Scholars Journal of Medical Case Reports
Abbreviated Key Title: Sch J Med Case Rep
ISSN 2347-9507 (Print) | ISSN 2347-6559 (Online)
Journal homepage: https://saspublishers.com

OPEN ACCESS

Surgery

Prevalence and Peroperative Factors Associated with Early Post-Operative Complications at the University Clinics in Kisangani (DRC)

Felly Kanyinda Ciamala[1,2*], Ralph Munsense Tshiyombo[1,4], Asaph Bwini Dianaben[1,3], Tom Wami Tomo[1], Pericles Lokangu Kalokola[1], Pascal Kayembe Shambuyi[1,2], Roger Amisi Kitoko[1], Freddy Wami W'Ifongo[1]

[1]Department of Surgery, Faculty of Medicine and Pharmacy, University of Kisangani, Kisangani, Democratic Republic of the Congo
[2]Department of Surgery, Faculty of Medicine, Public Health and Pharmacy, University of Mbujimayi, Mbujimayi, Democratic Republic of the Congo
[3]Department of Surgery, Faculty of Medicine, University of Kikwit, Kikwit, Democratic Republic of the Congo
[4]Third Defence Zone Military Hospital (HM3ZDef), Kisangani, Democratic Republic of the Congo

DOI: https://doi.org/10.36347/sjmcr.2025.v13i04.047 | **Received:** 16.03.2025 | **Accepted:** 20.04.2025 | **Published:** 29.04.2025

***Corresponding author:** Felly Kanyinda Ciamala
Department of Surgery, Faculty of Medicine and Pharmacy, University of Kisangani, Kisangani, Democratic Republic of the Congo

Abstract | **Original Research Article**

***Background and Objectives*:** Post-operative complications (POC) are new pathological phenomena occurring in the post-operative period and generally worsening the previous situation through their morbidity and mortality. Our aim was to determine the prevalence and intraoperative factors associated with early POC at University Clinics of Kisangani (CUKIS). ***Methods*:** This was an analytical cross-sectional study carried out in the CUKIS Department of Surgery from 1 January 2014 to 31 December 2023. The target population consisted of all patients who had undergone full post-operative follow-up. A logistic regression model using RStudio version 4.4.0 software was used to determine the intraoperative factors predictive of early postoperative complications. ***Results*:** The prevalence of early POC was estimated at 35%, with surgical site infection the most frequent CPO at 45.3%. After multivariate analysis using logistic regression, fracture of two bones in the leg; exploratory laparotomy; adenomectomy; surgical trimming; skin grafting; osteosynthesis; amputation; and types of surgery according to Altemeier 3 and 4 were significant risk factors associated with the occurrence of POC in the intraoperative period. ***Conclusion*:** Certain factors can predict the occurrence of intraoperative POC. Knowledge of these factors can help practitioners to take useful steps before each operation on a patient with these factors, with a view to preventing or managing POC.

Keywords: Early Postoperative Complications-Prevalence-Associated Factors.

INTRODUCTION

Post-operative complications (POCs) are new pathological phenomena occurring in the post-operative period and generally worsening the previous situation through their morbidity and mortality [1, 2]. They may be immediate, early or late, depending on how soon they appear [3]. They are important indicators of the quality of surgical care [1]. Despite the use of increasingly effective and less invasive techniques to reduce postoperative morbidity, CPO remains a major problem in surgery [2].

In the USA, the incidence of CPO is estimated at 30.3% according to a study carried out in 2002 by Healey [4]. In Europe, particularly in Switzerland, Jean Claude Renggli reported a CPO rate of 23.3% in 2003 [5]. In Germany, a study conducted by Markus on post-operative care recorded a CPO rate of 29.5% [6].

In Africa, a study carried out by Tonye in 2015 in Cameroon, on early postoperative complications in Yaoundé, reported an overall rate of 14.3% [2]. While Cheickna T. in her study on postoperative complications in the General Surgery Department of the Commune I Reference Health Centre in the District of Bamako in Mali reported a postoperative complication rate of 6.67% [7].

In the Democratic Republic of Congo, a study carried out by Augustin Kibonge in 2021 on early postoperative complications in digestive surgery in Lubumbashi reported a frequency of 32.2% [8].

