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Pre-Operative Factors Associated with Early Post-Operative Complications at the Kisangani University Clinics in the Democratic Republic of the Congo

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Abstract

Background and Objectives: Post-operative complications (POC) are new pathological phenomena occurring in the post-operative period and worsening the previous situation through their morbidity and mortality. Our aim was to determine the prevalence and preoperative factors associated with early POC at University Clinics of Kisangani (CUKIS). **Methods:** This was a cross-sectional study conducted 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 factors predicting early postoperative complications. **Results:** The prevalence of early POC was estimated at 35%, with surgical site infection the most frequent POC at 45.3%. After multivariate analysis using logistic regression, the social category of widow(er)s, transfer, previous laparotomy, acute generalised peritonitis, preoperative length of stay of more than 10 days and ASA score 2 and 5 were significant risk factors associated with the occurrence of POC in the preoperative period. **Conclusion:** Certain factors can predict the occurrence of POC. Knowledge of these factors can help practitioners to take useful measures before each surgical operation on a patient with these factors, with a view to preventing or managing POC.

Keywords

Early Postoperative Complications, Prevalence, Associated Factors

1. Introduction

Post-operative complications (POC) are new pathological phenomena occurring in the post-operative period and 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, POC remains a major problem in surgery [2].

In the USA, the incidence of POC is estimated at 30.3% according to a 2002 study by Healey [4].

In Africa, a 2015 study by Tonye in Cameroon of early postoperative complications in Yaoundé reported an overall rate of 14.3% [2].

In the Democratic Republic of Congo, a study carried out by Augustin Kimbonge in 2021 on early postoperative complications in digestive surgery in Lubumbashi reported a frequency of 32.2% [5].

In industrialised countries, where working conditions are favourable and human, material and infrastructural resources are available, there are nevertheless factors that are incriminated against in the occurrence of POC. These are related to patient characteristics [6].

In developing countries, numerous publications report that factors related to surgical procedure and the environment are the most incriminating factors 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] [2] [7] [8].

In Kisangani, the factors linked to the occurrence of POC 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 preoperative factors associated with early postoperative complications at University Clinics of Kisangani.

2. 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 complete post-operative follow-up, of whom 170 presented with early POC. The various surgical procedures performed were: general and visceral surgery (hernia repair, appendectomy, exploratory laparotomy,

surgical wound dressing, prostate adenomectomy, orchidopexy/orchidectomy, hydrocele repair, Kystectomy (Thyreoglossus), skin grafting, cystostomy, thyroidectomy, lumbotomy, mastectomy, flattening, fistulectomy, stone extraction and surgical tumour removal) and traumato-orthopaedics (osteosynthesis of fractures, amputation of various segments of the limbs, embarrure lifting, ballooning hips, ballooning shoulders, bloody reduction, arthrotomy and removal of orthopaedic devices). A total of 170 patients were included in our study. All patients who had undergone surgery during the study period, had presented with one or more clinically diagnosed POC, 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, preoperative diagnosis, preoperative length of stay, ASA score and type 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 managers 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.

3. Results

3.1. Epidemiological Data

Of the 1476 patients who underwent surgery during our study period, 486 received full post-operative follow-up. We identified 170 patients who presented with early post-operative 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 POC, with 28.2%. Most patients were male (74.1%) and married (56.5%).

3.2. Patient Clinical Data

The majority of POC cases (52.9%) were admitted via the emergency department. Arterial hypertension was the most frequent medical history (12.9%) and herniorrhaphy the most frequent surgical history (6.5%). Acute generalized peritonitis and benign prostatic hypertrophy were the most frequent preoperative diagnoses in general and visceral surgery, with 14.1% and 12.9%, respectively. Fractures were more

frequent in orthopaedic trauma, at 17.6%. The preoperative period was less than 10 days in most cases (66.5%). Most patients operated on were classified as ASA 1 (66.5%), and surgical site infection was the most frequent POC in 45.3% of cases.

3.3. Socio-Demographic Factors

In bivariate analysis, age ≥ 40 years, and the categories of married, widowed and divorced were significantly associated with the occurrence of POC (p = 0.001). In multivariate analysis, only the widowed category (aOR= 7.28 [1.49 - 54.5]) was considered a significant risk factor (Table 1) (Table 2).

Table 1. Distribution of cases according to sociodemographic factors.

