its low cost. It is the technique of choice for surgical procedures of less than two hours duration on the lower half of the body and was used in 86% of cases at Ziguinchor Regional Hospital in Senegal.<sup>[26]</sup>

In the DRC, specifically in Lubumbashi, Kabey AK and his collaborators in a study on anaesthetic practices found that general anaesthesia was performed in 86.7% of cases, regional anaesthesia for 11.8% and combined anaesthesia in 0.6%. The majority of regional anaesthesia techniques consisted of spinal anaesthesia (66%).<sup>[13]</sup> These results are similar to our own.

The staff in the anaesthetic department of GRH of Beni consists of just two nurse anaesthetists, both of whom are graduates, that is to say having a level A1 (three years) nursing studies, specializing in Anaesthesia and Intensive Care. One has five years of experience and the other seven years of experience. There is no consultant anaesthetist or any other personnel trained in the field of anaesthesia at GRH of Beni. There is a shortage of Anaesthetists and Intensive Care consultants in the city

of Beni in particular, and throughout the country in general.

According to a study conducted by Ahuka OL on the distribution of medical specialists in the four major clinical disciplines as well as Anaesthesia and Intensive Care in the Democratic Republic of the Congo (DRC) in June 2014, out of 339 specialists in the four major clinical disciplines in the DRC, there were only 33 consultants anaesthetists (9.7%). Among these specialists, 49.9% (169/339) work in Kinshasa, the capital of the DRC and 91.7% (311/339) specialists work in provincial capitals and in Kinshasa, that is to say in urban environments.<sup>[29]</sup>

Djomkoué M., in her study conducted at the Gabriel Touré University Hospital Center in Bamako, found that eighty-three percent of the anaesthetics were administered by medical assistants against 2% by physician anaesthetists.<sup>[18]</sup> Samake B. and his collaborators,<sup>[20]</sup> found 94% of anaesthetics were performed by medical assistants and 6% by physician anaesthetists. This contrasts with the studies of Gravot B,<sup>[26]</sup> and Venet C,<sup>[30]</sup> in which 100% of anaesthetics were administered by physician anaesthetists.

Among the adverse events related to anaesthesia found in this study, hypotension, tachycardia, hypertension, failure of spinal anaesthesia, allergic reactions, laryngeal oedema, and lignocaine poisoning were found, respectively, in 67 cases, 44 cases, 22 cases, 12 cases, 3 cases, 2 cases, 2 cases. Laryngeal spasm was recorded during the extubation of one patient. No deaths were recorded. In general, recovery was uneventful in the hour following the surgical intervention.

The adverse events noted in this study are comparable to those found by other African authors such as Ka-Sall in Senegal,<sup>[31]</sup> however, in a study of Harrison G,<sup>[32]</sup> the incidence of intraoperative arterial hypotension was 16.8%.

## CONCLUSIONS

Anaesthetic practices at Beni General Referral Hospital are adapted to an environment where there is insufficient qualified staff and lack of appropriate equipment. It is for this reason that the only simple and, above all, effective techniques are selected depending on the products and equipment available. General anaesthesia based on ketamine is preferred, as well as spinal anaesthesia and local anaesthesia. This is the reason why more specialized surgery cannot be performed in the hospital. As this is the only referral hospital in the region, this situation is totally unsatisfactory and requires urgent attention.

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## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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