Prevalence of Comorbid Diseases and Impact on Anaesthesia Outcomes in a Nigerian Tertiary Hospital

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Abstract

Background: The risk associated with anaesthesia increases when surgical patients present with diseases other than the one for which surgery is intended. The anaesthetist is tasked with managing comorbidities in the perioperative period. This observational, cohort study aims to identify perioperative comorbidities, determine their prevalence and the impact they have on anaesthesia outcome.

Methodology: This observational cohort study was carried out at the University of Ilorin Teaching Hospital, and 215 patients presenting for elective surgery were interviewed preoperatively and their records reviewed using a checklist. Subsequently, they were followed up after surgery for twenty-four hours to retrieve intraoperative and postoperative details and also the outcome of surgery. The results from this study were expressed as frequencies or proportions of total, means and standard deviations. Associations were assessed using Student's t-test and analysis of variance (ANOVA) for comparisons of means, while the chi-square test was used for categorical variables. Statistical significance was set at $p < 0.05$, corresponding to a 95% confidence level.

Results: Of the patients enrolled in the study, 68 had at least one comorbid condition, yielding a comorbidity prevalence of 31.63%. Hypertension was the most frequent, with 52 (76.47%) patients, followed by obesity in 21 (30.88%) and diabetes mellitus in 9 (13.24%) patients. The mean duration of comorbidities was 7.91(6.78) years. Notably, patients with comorbidities had an increased rate of intraoperative complications and case cancellations (odds ratio 12.444, 95% CI 3.441 to 45.009 and P= 0.000).

Conclusion: Adult surgical patients scheduled for elective surgical procedures frequently have comorbidities resulting in increased perioperative complications and case cancellations.

Keywords: *Comorbidity, Anaesthesia Outcome, Intraoperative Complications, Case Cancellation*

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Introduction

Patient safety is a primary concern in anaesthesia practice, and with the increasing complexity of surgical procedures, the risk of possible complications has also escalated (1). This risk is further aggravated when surgical patients present with diseases different from the indication for surgery (2). The patients presenting for anaesthesia and surgery are in a spectrum from the physically fit and healthy to those with diverse types of intercurrent diseases, also called comorbidities. Comorbidities are coexisting diseases to an index pathology with direct impact on the prognosis or indirectly affect the choice of treatment of the index disease (3). While these diseases may be well controlled in some patients, others present with severe, uncontrolled forms of the disease. In this study, the indication for surgery was the index pathology. Studies done in the southern part of Nigeria have documented the

prevalence of comorbidities among preoperative patients to be between 19.60 and 27.30% (4,5). A study in Ethiopia reported that 12% of patients had a comorbid disease (6), while in the United States of America, 63% of surgical patients had comorbidities (7).

It is the responsibility of the anaesthetist to manage comorbidities in the perioperative period because when these diseases are not adequately controlled, they increase perioperative adverse events (4), length of hospital stay, post-operative morbidity (8) and mortality (2). Comorbidities may also alter the course of anaesthesia and result in case cancellation or delay (9). A study in Europe reported increased hospital costs, prolonged postoperative length of stay and increased postoperative complications among patients with multiple comorbidities (10).

Conversely, two other studies reported contrary findings (5,11). Failure of medical personnel to identify comorbidities during anaesthesia or during the preoperative evaluation resulted in increased length of hospital stay and mortality (12). The studies into preoperative comorbidities in Nigeria are few and focus mainly on patients in the southern part of the country. The question, " How do comorbidities impact anaesthesia care?" has not been adequately answered. Preoperative identification of patients with comorbidities would allow the appropriate deployment of human and infrastructural resources to ensure patient safety. This study aimed to determine the prevalence of comorbidities among surgical patients in a tertiary hospital in north-central Nigeria, while the objectives are to determine the specific type of comorbid diseases, the associated risk factors and the impact of comorbid diseases on case cancellation and surgical complications within the first twenty-four postoperative hours.

Materials and Methods

Study design

This was a hospital-based, observational, cohort study that prospectively followed up preoperative patients with comorbidities and compared them with controls without comorbidities from February 2024 to October 2024.

Study setting

The University of Ilorin Teaching Hospital is located in the middle-belt of Nigeria. This tertiary hospital does an average of one thousand six hundred elective surgical procedures annually. Specifically, the study was conducted in the operating theatre, which consists of eight operating suites and the male and female surgical wards from where the patients were recruited before surgery and to which they recuperated after surgery.

Study variables

The primary variable was the prevalence of comorbid disease, while the secondary variables are surgical complications, case cancellations and disease risk factors.

