Scientific Research Publishing

Open Journal of Anesthesiology, 2024, 14, 93-107
https://www.scirp.org/journal/ojanes
ISSN Online: 2164-5558
ISSN Print: 2164-5531

Morbidity and Mortality during Anaesthesia in Patients with versus without Diabetes: Single-Centre Cohort Study

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How to cite this paper: Mukuna, N., Mbombo, W., Nsiala, J., Nkodila, A., Mosolo, A., Mbuyi, F., Kukila, J., Kambala, P., Kashala, R., Nsitwavibidila, C., Kobo, P., Kankonde, D., Likinda, G., Mubenga, J.C., Anga, K., Diyamona, L. and Barhayiga, B. (2024) Morbidity and Mortality during Anaesthesia in Patients with versus without Diabetes: Single-Centre Cohort Study. *Open Journal of Anesthesiology*, **14**, 93-107.
https://doi.org/10.4236/ojanes.2024.143007

Received: January 15, 2024
Accepted: March 24, 2024
Published: March 27, 2024

Abstract

Background and objective: Classically, diabetic subjects are at high risk of anaesthesia compared with general population. However, some recent publications have shown contrasting and sometimes contrary results. The aim of our study was to evaluate morbidity and mortality during and after anaesthesia in patients with versus without diabetes operated on at Monkole Hospital over the last ten years. **Methods:** Retrospective cohort study including all patients who underwent all-comers surgery excluding cardiac surgery between 2011 and 2021. Each diabetic patient was matched to 2 non-diabetic controls on age and sex. The evaluation criterion was the frequency of occurrence of at least one perioperative complication and/or death up to day 30. A multivariate analysis using a Cox model was used to determine the factors associated with the occurrence of this morbidity and mortality. The model was adjusted for comorbidities, preoperative hyperglycaemia, ASA score, type of anaesthesia and severity of surgery. **Results:** A total of 351 diabetic patients (mean age 53.3 ± 14.18 years) and 701 non-diabetic patients (mean age 53.52 ± 14.7 years) were included and analysed. Preoperatively, hyperglycaemia (blood glucose > 180 mg/dl) was observed in 24.3% of diabetic patients compared with 1.6% of non-diabetic patients. The incidence of overall perioperative complications was 25.6% in diabetic patients compared with 28.6% in non-diabetic

patients (p = 0.27). The risk factors associated with this morbidity were general anaesthesia with oro-tracheal intubation vs loco-regional anaesthesia (OR = 3.06 [95%CI: 1.91 - 4.94]; p < 0.001) and major vs minor surgery (OR =2.09 [95%CI: 1.19 - 3.69]; p = 0.01). Diabetic status was not identified as an independent risk factor (OR = 1.2 [95%CI: 0.73 - 1.99]; p = 0.148). Mortality was 2.3% in diabetic patients versus 3% in non-diabetic patients (p = 0.226). **Conclusion:** This study shows that there is not significant increase in perioperative morbidity and mortality in diabetic patients compared with non-diabetic ones of similar severity. These results suggest that diabetes itself (excluding associated comorbidities) has only a minor impact on perioperative morbidity and mortality.

Keywords

Anaesthesia, Diabetes, Morbidity, Mortality, Perioperative

1. Introduction

Diabetes is a public health problem whose incidence is rising steadily and could reach more than 5% of the world's population by 2030 [1]. The increase in the prevalence of diabetes is greatest in Africa: 143%. In the Democratic Republic of Congo (DRC), diabetics already account for almost 7% of the population, or 4,000,000 people [2]. It is therefore highly likely that a diabetic will benefit from anaesthesia, whether for general surgery or for surgery to treat the complications of his or her disease. Diabetes is also responsible for or associated with a large number of co-morbidities affecting major vital functions (coronary artery disease, renal insufficiency, neurovegetative dysautonomia, etc.), making anaesthetic management of these patients complex.