In industrialised countries, where working conditions are favourable and human, material and infrastructural resources are available, there are nevertheless factors that are incriminated in the

occurrence of CPO. These are mainly related to patient characteristics [9].

In developing countries, numerous publications report that factors linked to the surgical procedure and the environment are the most incriminating in the occurrence of postoperative complications. These include a pre-operative hospital stay of more than 7 days, an operation lasting more than 2 hours, the type of surgery according to Altemeier, hospital conditions and many others [1-11].

In Kisangani, the factors linked to the occurrence of CPO are not well documented, yet they are just as common as in most developing countries.

The main objective of this study was to determine the prevalence and intraoperative factors associated with early postoperative complications at the University Clinics of Kisangani.

MATERIALS AND METHODS

This was a cross-sectional study with an analytical aim and retrospective collection. It was conducted in the Department of Surgery of the University Clinics of Kisangani in the Democratic Republic of Congo. Data were collected from [1]January 2014 to 31 December 2023 (10 years). During this period, 1476 patients underwent surgery. A total of 486 patients underwent full post-operative follow-up, of whom 170 had developed POC and were the subject of our study. All patients operated on during the period of our study, who presented one or more clinically diagnosed POCs, and whose records could be used, were included in this study. Patients who had undergone surgery but whose records could not be analysed were excluded. The following parameters were studied: age, sex, marital status, patient admission mode, history, intraoperative diagnosis, nature of surgery, type of anaesthesia, type of surgery according to Altemeir and types of POC. Data were collected using Excel 2021 and then exported to R software version 4.4.0. Frequency and mean were calculated. The Pearson chi-squared test and the Exact File were used to study the associations between the variables. A bivariate analysis was used to identify the variables to be included in the univariate and multivariate logistic regression model. The variables to be included in the final model were selected using the bottom-up stepwise method based on the Akaike information criterion (AIC), starting with a set of variables with a $p \leq 0.2$ in the bivariate analysis. Crude and adjusted ORs were determined successively. For all the statistical tests used, the significance threshold of 95% ($\alpha = 0.05$) was therefore considered.

Ethical Considerations

The management of the University Clinics of Kisangani gave administrative approval for the study, and the Department of Surgery approved the protocol and the conduct of the study. All information obtained from patient files was kept completely anonymous.

RESULTS

1. Epidemiological Data

Of the 1476 patients who underwent surgery during our study period, 486 were followed up postoperatively. We identified 170 patients who presented with early postoperative complications, giving a prevalence rate of 35.0%. The mean age was 41.5 years, with a standard deviation of 24.2 years; the 60-79 age group was most affected by POCs, with 28.2%. Most patients were male (74.1%) and married (56.5%).

2. Clinical Data

The majority of POC cases (52.9%) were admitted via the emergency department. The most common medical histories were hypertension, gastritis and diabetes (12.9%, 10.0% and 7.1% respectively), while surgical histories such as hernia repair and appendectomy were more prevalent (6.5% and 5.9% respectively). Benign prostatic hypertrophy and ileal perforation were the most frequent intraoperative diagnoses in general and visceral surgery, with 12.4% and 4.1% respectively. Fractures of two leg bones were more frequent in orthopaedic trauma, at 5.9%. Exploratory laparotomy was the most common surgical procedure in general and visceral surgery (30.0%), followed by adenomectomy (11.8%), and osteosynthesis was more common in orthopaedic trauma (12.4%), followed by amputation (5.9%). General anaesthesia was used most often (92.4%). The types of surgery according to Altemeier 1 and 2 were the most frequently performed, and surgical site infection was the most frequent CPO in 45.3% of cases.