Study population

The study population was all adult surgical patients in the North-Central zone of Nigeria, but the accessible population were consenting adult patients scheduled for elective surgical procedures using general anaesthesia at the University of Ilorin Teaching Hospital, Ilorin. The surgical procedures included general surgery, orthopaedic surgery, plastic surgery and urology. Only patients who provided written informed consent were recruited into the study. Paediatric patients, day care surgery and patients with communication challenges resulting from a language barrier were excluded. The controls were the study participants who had no history of comorbidities and had not been diagnosed with comorbidities after surgical review and investigations, meeting the inclusion criteria.

Sample size

The sample size was calculated using Fisher's formula ($n= Z2pq/d^2$) (14) as follows:

n= the desired sample size when the population is greater than 10,000

z= the standard normal deviate, usually set at 1.96, which corresponds to the 95% confidence interval

p=the proportion in the target population estimated to have a particular characteristic, which was 19.60% (4)

q=1.0 -p

d= The degree of accuracy desired was set at 0.05.

Therefore, the desired sample size was calculated as follows:

$n= 1.96^2 \times (0.196 \times [1-0.196])/0.05^2$

$= 242.15$

Since the population was less than 10,000, the following formula was applied:

$nf = n / \{1 + (n/N)\}$

Where:

nf = the desired sample size when the population is less than 10,000

n = the desired sample size when the population is greater than 10,000.

N = the estimate of the population size. Total number of surgical procedures done at UITH for the year 2023 was 1005,

$nf = 242.15 / \{1+(242.15/1005)\} = 195.13$

Considering an attrition factor of 10% = 19.51

The sample size needed was = 214.64. Therefore, the number of patients required for this study was 215.

Data collection

The participants were visited on the night before surgery after preoperative assessment had been conducted by the responsible anaesthetist. With the aid of a questionnaire developed by the authors, data were collected and documented. Demographic data such as the patients' age, weight, height, body mass index and gender were recorded. Also noted were the proposed surgery, presence of known risk factors that drive the development of comorbidities like physical inactivity, cigarette smoking, elevated blood sugar, elevated lipids and the presence of a family history of comorbid diseases. The specific comorbidities such as diabetes mellitus, hypertension, ischaemic heart disease, asthma and thyroid disease were documented, as well as the length of time living with a comorbid condition.

On the day of surgery, patients whose surgical procedures were cancelled on account of poorly controlled comorbidities were noted. For patients whose surgical procedures were done, intraoperative complications were documented, and the patients were monitored for two hours in the Post-Anaesthesia Care Unit for postoperative complications to determine the outcome of surgery. They were subsequently transferred to the surgical ward for further monitoring.

Methods to minimise bias/errors

To ensure reliability and validity and prevent measurement errors, a pilot test was carried out to identify potential challenges with the use of the questionnaire. The pilot test was carried out in the surgical ward and operating theatre on twenty adult patients scheduled for elective surgical procedures. The Cronbach's alpha was 0.8. Pilot test participants were not subsequently included in the research. Necessary adjustments were subsequently made to the questionnaire before commencement of the study. Furthermore, measurement errors were addressed by ensuring that the anaesthesia residents who collected the data had been specifically trained in the use of the questionnaire. Recall bias was addressed by confirming information provided by patients with documented records retrieved from patients' hospital files.

Data analysis

Data from this study were summarised and expressed as means, standard deviation, frequencies or proportions of the total. Categorical variables like gender and outcome of surgery were analysed using the chi-square test, while quantitative variables like duration of comorbidity and body mass index were analysed using Student's t-test and ANOVA. The association between exposure to comorbidities and perioperative complications was presented as

odds ratios. The computer software package was SPSS version 21.0. A p-value of less < 0.05 at 95% CI was considered statistically significant.

Ethical considerations

Approval was obtained from the University of Ilorin Teaching Hospital Ethical Review Board (PAN/2024/05/0501). Permission to access the patients in the surgical wards was obtained from the hospital management. Also, in accordance with the Declaration of Helsinki written informed consent, signed and dated, was obtained from all patients after the investigator explained the procedure to them (13).

All information obtained from the patients was treated with strict confidentiality, and anonymity.

Results

Patient demographic data

Of all patients enrolled, there were more females, 147 (68.37%), than males, 68 (31.63%). The mean age of the participants was 43.5 years with a standard deviation of 15.38. The males had a slightly higher mean age, 45.2 years (S.D 17.8), than the females, 42.7 years (S.D 14.1). The recruited patients were planned for various surgical procedures in diverse specialities. There were 62 gynaecological, 57 general surgical, 35 orthopaedic, 24 urologic, 11 neurosurgical and 26 procedures from other surgical specialities.