Diabetes has been identified in the past as an independent risk factor for adverse events following surgery. Morbidity (surgical site infection, heart attack, etc.) and mortality increase with every 1% rise in glycosylated haemoglobin, and ten times more when blood glucose levels exceed 2 g/l [3]. Frisch carried out a comparative study of diabetic and non-diabetic patients undergoing non-cardiac surgery and made the following observations: the overall 30-day mortality was 2.3% (72 of 3,112 patients), with a higher mortality (3.1%) observed in diabetic than in non-diabetic (2.1%) patients, but this difference did not reach statistical significance (p = 0.105). Compared with non-diabetic subjects, diabetic patients had a higher rate of complications including pneumonia (12.1% vs. 5.4%; p = 0.001), wound and skin infections (5% vs. 2.3%; p = 0.001), systemic blood infection (3.6% vs. 1.1%; p = 0.001), urinary tract infections (4.5% vs. 1.4%; p = 0.001), acute myocardial infarction (2.6% vs. 1.2%; p = 0.008), and acute renal failure (9.6% vs. 4.8%; p = 0.001). In addition, diabetic patients had higher length of stay and in intensive care unit length of stay than non-diabetic subjects (8.8 ± 0.6 vs 7 ± 10.8 days; p = 0.001 and 2.3 ± 6.2 vs 1.8 ± 6.5 days p = 0.01, respec-

tively) [4]. However, anaesthetic management practices for these patients have evolved considerably in recent years. Algorithms for better perioperative management of diabetic patients have been developed [5] [6]. The strategies for controlling blood glucose levels during the perioperative period have therefore received a great deal of attention in order to reduce perioperative complications [7] [8]. A study published very recently in JAMA Surgery (June 2022) even found, paradoxically, more perioperative complications in non-diabetic patients than in diabetic patients [9].

It is in this context that we sought to retrospectively evaluate in our practice the incidence of intra- and post-anaesthetic complications in patients with and without diabetes who had undergone surgery and anaesthetic management at Monkole Hospital over the last ten years. Our hypothesis is that there has been an improvement in the perioperative management of diabetes in parallel with advances in anaesthesia, which may have reduced the excess risk in diabetic patients compared with a population of non-diabetic patients of similar severity, particularly with regard to co-morbidities.

2. Methods

2.1. Type and Setting of the Study

We conducted a retrospective cohort study between 2011 and 2021 at the Monkole Hospital. This is a secondary-level non-university hospital on the outskirts of Kinshasa, the capital of the Democratic Republic of Congo. The hospital has 110 beds. It has all the basic services and an intensive care unit. Our study was approved by the ethical committee of the School of Public Health of the University of Kinshasa under the number ESP/CE/123/2022. The principles of confidentiality and anonymity were respected in accordance with the Helsinki Convention. We have no conflict of interest in this work.

2.2. Study Population

Our study was exhaustive. All adult patients who underwent surgery of any speciality except cardiac surgery at Monkole Hospital during the study period were included. Patients were considered diabetic if they declared a history of diabetes or the use of anti-diabetic medication. Each diabetic patient was matched to 2 non-diabetic controls on age and sex. The youngest diabetic patient was 20 years old, so the minimum age was set at 20.

2.3. Perioperative Blood Glucose Management and Anaesthetic Technique

Preoperatively, all oral antidiabetic drugs were administered until the evening before the operation, with the exception of metformin, which was stopped the day before the operation. Blood glucose levels were monitored systematically in diabetic patients and on a case-by-case basis in non-diabetic patients. In the event of hyperglycaemia, the patient was put on regular insulin subcutaneously

or sometimes intravenously, with the aim of achieving a blood glucose level of less than 180 mg/dl, without postponing the operation if this objective was not achieved. Intraoperatively, blood glucose was controlled by injections of regular insulin only in diabetic patients, and regular insulin was administered with the same blood glucose target. Post-operatively, insulin therapy was continued with the aim of achieving a blood glucose level of less than 160 mg/ml. The choice of anaesthetic technique (general or loco regional anaesthetic) is left to the doctor in charge of the patient and takes into account the patient's condition, preferences and contraindications, assessing the risk/benefit on a case-by-case basis.