3. Peroperatory Factors Associated with Cpo

In bivariate analysis, benign prostatic hyperplasia, ileal perforation and open fracture of two leg bones were intraoperative diagnoses significantly associated with the occurrence of postoperative complications. Exploratory laparotomy, adenomectomy, surgical trimming, skin grafting, cystostomy, osteosynthesis and amputation were surgical procedures significantly associated with the occurrence of postoperative complications. **Table I and II**. Types of surgery according to Altemeier 3 and 4 were significantly associated with the occurrence of postoperative complications. **Table III**

In multivariate analysis, fracture of two leg bones (aOR= 2.10; [95% I.C = 0.76 - 6.28]); exploratory laparotomy (aOR= 5.58; [95% I.C at 95% = 3.12 - 10.2]); adenomectomy (aOR= 44.4; [I.C at 95% = 12.1 - 287]); surgical trimming (aOR= 7.54; [I.C at 95% = 3.21 - 18.6]); skin graft (aOR= 16.4; [I.C at 95% = 3.72 - 114]); osteosynthesis (aOR= 5.82; [I.C at 95% = 2.76 - 12.6]); amputation (aOR= 7.4; [I.C at 95% = 2.56 - 23.2]); types of surgery according to Altemeier 3 (aOR= 2.65; [I.C at

95% = 1.32 - 5.23]) and 4 (aOR= 17.8; [I.C at 95% = 9.41 - 35.6]) were considered significant risk factors.

Table IV and V

Table I: Distribution of cases by type of surgery in general and visceral surgery

Variables	COMPLICATIONS		Total	p -value[2]
	Yes (N = 170 [1])	**No (**N = 316 [1])	(N = 486 [1])	
Exploratory laparotomy				**< 0,001**
Yes	51 (30,0%)	44 (13,9%)	95 (19,5%)	
No	119 (70,0%)	272 (86,1%)	391 (80,5%)	
Adenomectomy				**< 0,001**
Yes	20 (11,8%)	2 (0,6%)	22 (4,5%)	
No	150 (88,2%)	314 (99,4%)	464 (95,5%)	
Surgical trimming				**0,002**
Yes	17 (10,0%)	10 (3,2%)	27 (5,6%)	
No	153 (90,0%)	306 (96,8%)	459 (94,4%)	
Appendectomy				**<0,001**
Yes	7 (4,1%)	92 (29,1%)	99 (20,4%)	
No	163 (95,9%)	224 (70,9%)	387 (79,6%)	
Hernia repair				**<0,001**
Yes	7 (4,1%)	94 (29,7%)	101 (20,8%)	
No	163 (95,9%)	222 (70,3%)	385 (79,2%)	
Skin grafting				**0,011**
Yes	7 (4,1%)	2 (0,6%)	9 (1,9%)	
No	163 (95,9%)	314 (99,4%)	477 (98,1%)	
Cystostomies				**0,005**
Yes	5 (2,9%)	0 (0,0%)	5 (1,0%)	
No	165 (97,1%)	316 (100,0%)	481 (99,0%)	
Hydrocele cure				0,7
Yes	4 (2,4%)	6 (1,9%)	10 (2,1%)	
No	166 (97,6%)	310 (98,1%)	476 (97,9%)	
Cystectomy				0,2
Yes	1 (0,6%)	8 (2,5%)	9 (1,9%)	
No	169 (99,4%)	308 (97,5%)	477 (98,1%)	
Mastectomy				>0,9
Yes	1 (0,6%)	2 (0,6%)	3 (0,6%)	
No	169 (99,4%)	314 (99,4%)	483 (99,4%)	

[1]n (%)

[2]Chi-square test of independence; Fisher's exact test

Table II: Distribution of cases by nature of trauma-orthopaedic surgery

Variables	COMPLICATIONS		Total	p-value[2]
	Yes (N = 170 [1])	**No (**N = 316 [1])	(N = 486 [1])	
Osteosynthesis				**0,004**
Yes	21 (12,4%)	16 (5,1%)	37 (7,6%)	
No	149 (87,6%)	300 (94,9%)	449 (92,4%)	
Amputation				**0,019**
Yes	10 (5,9%)	6 (1,9%)	16 (3,3%)	
No	160 (94,1%)	310 (98,1%)	470 (96,7%)	
Swaying shoulder				0,3
Yes	3 (1,8%)	2 (0,6%)	5 (1,0%)	
No	167 (98,2%)	314 (99,4%)	481 (99,0%)	
Lifting the jam				0,7
Yes	2 (1,2%)	6 (1,9%)	8 (1,6%)	
No	168 (98,8%)	310 (98,1%)	478 (98,4%)	
Swaying hip				0,7
Yes	1 (0,6%)	4 (1,3%)	5 (1,0%)	
No	169 (99,4%)	312 (98,7%)	481 (99,0%)	
Amputation				0,3
Yes	1 (0,6%)	0 (0,0%)	1 (0,2%)	
No	169 (99,4%)	316 (100,0%)	485 (99,8%)	