Variables	COMPLICATIONS		Total (N = 486[1])	p-value[2]
	Yes (N = 170[1])	No (N = 316[1])		
AGE (years)				**<0.001**
<20	36 (21.2%)	68 (21.5%)	104 (21.4%)	
20 - 39	46 (27.1%)	170 (53.8%)	216 (44.4%)	
40 - 59	35 (20.6%)	46 (14.6%)	81 (16.7%)	
60 - 79	48 (28.2%)	30 (9.5%)	78 (16.0%)	
≥80	5 (2.9%)	2 (0.6%)	7 (1.4%)	
SEX				0.2
Male	126 (74.1%)	218 (69.0%)	344 (70.8%)	
Female	44 (25.9%)	98 (31.0%)	142 (29.2%)	
MARITAL STATUS				**<0.001**
Married	96 (56.5%)	124 (39.2%)	220 (45.3%)	
Single	62 (36.5%)	190 (60.1%)	252 (51.9%)	
Widower	10 (5.9%)	2 (0.6%)	12 (2.5%)	
Divorcee	2 (1.2%)	0 (0.0%)	2 (0.4%)	

[1]n (%). [2]Fisher's exact test; chi-square test of independence.

Table 2. Distribution of cases according to the analysis of sociodemographic factors.

Variables	Staff[1]	cOR[2]	95% CI	p	aOR[2]	95% CI	p
Age							
<20	34.6% (36/104)	—	—		—	—	
20 - 39	21.3% (46/216)	0.51	0.30 - 0.86	**0.011**	0.42	0.23 - 0.73	**0.003**
40 - 59	43.2% (35/81)	1.44	0.79 - 2.62	0.2	0.76	0.32 - 1.81	0.5
60 - 79	61.5% (48/78)	3.02	1.65 - 5.61	**<0.001**	1.50	0.62 - 3.65	0.4
≥80	71.4% (5/7)	4.72	0.97 - 34.1	0.072	1.61	0.25 - 13.5	0.6
Civil status							
Single	24.6% (62/252)	—	—		—	—	

Continued

Mary	43.6% (96/220)	2.37	1.61 - 3.52	**<0.001**	1.82	0.95 - 3.46	0.067
Divorced	100.0% (2/2)	AND	0.00 - NA	>0.9	AND	0.00 - NA	>0.9
Widower	83.3% (10/12)	15.3	3.91 - 101	**<0.001**	7.28	1.49 - 54.5	**0.024**

[1]% (n/N). [2]cOR = crudde odds ratio; aOR = ajusted odds ratio; CI = confidence interval.

3.4. Clinical Factors

In bivariate analysis, emergency and transfer were significantly associated with the occurrence of POC (p = 0.001) (Table 3). Arterial hypertension, diabetes and STIs were the medical antecedents significantly associated with the occurrence of POC and laparotomy was the surgical antecedent significantly associated with the occurrence of POC. Acute generalized peritonitis, benign prostatic hypertrophy and diabetic foot were preoperative diagnoses significantly associated with the occurrence of POC in general and visceral surgery, and fracture was in trauma orthopaedics. Preoperative stay ≥ 10 days and ASA scores 2 to 5 were significantly associated with the occurrence of POC (Table 4).

In multivariate analysis, emergency (aOR = 3.55; [95% CI = 2.32 - 5.5]); transfer (aOR = 5.79; [95% CI = 3.19 - 10.7]); previous laparotomy: (aOR = 9.42; [95% CI = 2.43 - 62.0]); acute generalized peritonitis as a preoperative diagnosis: (OR = 4.95; [95% CI at 95% = 1.81 - 17.4]); preoperative length of stay of more than 10 days and ASA 2 (aOR = 1.68; [CI at 95% = 1.02 - 2.77]) and ASA 5 (aOR = 5.44; [CI at 95% = 1.15 - 38.4]) scores were considered significant risk factors (Table 5 and Table 6).

Table 3. Distribution of cases according to the mode of admission of patients.

Variables	COMPLICATIONS		Total (N = 486[1])	p-value[2]
	Yes (N = 170[1])	No (N = 316[1])		
Admission mode				**<0.001**
Emergency	90 (52.9%)	106 (33.5%)	196 (40.3%)	
External consultation	44 (25.9%)	184 (58.2%)	228 (46.9%)	
Transfer	36 (21.2%)	26 (8.2%)	62 (12.8%)	

[1]n (%). [2]chi-square test of independence.

Table 4. Distribution of cases according to the analysis of factors linked to the mode of admission.

Variables	cOR[2]	95% CI	p	aOR[2]	95% CI	p
Admission mode						
External consultation		—		—	—	
Emergency	3.55	2.32 - 5.51	**<0.001**	3.55	2.32 - 5.51	**<0.001**
Transfer	5.79	3.19 - 10.7	**<0.001**	5.79	3.19 - 10.7	**<0.001**

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

Table 5. Distribution of cases according to ASA score and preoperative stay.