2.4. Data Collection and Assessment Criteria

Data were extracted from a local register of patients operated on and managed under anaesthesia in this hospital. Perioperative complications were defined and reported according to the Standardized Endpoints for Perioperative Medicine (StEP) [10]. We looked for cardiovascular complications (arrhythmias, haemodynamic instability, acute pulmonary oedema (APO), myocardial infarction and cardiac arrest); neurological complications (delirium, convulsions, coma, stroke); respiratory complications (failed intubation, desaturation (saturation less than 90%), pneumopathy, pulmonary embolism, mechanical ventilation lasting more than 48 hours, reintubation or tracheotomy); renal (acute renal failure), metabolic (hyperglycaemia and hypoglycaemia); surgical (surgical site infection and/or sepsis, bleeding, repeat surgery) and other (allergy, postoperative nausea vomiting (PONV), chills, anaemia requiring transfusion). Hyperglycaemia was defined as a blood glucose level ≥ 180 mg/dl and hypoglycaemia as a blood glucose level < 60 mg/dl. The primary endpoint was the frequency of occurrence of at least one perioperative complication and/or death up to day 30.

2.5. Statistical Analysis

The sample size was calculated using Keyes formula. For an alpha risk of 0.05, a power of 80%, an expected proportion of diabetics of 20% and a minimum odds ratio to detect of 2.0, at least 143 patients had to be included in each group. Data were entered into an Excel file. They were checked and coded before being transferred to SPSS 26.0 for analysis. Patient characteristics were described using the mean with standard deviation for quantitative variables and proportions with 95% CI for qualitative variables. Quantitative variables were compared using Student's t-test and qualitative variables were compared using Chi-square test or Fischer's exact test where appropriate. Multivariate analysis using a Cox model was used to determine the factors associated with the occurrence of perioperative complications. The model was adjusted for comorbidities, preoperative hyperglycaemia, ASA score, type of anaesthesia and severity of surgery. The association between each factor and perioperative morbidity and mortality was estimated using odds ratios (ORa) and their 95% confidence intervals. For all tests,

the significance level was set at 5%.

3. Results

3.1. Patient Flow Diagram

Figure 1 shows the patient flow diagram.

During this period, 9708 patients underwent anaesthesia, including 351 diabetics and 9357 non-diabetics, giving an incidence of diabetes of 3.6%. As the youngest diabetic patient was 20 years old, we excluded all patients aged under 20, *i.e.* 2725 patients, and retained only 6632 non-diabetic patients aged at least 20. From these 6632 non-diabetic patients over 19 years old, we performed an age and sex matching with a ratio of 1 diabetic patient for 2 diabetic patients. Our final sample consisted of 1052 patients, including 701 non-diabetics and 351 diabetics, all aged over 19 years old.

3.2. Preoperative Patient Characteristics

Table 1 shows the preoperative characteristics of the patients.

The preoperative characteristics of the patients were identical between the 2 groups except for blood glucose levels. The mean age of patients with diabetes was 53.3 ± 14.18 years and that of patients without diabetes was 53.52 ± 14.7 years. The mean preoperative blood glucose level was 158.1 ± 69.9 mg/dl in diabetic patients compared with 97.7 ± 24.8 mg/dl in non-diabetic patients. Hyperglycaemia (>180 mg/dl) was present in 24.3% of diabetic patients compared with 1.6% of non-diabetic patients. This difference was statistically significant ($p < 0.001$). The duration of surgery was greater than two hours in 27.9% of diabetic patients compared with 32.2% of non-diabetic patients ($p = 0.157$).

