

Factors Associated with Severe Haemorrhage During Abdominal Myomectomy in Two Teaching Hospitals in Yaoundé, Cameroon: A Case–Control Study

Patrick Aimé Adala Soumé^{1*}, Esther Juliette Ngo Um Meka^{1,2}, Etienne Belinga^{1,3}, Jean Dupont Kemfang Ngowa^{1,3}

¹Department of Surgery and Specialties, Faculty of Medicine and Biomedical Sciences, University of Yaoundé I, Yaoundé, Cameroon

²Department of Obstetrics and Gynaecology, Yaoundé Gynaeco-Obstetric and Paediatric Hospital (HGOPY), Yaoundé, Cameroon

³Yaoundé Teaching Hospital for Endoscopic Surgery and Human Reproduction (CHRACERH), Yaoundé, Cameroon

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*Corresponding author: Patrick Aimé Adala Soumé

Department of Surgery and Specialties, Faculty of Medicine and Biomedical Sciences, University of Yaoundé I, Yaoundé, Cameroon

Abstract

Original Research Article

Background: In Cameroon, abdominal myomectomy remains the standard approach for large multifibroid uteri, and haemorrhage is its main complication. We aimed to identify factors associated with severe haemorrhage during abdominal myomectomy. **Methods:** We conducted a retrospective case–control study at the Yaoundé Teaching Hospital for Endoscopic Surgery and Human Reproduction (January 2016 – March 2018) and the Yaoundé Gynaeco-Obstetric and Paediatric Hospital (January 2013 – December 2017). Cases had a total blood loss ≥ 1000 mL (intraoperative loss plus 48-hour drain output) and/or perioperative transfusion; controls (two per case) had neither. Variables significant on bivariate analysis were entered into a binary logistic regression model. **Results:** Of 366 recorded procedures, 225 files were analysed (75 cases, 150 controls). Independent factors were previous laparotomy (adjusted odds ratio [aOR] 5.56; 95% confidence interval [CI] 2.28–13.54; $p < 0.001$), uterine size ≥ 20 weeks (aOR 5.14; 95% CI 1.92–13.76; $p = 0.001$), dominant fibroid ≥ 10 cm (aOR 3.27; 95% CI 1.33–7.94; $p = 0.009$) and body mass index ≥ 30 kg/m² (aOR 2.62; 95% CI 1.03–6.65; $p = 0.042$). **Conclusion:** The risk of severe haemorrhage can be anticipated at the first consultation: previous abdominal scar, large uterus, large dominant fibroid and obesity. These criteria should guide blood reservation, preoperative preparation and referral to a tertiary centre.

Keywords: myomectomy; laparotomy; uterine fibroids; haemorrhage; blood transfusion; Cameroon.

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INTRODUCTION

Uterine fibroids are the most common benign tumours in women of reproductive age [1]. In sub-Saharan Africa, they occur earlier, are more numerous and larger, and affect a population that is often nulliparous and wishes to conceive [1,2]. In Cameroon, the prevalence of fibroids reaches 16.7% among pregnant women followed in Limbe and Buea [2].

This profile explains why abdominal myomectomy remains the standard approach in our centres. At the CHRACERH in Yaoundé, Kasia *et al.*, reported a mean of five fibroids per patient, with a mean diameter of 8 cm, and concluded that laparotomy remained the most appropriate approach in Black women [3]. Recent series from the same centre and the subregion describe uteri of 18 to 22 weeks' size carrying 10 to 20 nodules [4,5].

Haemorrhage is the most frequent and most feared complication of this procedure. In Ilorin (Nigeria), blood loss exceeded 1000 mL in 27.1% of myomectomies and 58.2% of patients were transfused [6]; in a Nigerian trial, intraoperative transfusion was required in 55% to 60% of patients [7]. Uncontrolled bleeding exposes the patient to haemostatic hysterectomy, a particularly severe outcome in women operated on to preserve their fertility, of whom only 16.2% conceive after myomectomy in Douala [8,9].

This risk weighs more heavily in a setting where the World Health Organization (WHO) African Region collects only about half of the blood it needs [10]. Preoperative identification of high-risk patients would allow targeted blood reservation, medical preparation and choice of operating centre. Cameroonian data on these factors remain scarce; local studies have focused on postoperative adhesions [3], fertility [8] or the comparison of haemostatic methods [4].