Risk factors

The most frequent risk factor was genetic predisposition in 19 (27.94%) patients. Male gender was a risk factor in 17 (25.00%) patients. There were three (4.41%) patients with a history of smoking cigarettes; one of them was a current smoker. Two (2.94%) of the respondents reported that they lived a stressful life with minimal rest, while another 2 (2.94%) admitted that their diet was unhealthy. One (1.47%) respondent had elevated blood lipids, while no respondent reported a lifestyle of physical inactivity.

Presence of comorbid disease

The prevalence rate of comorbid disease was 31.63% (68/215). The majority of the patients with comorbidities (49, 72.06%) presented with one comorbidity, 14 (20.59%) presented with two comorbidities and five patients (7.35%) presented with three comorbidities.

The respondents with comorbidities had a significantly higher mean age of 53.19 (12.72) years than those without comorbidities, 38.95 (14.38) years (p=0.00001, t-test). There was no significant difference in gender distribution between the two groups of patients, with 17 (25.00%) males and 51 (75.00%) females among patients with comorbidities and 51 (34.69%) males and 96 (65.31%) females in those without comorbidities (p = 0.155, chi-square). However, the mean BMI was significantly higher in the group with comorbidities (p = 0.00001, t-test).

Multiple linear regression analysis was used to test if gender, age and number of risk factors predicted the presence of comorbidities. The overall regression was statistically significant ($R^2 = 0.33$, F = 33.93, p = 6.13E-18). Age and the number of risk factors significantly predicted the presence of comorbidities (β = 0.008, 0.33 and p = 1.68E-05, 3.49E-11, respectively).

Table 1
Multivariate Analysis of the Presence of Comorbidities

	Coefficients	Std Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	-0.12886	0.093891	-1.37248	0.17137	-0.31395	0.056221	-0.31395	0.056221
Gender	0.031432	0.057785	0.543956	0.587046	-0.08248	0.145342	-0.08248	0.145342
Age	0.008179	0.001857	4.40562	1.68E-05	0.00452	0.011839	0.00452	0.011839
No. of risk factors	0.331689	0.047432	6.992972	3.49E-11	0.238188	0.42519	0.238188	0.42519

However, gender did not significantly predict the presence of comorbidities with β = 0.03 and p = 0.59. Table 1.

Specific comorbidity

Among the 68 patients with comorbidities, hypertension was the most frequent, 52 (76.47%), followed by obesity, 21 (30.88%) and diabetes mellitus, 9 (13.24%). Other comorbidities like thyroid disease, allergies, renal disease, jaundice and asthma occurred in 2 patients each, while shortness of breath, sickle cell disease and HIV/AIDS were found in one patient each.

Duration of comorbidity

Comorbidities were newly diagnosed in 14 patients (20.6%), while 54 patients (79.4%) had a prior diagnosis. Among patients with a previous diagnosis of comorbidities, 26 (48.15%) had lived with the comorbidity for less than five years, 42 patients (77.78%) had lived with the comorbidity for less than 10 years. The mean duration of comorbidities was 7.91(6.78) years (Fig 1).

Outcome of surgery

The majority of the patients, 198 (92.09%), did not have complications or case cancellations. Of the 68 patients with comorbidities, 14 (20.59%) patients had complications or case cancellations, specifically, 10 had intraoperative complications, one had a postoperative complication, and three had their surgical procedures cancelled because of an uncontrolled underlying medical condition.