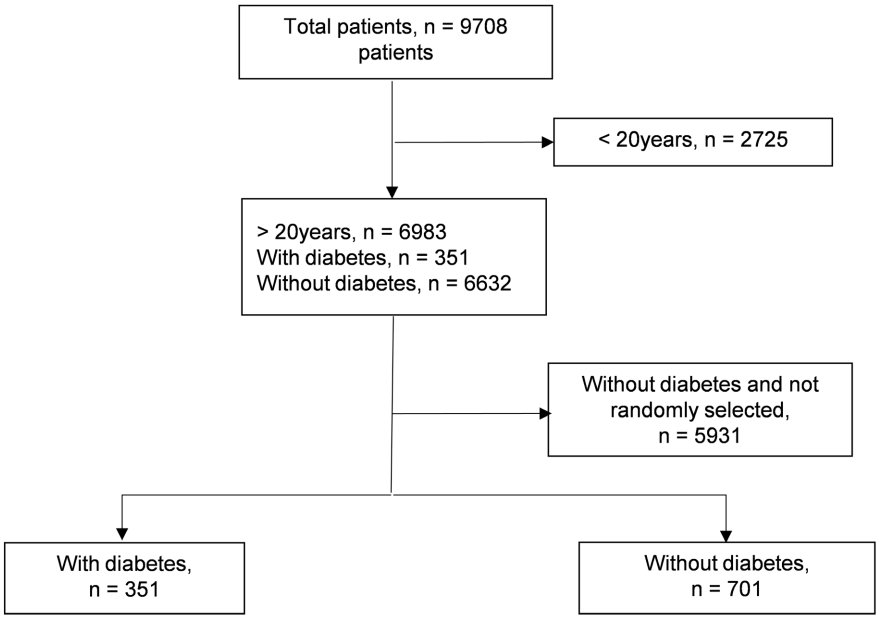

Figure 1. Patient flow diagram.

Table 1. Preoperative characteristics of patients.

Variables	With diabetes n = 351 (%)	Without diabetes n = 701 (%)	Total n = 1052 (%)	P
Age (X ± SD)	53.3 ± 14.18	53.52 ± 14.7	-	
Under 65years	270 (76.9)	538 (73.7)	808 (76.8)	Ns
65years and over	81 (23.1)	163 (23.3)	244 (23.2)	
Sex				Ns
Male	172 (49)	344 (49)	516 (49)	
Female	179 (51)	357 (50.9)	536(51)	
BMI (Kg/m^2)	27.6 ± 7.3	26.8 ± 6.9	-	Ns
Type of surgery				**0.001**
Obstetrics	70 (19.9)	123 (14.5)	193 (18.4)	
Gynaecology	23 (6.6)	84 (12)	107 (10.2)	
Orthopaedics	37 (10.5)	129 (18.4)	166 (15.8)	
Visceral surgery	165 (47)	222 (31.7)	387 (36.8)	
Urology	46 (13.1)	126 (18)	172 (16.3)	
Neurosurgery	10 (2.8)	17(2.4)	27 (2.6)	
Comorbidities				**0.168**
Yes	202 (57.5)	371 (52.9)	573 (54.5)	
No	149 (42.5)	330 (47.1)	479 (45.5)	
Surgery severity				**0.896**
Major	180 (51.3)	355 (50.6)	535 (50.9)	
Minor	171 (48.7)	346 (49.4)	517 (49.1)	
ASA class				**0.07**
I	213 (60.7)	471 (67.2)	684 (65)	
II	110 (31.3)	183 (26.1)	293 (27.9)	
III	24 (6.8)	44 (6.3)	68 (6.5)	
IV	4 (1.1)	3 (0.4)	7 (0.7)	
Glycaemia(mg/dl) X ± SD	158.1 ± 69.9 **n = 350**	97.7 ± 24.8 **n = 127 (%)**	- **n = 377 (%)**	**<0.001**
60 - 110	83 (23.7)	101 (79.5)	184 (38.6)	
111 - 179	182 (52)	24 (18.9)	208 (43.2)	
180 and more	85 (24.3)	2 (1.6)	87 (18.2)	

Legend: X = mean, SD = standard deviation; BMI = Body Mass Index; ns = not significant; ASA = American Society of Anaesthesiologists.

3.3. Anaesthetic Data

Table 2 summarises the anaesthetic techniques used in the patients. There was no significant difference (p = 0.459) between diabetics and non-diabetics with regard to premedication. Locoregional anaesthesia (LRA) was used in 63.8% of

cases in diabetics compared with 53.4% of cases in non-diabetics. General anaesthesia with orotracheal intubation was used in 18.2% of cases with diabetes compared with 28.4% of cases without diabetes, with a significant difference (p = 0.001). The anaesthetics used in these patients are detailed in Table 3.

Table 2. Anaesthetic techniques.