[1]n (%)

[2]chi-square test of independence; Fisher's exact test

Table III: Distribution of cases by type of anaesthesia and type of surgery according to Altemeier

Variables	COMPLICATIONS		Total (N = 486 [1])	p-value[2]
	Yes (N = 170 [1])	**No (**N= 316 [1])		
Type of anaesthesia				0,3
General	157 (92,4%)	292 (92,4%)	449 (92,4%)	
Local	9 (5,3%)	10 (3,2%)	19 (3,9%)	
Rachi anaesthesia	4 (2,4%)	14 (4,4%)	18 (3,7%)	
Type of surgery				**<0,001**
Altemeier 1	46 (27,1%)	176 (55,7%)	222 (45,7%)	
Altemeier 2	41 (24,1%)	100 (31,6%)	141 (29,0%)	
Altemeier 3	18 (10,6%)	26 (8,2%)	44 (9,1%)	
Altemeier 4	65 (38,2%)	14 (4,4%)	79 (16,3%)	

[1]n (%)

[2]Chi-square test of independence; Fisher's exact test

Table IV: Distribution of cases according to analysis of factors linked to the nature of the surgical procedure

Variables	Number of employees[1]	cOR[2]	95% IC[2]	p	aOR[2]	95% IC[2]	p
Exploratory laparotomy							
No	30,4% (119/391)	-	-		-	-	
Yes	53,7% (51/95)	2,65	1,68 - 4,20	**<0,001**	5,58	3,12 - 10,2	**<0,001**
Adenomectomy							
No	32,3% (150/464)	-	-		-	-	
Yes	90,9% (20/22)	20,9	6,01 - 132	**<0,001**	44,4	12,1 - 287	**<0,001**
Cystostomies							
No	34,3% (165/481)	-	-		-	-	
Yes	100,0% (5/5)	NA	0.00 - NA	>0,9	NA	0.00 - NA	>0,9
Surgical trimming							
No	33,3% (153/459)	-	-		-	-	
Yes	63,0% (17/27)	3,4	1,54 - 7,87	**0,003**	7,54	3,21 - 18,6	**<0,001**
Appendectomy							
No	34,6% (160/462)	-	-		-	-	
Yes	41,7% (10/24)	1,35	0,57 - 3,08	0,5	0,65	0,24 - 1,73	0,4
Hernia repair							
No	42,3% (163/385)	-	-		-	-	
Yes	6,9% (7/101)	0,1	0,04 - 0,21	**<0,001**	0,34	0,13 - 0,75	**0,013**
Skin grafting							
No	34,2% (163/477)	-	-		-	-	
Yes	77,8% (7/9)	6,74	1,61 - 45,6	**0,018**	16,4	3,72 - 114	**<0,001**
Osteosynthesis							
No	33,2% (149/449)	-	-		-	-	
Yes	56,8% (21/37)	2,64	1,34 - 5,29	**0,005**	5,82	2,76 - 12,6	**<0,001**
Amputation							
No	34,0% (160/470)	-	-		-	-	
Yes	62,5% (10/16)	3,23	1,18 - 9,64	**0,026**	7,4	2,56 - 23,2	**<0,001**
[1]% (n/N)							
[2]cOR = crudde odds ratio; aOR = adjusted odds ratio, CI = confidence interval							

Table V: Distribution of cases according to Altemeier's analysis of factors linked to types of surgery

Variables	Number of employees[1]	cOR[2]	95% CI	p	aOR[2]	95% CI	p
Type of surgery							
Altemeier 1	20,7% (46/222)	-	-		-	-	
Altemeier 2	29,1% (41/141)	1,57	0,96 - 2,55	0,070	1,57	0,96 - 2,55	0,070
Altemeier 3	40,9% (18/44)	2,65	1,32 - 5,23	**0,005**	2,65	1,32 - 5,23	**0,005**
Altemeier 4	82,3% (65/79)	17,8	9,41 - 35,6	**<0,001**	17,8	9,41 - 35,6	**<0,001**