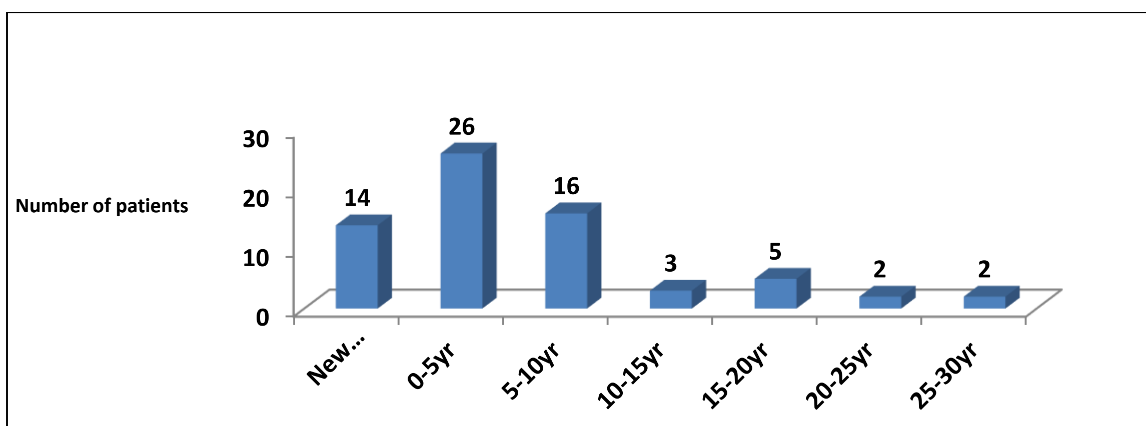

Figure 1
Duration of Comorbidities

Table 2
Outcome of Surgery and Perioperative Complications/Case Cancellation

		Perioperative complications Present	Perioperative complications Absent	Odds ratio	p-value
Comorbidity	Yes	14	54	12.444	0.000
	No	3	144		

Key: Odds ratio 12.444, 95% CI 3.441 to 45.009, z statistic 3.844, p = 0.000

Table 3
Number of Comorbidities and Outcome of Surgery

		Patients with 1 comorbidity	Patients with 2 comorbidities	Patients with 3 comorbidities	Chi-square test	p-value
Outcome	No complications	37	9	1	11.962	0.002
	Complications/ Case cancellation	6	5	4		

However, among the 147 without comorbidities, 3 (2.04%) had complications and case cancellations (Table 2). Intraoperative complications and case cancellations are more frequent among patients with comorbidities than in those without comorbidities, with an odds ratio of 12.444, 95% CI 3.441 to 45.009, z statistic 3.844 and p-value of 0.000. There was a statistically significant association between the number of comorbidities and the incidence of perioperative complications and case cancellations, with a p value of 0.002 (Table 3). Intraoperative complications were more frequently found in the cardiovascular system, with blood pressure fluctuations (hypotension/hypertension) occurring in eight patients with comorbidities and in one patient in the group without comorbidities.

Multiple linear regression analysis was used to test if the presence of comorbidity, the number of comorbidities, gender and age predicted the outcome of surgery. The overall regression was statistically significant ($R2 = 0.22$, $F = 14.55$, $p = 1.65E-10$). The presence of comorbidity, gender and age did not significantly predict the outcome of surgery (β -0.09, -0.03, 0.00 and p = 0.21, 0.32 and 0.26, respectively). However, the number of comorbidities significantly predicted the outcome of surgery with β = 0.20 and p = 1.92E-05 (Table 4).

Discussion

In this study, the prevalence rate for comorbid disease was 31.63%. The patients with comorbidities had a significantly higher mean age, body mass index, increased case cancellations and intra- and postoperative complications.

The prevalence of comorbidities in surgical patients has been estimated by two previous studies to be 19.60% (4) and 27.30% (5). Our study found a prevalence of 31.63% among the preoperative surgical patients. It is conceivable that the prevalence rate from any study will depend on the medical disorders that are included in the comorbidities list, differences in patient demographics, the type of hospital, whether it is secondary or tertiary and the variety of surgeries performed in the facility. Therefore, the difference in prevalence rates may be expected. These prevalence rates highlight the importance of the preoperative assessment as an opportunity for anaesthetists to identify comorbidities in surgical patients. The knowledge of the presence of comorbidities before surgery allows the anaesthetist to take steps to control these diseases and institute appropriate intraoperative monitoring and care to adequately manage the diseases.

Hofer *et al* reported that failure to detect comorbidities documented in patients' records during preoperative assessments increased the length of hospital stay and mortality (12). The patients with comorbidities had a statistically significant increase in mean age compared to those without comorbidities. Also, multivariate regression analysis demonstrated that increasing age predicted the presence of comorbidities.

Table 4
Multivariate Analysis of Outcome of Surgery

	Coefficients	Std Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	-0.0264	0.052852	-0.49959	0.617889	-0.13059	0.077784	-0.13059	0.077784
Presence of comorbidity	-0.08885	0.070135	-1.26688	0.206602	-0.22711	0.049406	-0.22711	0.049406
No. of comorbidities	0.195089	0.044601	4.374096	1.92E-05	0.107166	0.283012	0.107166	0.283012
Gender	-0.03242	0.032796	-0.98854	0.324025	-0.09707	0.032231	-0.09707	0.032231
Age	0.001232	0.00108	1.141069	0.255141	-0.0009	0.003361	-0.0009	0.003361

This may be because the prevalence of non-communicable diseases like hypertension is higher with advancing age (15). Therefore, it is expected that with the higher age of surgical patients, the prevalence of comorbid diseases will increase. Studies by Wu *et al* and Edomwonyi *et al* had similar findings (2,4). Therefore, clinicians should expect to manage more comorbidities as the age of surgical patients increases. This is not just an intraoperative challenge, as increasing patient age could result in increased in-hospital mortality (16).