Variables	With diabetes n = 351 (%)	Without diabetes n = 701 (%)	Total n = 1052 (%)	P
Premedication				**0.459**
Yes	13 (3.7)	39 (5.6)	52 (5.1)	
No	338 (96.3)	662 (94.4)	1000 (94.9)	
Anaesthetic technique				**0.001**
LRA	224 (63.8)	374 (53.4)	598 (56.8)	
GA without intubation	63 (17.9)	128 (18.3)	91 (18.2)	
GA with intubation	64 (18.2)	199 (28.4)	263 (25)	

Legend: GA = general anaesthesia; LRA = locoregional anaesthesia.

Table 3. Anaesthetic products.

Variables	With diabetes	Without diabetes	Total	P
Drugs of LRA	**n = 231(%)**	**n = 384 (%)**	**615**	**<0.001**
Bupivacaine only	7 (2)	3 (0.4)	10	
Bupivacaine + morphine	155 (44.2)	182 (26)	337	
Bupivacaine + morphine + fentanyl or clonidine	69 (19.7)	199 (28.4)	268	
Narcotic at induction	**n = 19 (%)**	**n = 330 (%)**	**n = 349**	**<0.001**
Propofol	13 (35)	282 (40.2)	295	
Ketamine	6 (1.7)	35 (5)	41	
Ketamine + propofol	0 (0)	13 (1.9)	13	
Curares	**n = 62(%)**	**n = 203 (%)**	**n = 267**	**<0.001**
Suxamethonium	38 (10.8)	150 (21.4)	188	
Pancuronium	10 (2.8)	27 (3.9)	37	
Atracurium	12 (3.4)	26 (3.7)	38	
Narcotic maintaining	**n = 127 (%)**	**n = 335 (%)**	**n = 462**	**<0.001**
Ketamine	19 (5.4)	7 (1)	26	
Propofol	54 (15.4)	86 (12.3)	140	
Isoflurane	54 (15.4)	143 (20.4)	197	
Sevoflurane	0 (0)	99 (14.1)	99	
Morphinics	**n = 125 (%)**	**n = 324 (%)**	**n = 449**	**0.003**
Fentanyl	67 (19.1)	187 (26.7)	254	
Sufentanyl	58 (16.5)	137 (19.5)	195	

Legend: ALR = locoregional anaesthesia.

3.4. Intra- and Post-Anaesthetic Morbidity and Mortality

Figure 2 shows the intra- and post-anaesthetic morbidity and mortality of patients. Intraoperative and postoperative complications are listed in Table 4 and Table 5 respectively.

The incidence of perioperative complications was 25.3% in diabetic patients compared with 28.6% in non-diabetic patients (p = 0.27). Neither medical nor surgical complications were more frequent in diabetic patients. Surgical complications occurred in 0.9% of cases in diabetic patients compared with 2.1% in non-diabetic patients. Mortality tended to be lower in diabetics (2.3%) than in non-diabetics (3%), but the difference was not statistically significant (p = 0.226).

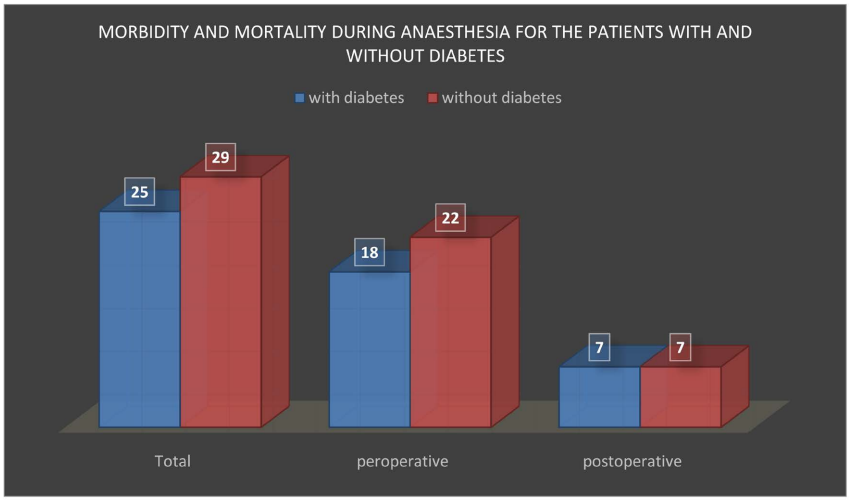

Figure 2. Intra- and post-anaesthetic morbidity rates.