Variables	COMPLICATIONS		Total (N = 486[1])	p-value[2]
	Yes (N = 170[1])	No (N = 316[1])		
Patient Types				**0.036**
ASA1	113 (66.5%)	246 (77.8%)	359 (73.9%)	
ASA2	34 (20.0%)	44 (13.9%)	78 (16.0%)	
ASA3	12 (7.1%)	14 (4.4%)	26 (5.3%)	
ASA4	6 (3.5%)	10 (3.2%)	16 (3.3%)	
ASA5	5 (2.9%)	2 (0.6%)	7 (1.4%)	
Preoperative stay (days)				**<0.001**
<10	113 (66.5%)	294 (93.0%)	407 (83.7%)	
10 - 19	27 (15.9%)	16 (5.1%)	43 (8.8%)	
20 - 29	16 (9.4%)	4 (1.3%)	20 (4.1%)	
30 - 39	4 (2.4%)	0 (0.0%)	4 (0.8%)	
≥40	10 (5.9%)	2 (0.6%)	12 (2.5%)	

[1]n (%). [2]chi-square test of independence; Fisher's exact test.

Table 6. Analysis of factors related to the ASA score and preoperative stay.

Variables	Staff[1]	cOR[2]	95% CI	p	aOR[2]	95% CI	p
Type of patient							
ASA1	31.5% (113/359)	—	—		—	—	
ASA2	43.6% (34/78)	1.68	1.02 - 2.77	**0.041**	1.68	1.02 - 2.77	**0.041**
ASA3	46.2% (12/26)	1.87	0.82 - 4.17	0.13	1.87	0.82 - 4.17	0.13
ASA4	37.5% (6/16)	1.31	0.44 - 3.61	0.6	1.31	0.44 - 3.61	0.6
ASA5	71.4% (5/7)	5.44	1.15 - 38.4	**0.045**	5.44	1.15 - 38.4	**0.045**
Pre-operational stay							
<10	27.8% (113/407)	—	—		—	—	
10 - 19	62.8% (27/43)	4.39	2.30 - 8.62	**<0.001**	4.39	2.30 - 8.62	**<0.001**
20 - 29	80.0% (16/20)	10.4	3.72 - 36.9	**<0.001**	10.4	3.72 - 36.9	**<0.001**
30 - 39	100.0% (4/4)	NA	0.00 - NA	>0.9	NA	0.00 - NA	>0.9
≥40	83.3% (10/12)	13.0	3.36 - 85.5	**0.001**	13.0	3.36 - 85.5	**0.001**

[1]% (n/N). [2]cOR = crudde odds ratio; aOR = ajusted odds ratio; CI = confidence interval.

4. Discussion

4.1. Epidemiological Data

In our series, we found a POC rate of 35.0%. This rate is close to that of Augustin Kimbonge in Lubumbashi in the DRC, who found 32.2%; and much higher than

that found by Tonye in Cameroon, which was 14.3% [2] [5]. 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 [8]. In most African societies, as in our own, the most active population is made up of young adult males, which could explain their exposure to disease in general, and to postoperative complications in particular.

4.2. Patient Clinical Data

The majority of POC 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; our results are lower than those of Coulibaly Y, who found in his study that 65% of patients were admitted by emergency departments [1] [9]. 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. Acute generalized peritonitis, benign prostatic hypertrophy and traumato-orthopaedic fractures were more frequent. Augustin Kimbonge found acute generalized peritonitis followed by acute intestinal obstruction to be the most frequent surgical indications, which could be explained by the fact that he had only worked in digestive surgery [5]. Gogoua RD, in his study of early revision operations in orthopaedic traumatology at the Treichville-Abidjan University Hospital, found that the initial lesions were varied and dominated by open fractures [10]. Our results could be explained by the fact that the above-mentioned pathologies are more frequent in our environment on the one hand, but also by the fact that the CUKIS is a tertiary care structure with the most qualified digestive and orthopaedic surgeons in our environment, which would motivate most patients to consult it in the event of the above-mentioned pathologies. The time between hospitalization and surgery was less than 10 days in most cases, *i.e.* 66.5%; our results are close to those of Coulibally, who found that the average hospital stay was 4.3 days ± 3.12; Ndayisaba found an average of 5 days [1] [11]. Our results can be explained by the fact that, in our study, most of our patients were seen as emergencies, which accelerated their treatment in a brief time.