This study found that an increasing number of risk factors significantly predicted the presence of comorbid disease. Risk factors such as obesity, physical inactivity, cigarette smoking and unhealthy diet could increase the presence of non-communicable diseases (17). The most frequent risk factor in this study was hereditary. Hereditary factors are difficult to modify, but lifestyle modifications like a healthy diet, exercise and sufficient amounts of high-quality sleep have beneficial effects on the management of non-communicable diseases (18). As the impact of risk factors on the prevalence of non-communicable diseases became better understood, interventions to modify these risk factors have taken a prominent place in preventive and therapeutic attempts. Among surgical patients presenting for elective procedures, preoperative lifestyle modification in the form of prehabilitation interventions has been associated with a reduction in morbidity, length of hospital stay and improvement in quality of life (19).

This study did not find a gender difference in the prevalence of comorbidities. This is important as a previous study in surgical patients with comorbidities found males are more likely to die in the hospital (16). This study also found that patients with comorbidities were statistically more likely to have a higher Body Mass Index (BMI) than those who had no comorbidities. Non-communicable diseases are more frequent in people with a higher BMI. A higher BMI has also been associated with more postoperative complications after nephrectomy (8).

Hypertension was the most frequent comorbidity in our study, as was also reported in another study in southern Nigeria (4). However, while Diabetes Mellitus was the second most common in the study by Edomwonyi (4), obesity occupied that position in our study. This highlights the WHO projection that obesity as a healthcare challenge would increase in Nigeria (20).

Comorbidities were associated with a poorer outcome of surgery, with increased perioperative complications and case cancellations in the current study. From the multivariate analysis, an increasing number of comorbidities was predictive of a poorer outcome of surgery and not just the presence of comorbidities. Surgical procedures were cancelled to allow for better control of medical disorders that could have resulted in poor outcomes. Comorbidities may contribute to adverse outcomes after surgery, and they independently predicted the risk for mortality during hospital admission (16). Another study reported that surgical patients with comorbidities had poorer survival, longer operative time, greater length of hospital stay, and more postoperative complications (21). The most frequent intraoperative complication we found was blood pressure fluctuation. Cardiovascular complications such as hypertension 19.04%, bradycardia 19.04%, hypotension 14.29% and tachycardia 14.29% were also the most frequent intraoperative complications found by Edomwonyi (4).

Despite the fact that some studies have found an association between comorbidities and operative mortalities, another study found that the increase in major postoperative complications was not accompanied by a commensurate increase in mortality as the number of

comorbidities increased (2). Notably, no mortality was recorded in the current study. Similarly, Eyelade *et al* (5) also reported that despite the presence of intercurrent medical diseases, many surgical patients had an uneventful perioperative period. It may be that adequate preparation and management can prevent a fatal outcome from comorbidities in the perioperative period.

Study Limitations

The study relied in part on the self-report of patients to identify comorbidities. Patient self-report has been previously associated with recall bias. Attempts were made to mitigate this by retrieving information from hospital records where available. Moreover, the variety of surgical procedures patients were exposed to in this study could serve as a confounding factor.

Conclusion

We conclude that comorbidities are a frequent finding in surgical patients. They were more common in older patients. The most frequently observed comorbidities were hypertension, obesity and diabetes mellitus. These diseases impact the course of anaesthesia by increasing perioperative complications and the rate of case postponements.

Recommendations

We suggest the establishment of pre-anaesthesia clinics as a tool for better detection and control of comorbidities and the use of perioperative protocols to guide the management of specific comorbidities. To adequately assess the impact of comorbidities on anaesthesia outcomes, we recommend further studies with a longer follow-up period, a limited variety of surgical procedures, and possibly a larger sample size to more rigorously assess causal relationships.

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Author contribution

Olufemi Ige made significant contributions to the study's conceptualisation and design; data acquisition, analysis and interpretation. Joshua Oni, Olubukonla Oluwanaike and Lookman Lawal contributed to study design, data acquisition, analysis and interpretation. All authors participated in drafting, critical revision and approval of the final manuscript.

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