Table 4. Intraoperative complications.

Complications	Diabetes n = 351 (%)	No diabetes n = 701 (%)	Total n = 1052 (%)	p = 0.2
No incident	288 (81.8)	550 (78.5)	837 (79.6)	
Difficult intubation	9 (2.5)	17 (2.4)	26 (2.4)	
Arterial hypotension	41(11.7)	93 (13.3)	134 (12.7)	
High blood pressure	5 (1.4)	6 (0.9)	11(1)	
Desaturation	1 (0.3)	1 (0.1)	2 (0.2)	
Bleeding/transfusion	3 (0.9)	8 (1.1)	9 (1.4)	
Allergic reaction	2 (0.6)	3 (0.4)	5 (0.5)	
LRA failure	1(0.3)	19 (2.7)	20 (1.9)	
Shivering	1(0.3)	1 (0.1)	2 (0.2)	
AFA	0 (0)	1 (0.1)	1 (0.1)	
Vomiting	0 (0)	2 (0.3)	2 (0.2)	

Legend: AFA = atrial fibrillation arrhythmia; LRA = loco-regional anaesthesia.

Table 5. Postoperative complications.

Complications	Diabetes n = 351 (%)	No diabetes n = 701 (%)	Total n = 1052 (%)	p = 0.07
Without complications	326 (92.9)	651 (92.9)	977 (92.9)	
Bleeding/transfusion	7 (2)	9 (1.3)	16 (1.5)	
Pruritus	2 (0.6)	2 (0.4)	4 (0.4)	
Shivering	1 (0.3)	1 (0.4)	2 (0.2)	
PONV	9 (2.5)	14 (1.9)	24 (2.2)	
Delirium/agitation	3 (0.9)	0 (0)	3 (0.3)	
Stroke	0 (0)	3 (0.4)	3 (0.3)	
MOF	0 (0)	9 (1.3)	10 (0.9)	
Pneumopathy	2 (0.6)	4 (0.6)	6 (0.6)	
Surgical complications	3 (0.9)	15 (2.1)	18 (1.7)	
Death	8 (2.3)	21 (3)	29 (2.8)	

Legend: MOF = multiple organ failure; PONV = postoperative nausea and vomiting.

Intraoperatively, difficulties with intubation, arterial hypotension, arterial hypertension and rhythm disorders were no more frequent in diabetics than in non-diabetics. And 81.8% of diabetics had no intraoperative complications, compared with 78.5% of non-diabetics.

The surgical complications were: postoperative peritonitis, revision due to the evolution of gangrene, surgical site infection, and they were present in 2.1% of non-diabetics compared with 0.9% of diabetics. Complications were not present in 92.9% of diabetics and 92.9% of non-diabetics. Pneumonia was equally frequent in both groups (0.6%). Mortality was 2.3% in diabetics compared with 3% in non-diabetics (p = 0.02).

3.5. Factors Associated with Morbidity and Mortality during and after Anaesthesia

Table 6 presents the factors associated with morbidity and mortality.

The risk factors associated with this morbidity were general anaesthesia with oro-tracheal intubation vs loco-regional anaesthesia (OR = 3.06 [95% CI: 1.91 - 4.94]; p < 0.001) and major vs minor surgery (OR =2.09 [95% CI: 1.19 - 3.69]; p = 0.01). The use of narcosis was a protective factor. Diabetic status was not identified as an independent risk factor (OR = 1.2 [95% CI: 0.73 - 1.99]; p = 0.148).

4. Discussion

In our study, after adjustment, the rate of morbidity and mortality in diabetic patients during and after anaesthesia was not higher than the one of non-diabetic control patients of similar severity. In multivariate analysis, the independent risk factors for morbidity and mortality were the type of anaesthesia and the severity of the surgery. Diabetes was not identified as an independent risk factor. Similar

Table 6. Factors associated with morbidity during and after anaesthesia.