[1]% (n/N)

[2] cOR = crudde odds ratio; aOR = adjusted odds ratio; CI = confidence interval

DISCUSSION

1. Epidemiological Data

In our series, we found a POC rate of 35.0%. This rate is close to that of Augustin Kibonge in Lubumbashi, DRC, who found 32.2%; and much higher than that found by Tonye in Cameroon, which was 14.3% [2-8]. This high rate could be explained by our large sample size. The mean age was 41.5 years, with a standard deviation of 24.2 years, and the majority were male (74.1%) or married (56.5%). Our results are like those of Guy Astride, who found that the mean age of patients was 37.6 ± 13 years and 66.7% were male [11]. In most African societies, as in our own, the most active population is essentially made up of young adult males, which could explain their predominance in the occurrence of diseases in general, and postoperative complications in particular.

2. Clinical Data

The majority of OPC cases (52.9%) were admitted by emergency departments. These results are like those of Ahmedou Moulaye Idriss, who found that 51.2% of cases were admitted by emergency departments; they are lower than those of Coulibaly Y, whose study found that 65% of patients were admitted by emergency departments [1-12]. This difference can be explained by the fact that Coulibaly worked in paediatric surgery, and since children are very fragile, parents usually bring them directly to emergency in the event of a health problem. In our study, most of the pathologies found were surgical emergencies, which could explain most emergency admissions. The most prevalent medical histories were hypertension, gastritis and diabetes with 9.1%, 8.0% and 4.5% of cases respectively, and surgical histories such as hernia repair and appendectomy were more prevalent with 5.1% and 4.9% respectively. In his study, Ndayisaba G found undernutrition, HIV, diabetes and obesity. Catherine Saleh Ugumba found arterial hypertension, diabetes, haemorrhagic diathesis, HIV/AIDS and cancer in 46.43% of cases. The above-mentioned authors were not interested in surgical history [13, 14]. Benign prostatic hypertrophy and ileal perforation were the most frequent intraoperative diagnoses in general and visceral surgery, with 12.4% and 4.1% respectively. Fractures of two leg bones were more frequent in orthopaedic trauma, at 5.9%. Our results differ from those of Guy astride Bang, who found gastric perforation, simple acute catarrhal appendicitis, intestinal occlusion due to tumour and ileal perforation respectively, although he did not work simultaneously in orthopaedic trauma surgery [11]. Adamou Harissou *et al*., in their study on Diagnostic delay and prognostic implication in an African setting; Case of digestive surgery emergencies at the national hospital in Zinder, Niger, found ileal perforation, appendicular perforation and strangulated hernias [15]. This difference can be explained by the fact that the latter only worked in digestive surgery. Gogoua RD, in his study of early orthopaedic trauma revision at the Treichville-Abidjan University Hospital, found that the initial lesions were varied and dominated by open fractures [16]. Our results could be explained by the fact that the above-mentioned pathologies are more frequent in our environment and were much more precursors of post-operative complications on the one hand, but also by the fact that the CUKIS is a tertiary care structure full of the most qualified visceral and orthopaedic surgeons in our environment, which would motivate most patients to consult it in the event of the above-mentioned pathologies. Exploratory laparotomy was the surgical procedure most frequently performed in general and visceral surgery (30.0%), followed by adenomectomy (11.8%), and osteosynthesis was most frequently performed in orthopaedic trauma (12.4%), followed by amputation (5.9%). Guy Astrid Bang's study found laparotomy for resection/anastomosis, perforation suture, adhesiolysis, etc., followed by appendectomy. Tonye found caesarean sections: 159 cases (60%); salpingectomies, herniorrhaphies and appendectomies [2-11]. This could be explained by the fact that Tonye had also worked in obstetrics and gynaecology. Our results can be explained by the fact that the diagnoses most frequently found in our series were benign prostatic hypertrophy, ileal perforation and fracture of two leg, which are the indications for the above-mentioned operations. General anaesthesia was used most frequently. (92.4%) The fact that general anaesthesia was used in many cases of surgery in the Department of Surgery at University Clinics of Kisangani can be explained by the fact that the University Clinics of Kisangani have neither an organised anaesthesia and intensive care service nor qualified staff in this field. In addition, material unavailability may also explain the predominance of general anaesthesia, but also, most surgical operations in our series required general anaesthesia. The types of surgery according to Altemeier 4 were more prevalent in patients with CPO. Our results differ from those of Gaudeuille A. who found that majority of surgical procedures (223/612), i.e. 36.43%, were classified as Altemeier 1 [10]. Our results can be explained by the fact that in our series, most of the intraoperative diagnoses are indications for Altemeir 4 surgery, as in the case of ileal perforation, for example. Surgical site infection was the most frequent CPO in 45.3% of cases. Our results concur with those of Ndour O. who found that surgical site infection was the most frequent CPO with 64.1% [17].