Many patients were classified ASA 1 in 66.5%; surgical site infection was the most frequent POC with 45.3% followed by anaemia with 24.7%. Our results concur with those of Ndour O. who found that most patients were classified as ASA1 and surgical site infection was the most frequent POC with 64.1% [12].

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.

4.3. Socio-Demographic Factors

In our series, age ≥ 40 years, and the categories of married, widowed and divorced were significantly associated with the occurrence of POC (p = 0.001). In multivariate analysis, only the widow/widower category: OR = 7.28 [1.49 - 54.5] was considered a significant risk factor (p = 0.024); our results are like those of Guy Aristide BANG who found that the age bracket > 65 years was associated with the occurrence of POC. In his series, he made no mention of patients' marital status, and the association of the married, widowed and divorced categories with the occurrence of POC could be explained by the fact that these categories are made up mainly of elderly subjects with several comorbidities, compared with single subjects who are mostly young and generally without comorbidities [13].

4.4. Clinical Factors

Emergency and transfer were significantly associated with the occurrence of POC in our series, while Tonye and Coulibaly found that the mode of emergency admission was associated with POC [1] [2].

This result could be explained by the fact that in our environment, most patients pass through houses of prayer and/or marabouts, in peripheral health centres before arriving at the CUKIS in a very advanced state of illness.

Hypertension, diabetes and STIs were the medical histories associated with the occurrence of POC. Hongming Cui, in her series, also found cardiovascular disease and diabetes among the factors associated with POC [14].

Hypertension and diabetes are co-morbidities that often make the body fragile and vulnerable to developing many post-operative complications.

Acute generalised peritonitis as a pre-operative diagnosis was significantly associated with POC in our series. Guy Astride Bang and Tounkara Cheickna had also found in their series that acute generalised peritonitis was associated with POC [8] [13].

Acute generalised peritonitis is a condition that carries inherent risks of complications, such as infection of the surgical site following surgery, which is dirty, according to Altemeier.

A preoperative stay of ≥10 days was associated with the occurrence of POC in our series, which is in line with Tonye's finding that a preoperative hospital stay of more than 7 days was associated with the occurrence of POC. Coulibaly Y in his series also found that the risk of POC increased when the preoperative hospital stay exceeded 7 days [1] [2].

According to Cruse PJE, the pre-operative length of stay should be as short as possible. There is a direct relationship between the length of hospital stay prior to the operation and the risk of infection, since the infection rate after "clean" surgery rises from 1.2% when the operation is performed on the day of admission to

2.1% after one week's hospital stay and 3.4% after more than two weeks' hospital stay. This phenomenon can be observed regardless of the hospital where the patient is admitted for pre-operative care and may be explained by the fact that the microbial flora of the skin is modified [15].

ASA scores of 2 to 5 were significantly associated with the occurrence of POC. Our results are like those of Bouafia Nabiha who found in her series that moderate or severe comorbidity was associated with POC [16]. At the same time, Tonye and Guy Astrid found ASA class 3 to be potentially associated with POC.

It is well known that ASA scores 2 to 5 are characterised by the presence of various co-morbidities, making the body fragile and vulnerable to post-operative complications.

5. 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 preoperative factors associated with the occurrence of POC are age ≥ 40 years; married, widowed and divorced categories; emergency and transfer; antecedents such as arterial hypertension, diabetes, STIs and laparotomy; preoperative diagnoses such as acute generalised peritonitis, benign prostatic hypertrophy, diabetic foot and fracture; preoperative stay ≥ 10 days and ASA score 2 to 5. However, only widowhood, emergency, transfer, previous laparotomy, preoperative diagnosis of acute generalised peritonitis, preoperative stay of more than 10 days and ASA 5 score were found to increase the risk of POC. Knowledge of these factors can help practitioners to take useful steps before each operation on a patient with these conditions, with a view to preventing or managing POC.

Authors' Contributions

- Kanyinda Ciamala F. MD: substantial contribution to design and configuration, data acquisition, data analysis and interpretation.
- Bwini Dianaben A. MD: revision and participation in the final approval of the version to be published.
- Kayembe Shambuyi P. MD: revision and participation in the final approval of the version to be published.
- Wami Tomo T. MD: review and participation in the final approval of the version to be published.
- Lokangu Kalokola P. MD: revision and participation in the final approval of the version to be published.
- Lukwamirwe Vahamwiti A. MD: revision and participation in the final approval of the version to be published.
- Amisi Kitoko R. MD PhD: review and participation in the final approval of the version to be published.
- Wami W'Ifongo F. MD PhD: revision and participation in the final approval of the version to be published.

Conflicts of Interest

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

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