Variables	ß	p	ORa	95%CI
Age (years)				
<65			1	
≥65	0.089	0.770	1.093	0.60 - 1.98
Sex				
Female			1	
Male	−00179	0.481	0.836	0.51 - 1.38
Comorbidities				
No			1	
Yes	0.054	0.820	0.947	0.60 - 1.51
ASA class				
I - II			1	
III - IV	0.353	0.168	1.423	0.86 - 2.35
Preoperative glycaemia				
<180 mg/dl			1	
≥180 mg/dl	0.501	0.148	1.651	0.84 - 3.26
Type of anaesthetic				
LRA			1	
Narcosis	−1.101	0.086	0.333	0.10 - 1.17
GA with intubation	1.121	**<0.001**	3.067	1.91 - 4.94
Surgery severity				
Minor			1	
Major	0.739	**0.011**	2.093	1.19 - 3.69
Diabetic status				
Without diabetes			1	
With diabetes	0.184	0.472	1.203	0.73 - 1.99

Legend: ASA = American society of anaesthesiologists; LRA = loco regional anaesthesia; GA = general anaesthesia.

results have been described in the literature [9] [11]. For example, in the study by Kotagal *et al.* [11] involving more than 40,000 hospitalised patients, 19% of whom had known diabetes, no significant difference was found in the occurrence of complications between diabetic and non-diabetic patients (12.6% versus 12.1%; p = 0.26). Paradoxically, an American team [9] even found in their study that a higher proportion of non-diabetic patients experienced postoperative complications than diabetic patients.

If certain studies carried out in the past had shown the opposite [3] [4], it was in fact because no matching and/or adjustment for potential confounding factors had been carried out. However, as other authors have pointed out before us, when the statistics were adjusted for the complications of diabetes or compared

with the same ASA class, even these old studies found no difference in morbidity and mortality after anaesthesia between diabetic and non-diabetic patients [12]. These results suggest that diabetes per se, *i.e.* at a similar level of severity, is not a perioperative risk factor. On the other hand, the increased risk of perioperative morbidity and mortality observed in diabetic patients by certain authors is probably linked to confounding factors, in particular the comorbidities associated with this disease, the severity of the surgery and the type of anaesthesia, as in the present study. One possible explanation for this lack of difference in perioperative morbidity between patients with and without diabetes is probably related to preoperative hyperglycaemia. Hyperglycaemia was present in both groups in the present study, although in different proportions. In the study by Kotagal *et al.* [11], blood glucose levels measured preoperatively in 47% of patients exceeded 180 mg/dl (10 mmol/l) in 40% of diabetics and 6% of patients without known diabetes. In addition, several studies have shown a correlation between blood glucose levels on admission and postoperative morbidity and mortality [13] [14], as well as a ten-fold increase in the risk of complications when there was a blood glucose imbalance prior to surgery in patients with or without diabetes [15]. In the study by Ouattara *et al.* [7] of 200 diabetic and non-diabetic patients undergoing cardiac surgery, uncontrolled intraoperative hyperglycaemia (>2 g/l or 11 mmol/l) was associated with a 7-fold increase in the risk of postoperative complications. In non-cardiac surgery, a prospective study including 80% non-diabetic patients also found this link [8]. According to the American Diabetes Association, this preoperative hyperglycaemia can be observed in patients with or without diabetes, and is linked to surgical stress. Its prevalence varies between 30% and 80% depending on the type of surgery, with the highest prevalence in cardiac surgery [16]. Its main mechanism is peripheral insulin resistance [17], which is also an independent prognostic factor for morbidity and mortality [18]. In addition, stimulation of endogenous glucose production [19], increased renal glucose resorption [20] and reduced glucose clearance [21] have been suggested as possible causes of hyperglycaemia.

More specifically, the death rate was not significantly different between patients with and without diabetes. In the literature, the prognosis of diabetic patients after surgery remains controversial. Some authors believe that the mortality rate is now identical between diabetic and non-diabetic patients [9] [22]. Others believe that diabetes is still a perioperative risk factor for death [23]. From a theoretical point of view, the prognostic impact of perioperative hyperglycaemia linked to surgical stress seems to differ depending on whether the patient is diabetic or not. In a cohort of non-cardiac surgery patients, Krinsley [24] reported a different blood glucose threshold above which mortality was significantly increased depending on whether the patient was diabetic (blood glucose 1.8 g/l or 10 mmol/l) or not (blood glucose 1.4 g/l or 7.8 mmol/l). Other authors have reported that this stress hyperglycaemia, for the same blood glucose level, was potentially less harmful in patients previously known to be diabetic [3] [8].