This result can be explained by the fact that in countries with limited resources such as ours, the poor state of hospital infrastructures and equipment, the insufficient supply and unreliable quality of medicines, shortcomings in administrative management and infection control efforts, and chronic under-funding are all factors that explain the high frequency of surgical site infections.

3. Peroperatory Factors Associated with Cpo

In bivariate analysis, benign prostatic hypertrophy, ileal perforation, open fracture of two leg bones, exploratory laparotomy, adenomectomy, surgical trimming, skin grafting, cystostomy, osteosynthesis, amputation, and types of surgery according to Altemeier 3 and 4 were significantly associated with the occurrence of postoperative complications.

In multivariate analysis, only fracture of two leg bones, exploratory laparotomy, adenomectomy, surgical trimming, skin grafting, osteosynthesis, amputation, and types of surgery according to Altemeier 3 and 4 were considered significant risk factors.

Guy Aristide Bang in his series, found a duration of intervention greater than 2h and dirty surgery according to Altemeier; Tonye had found, a duration of intervention >2h, classes 3 and 4 of Altemeier, the score of NNISS ≥ 2 [2-11].

Toure L. found the type of surgery and the NNIS score, and Coulibaly, the type of surgery. None of these authors mentioned intraoperative diagnosis or type of surgery [1-18]. In our series, we did not report the duration of surgery because it was not mentioned in the operating protocols and the NNISS score, which also considers the duration of surgery outside the ASA classes and the types of surgery according to Altemeier.

CONCLUSION

POC remains a major problem in surgery, despite the use of increasingly effective and less invasive techniques to reduce postoperative morbidity. This study revealed that the intraoperative factors associated with the occurrence of OPC were: intraoperative diagnoses such as benign prostatic hypertrophy, ileal perforation and open fracture of two leg bones; surgical procedures such as exploratory laparotomy, adenomectomy, surgical trimming, skin grafting, cystostomy, osteosynthesis and amputation; and types of surgery according to Altemeier 3 and 4. However, only the fracture of two leg bones, exploratory laparotomy, adenomectomy, surgical trimming, skin grafting, osteosynthesis, amputation, and the types of surgery according to Altemeier 3 and 4, were singled out as factors that increased the risk of the occurrence of CPO intraoperatively. Knowledge of these factors can help practitioners to take useful measures before each operation on a patient with these factors, with a view to preventing or managing OPC.

Authors' Contributions

- Felly Kanyinda Ciamala MD: Substantial contribution to design and configuration, data acquisition, data analysis and interpretation.
- Ralph Munsense Tshiyombo MD: Revision and participation in the final approval of the version to be published.
- Asaph Bwini Dianaben MD: Review and participation in the final approval of the version to be published.
- Tom Wami Tomo MD: review and participation in the final approval of the version to be published.
- Péricles Lokangu Kalokola MD: Revision and participation in the final approval of the version to be published
- Pascal Kayembe Shambuyi MD: Revision and participation in the final approval of the version to be published
- Roger Amisi Kitoko MD PhD: Revision and participation in the final approval of the version to be published.
- Freddy Wami W'Ifongo MD PhD: Revision and participation in the final approval of the version to be published.

Conflict of Interest: The authors declare no conflict of interest in relation to this article.

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