Only general anaesthesia with oro-tracheal intubation and the intensity of surgery were independent factors associated with greater morbidity and mortality in our study. Locoregional anaesthesia (LRA) was used more frequently than general anaesthesia (GA) in both diabetic and non-diabetic patients. In the literature, there is no evidence of superiority of one anaesthetic technique over another, in particular GA versus LRA in diabetic patients, even though LRA is associated with a lower rise in intraoperative blood glucose levels [6]. Spinal anaesthesia and epidural anaesthesia make it possible to limit hyperglycaemic aggression, but expose patients to a haemodynamic risk [6]. Our study was observational, and the choice between GA and LRA was made as for any other patient. The more frequent recourse to LRA could be justified by the type of surgery and the precariousness of material conditions in general in our country [25]. However, GA with intubation in our study would be the consequence of the severity of the pathology and not in itself the factor associated with complications. Indeed, it is usual for anaesthetists to prefer general anaesthesia with tracheal intubation for major or high-risk surgery, and therefore major surgery had true factor associated with complications.

Contrary to the data in the literature suggesting more difficult intubation in diabetics due to densification of the periarticular collagen structures of the temporomandibular and atlanto-occipital joints [6], this risk was similar in the 2 groups in our study. The more frequent use of LRA in diabetics in the present study may have reduced the number of diabetics to be intubated and therefore the risk of a difficult intubation. In addition, advances in the management of difficult intubations may have minimised this risk.

5. Limitations of the Study

The first is the retrospective nature of the analysis. As the information collected was dependent on registry data, some important information, such as preoperative HbA_1c levels, was not recorded. We deplore the absence of this assay, which would have enabled us to distinguish preoperative stress hyperglycaemia in a non-diabetic patient from pre-existing but unknown diabetes [26]. In addition, given that non-diabetic patients were not systematically tested for blood glucose in the postoperative period, it was also difficult to obtain physical evidence of post-operative stress in these patients and to gain insight into the mechanism of increased morbidity in their group.

As our study was observational, confounding bias could not be excluded. We tried to adjust our results as best we could in a multivariate model for certain factors such as age, sex, comorbidities, ASA risk, type of anaesthesia and severity of surgery. However, some residual confounding may remain. In addition, among patients with diabetes, investigations into vital organ damage were limited. Certain comorbidities, in particular asymptomatic coronary artery disease, could probably not be detected preoperatively.

The single-centre nature of the study limits its generalisability.

But, the existence of a control group including non-diabetic patients and the adjustment of results for potential confounding factors are the strengths of this study.

6. Conclusion

In this study, diabetic patients did not experience more intra- and post-anaesthetic complications than a population of non-diabetic patients of similar severity after adjustment for potential confounding factors. The intensity of the surgery was an independent risk factor for morbidity and mortality, while the use of narcosis was a protective factor. On the other hand, diabetes was not identified as an independent risk factor associated with morbidity and mortality. These results suggest that diabetes per se has only a minor impact on perioperative morbidity and mortality. Thus, the importance of the contribution of confounding factors in assessing anaesthetic risk in diabetic patients should be taken into account, including comorbidities, ASA score, perioperative hyperglycaemia, type of anaesthesia and severity of surgery.

Authors' Contributions

Noelly Mukuna and John Nsiala: Study design, drafting of the manuscript.

Wilfrid Mbombo: Study design, drafting of the manuscript and data collection.

Alphonse Mosolo and Freddy Mbuyi: Data collection and correction of the manuscript.

All other authors: Reading and correction of the manuscript.

Acknowledgements

We would like to thank the entire operating theatre team at Monkole Hospital, in particular: Jacquies Byengangu, Cathy Nziavake, Olga Milo, Théophile Mbala, Bénoit Rwabahizi, Maguy Tshiabu, Joyce Mbombo and Naomie Kankolongo for their collaboration and Milka Mbombo for his English corrections.

Conflicts of Interest

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

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