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The aim of this study was to identify the sociodemographic, clinical and operative factors associated with severe haemorrhage during abdominal myomectomy in two teaching hospitals in Yaoundé.

PATIENTS AND METHODS

Study design and setting

This retrospective case–control study, reported according to the STROBE guidelines [11], was conducted in two referral teaching hospitals in Yaoundé: the Yaoundé Teaching Hospital for Endoscopic Surgery and Human Reproduction (CHRACERH; 100 beds, six operating theatres, nine obstetrician-gynaecologists) and the Yaoundé Gynaeco-Obstetric and Paediatric Hospital (HGOPY; 54 obstetrics and gynaecology beds, four operating theatres, 12 obstetrician-gynaecologists). The study periods were January 2016 – March 2018 at the CHRACERH (operational since 2015) and January 2013 – December 2017 at the HGOPY.

Study population

All patients who underwent abdominal myomectomy were identified from the operating theatre registers, and their medical files were retrieved from the archives.

- **Cases:** total blood loss ≥ 1000 mL and/or intra- or postoperative transfusion. Total blood loss was the sum of the estimated intraoperative loss and the drain output at 48 hours. The 1000 mL threshold for severe haemorrhage and the inclusion of drainage volume in blood loss estimation were based on Helal *et al.*, [12].
- **Controls:** total blood loss < 1000 mL without transfusion.
- **Exclusion criteria:** preoperative haemoglobin < 10 g/dL; incomplete file (missing preoperative haemoglobin, intraoperative blood loss or 48-hour drain output); myomectomy performed during caesarean section.

Sample size

Sample size was calculated using Schlesselman's formula [13] with a ratio of two controls per case, $\alpha = 5\%$ and 80% power. Exposure proportions (uterus > 16 weeks) were 69.4% among cases and 48.5% among controls, according to Adesina *et al.*, [6]. The minimum sample size was 65 cases and 130 controls. Recruitment was consecutive.

Surgical procedure

The procedure was similar in both centres. Medical preparation (gonadotropin-releasing hormone [GnRH] analogues, progestogens) was prescribed to some patients; a haemoglobin level < 8 g/dL led to preoperative transfusion. Anaesthesia was general or regional, and the skin incision was transverse

(Pfannenstiel or Mouchel) or midline. An isthmic tourniquet (Foley catheter passed through the base of the broad ligament, lateral to the uterine vessels) was applied at the surgeon's discretion. Myoma beds were closed in two layers and a suction drain was left in place. Intraoperative blood loss was estimated from the volume in the suction canister and the number of soaked large abdominal swabs (100 mL each).

Variables

Sociodemographic variables were age, marital status and educational level. Clinical variables were parity, age at menarche, previous laparotomy (caesarean section, myomectomy, salpingectomy/salpingotomy, ovarian cystectomy), body mass index (BMI), uterine size expressed in weeks of gestation, and the number, size and location of fibroids. Operative variables were indication, type of anaesthesia, surgeon's experience (years since specialist qualification), type of skin incision, use of a tourniquet, number of uterine incisions, operative time (from skin incision to skin closure) and in-hospital outcome.

Statistical analysis

Data were entered using CSPro 7.0 and analysed with IBM SPSS Statistics 20. Associations were tested using the χ^2 test or Fisher's exact test, as appropriate, and expressed as crude odds ratios (OR) with 95% confidence intervals (CI). Variables associated with the outcome at $p < 0.05$ on bivariate analysis were entered into a binary logistic regression model to obtain adjusted odds ratios (aOR). Statistical significance was set at $p < 0.05$.

Ethical considerations

The protocol was approved by the Institutional Ethics Committee for Research of the Faculty of Medicine and Biomedical Sciences, University of Yaoundé I (*[clearance number to be inserted]*). Administrative authorisations were obtained from both hospitals. Data were anonymised using a code; individual consent was waived for this retrospective review of medical records.

RESULTS

Study population

Of 366 abdominal myomectomies recorded, 247 files (67.5%) were retrieved. Twenty-two were excluded (incomplete files or haemoglobin < 10 g/dL), leaving 225 patients: 75 cases and 150 controls (Figure 1). The mean age was 36 ± 6 years (range 24–55). Most patients were single (52.9%), had tertiary education (84.9%) and were nulliparous (79.6%). Sociodemographic characteristics did not differ between cases and controls (Table 1).

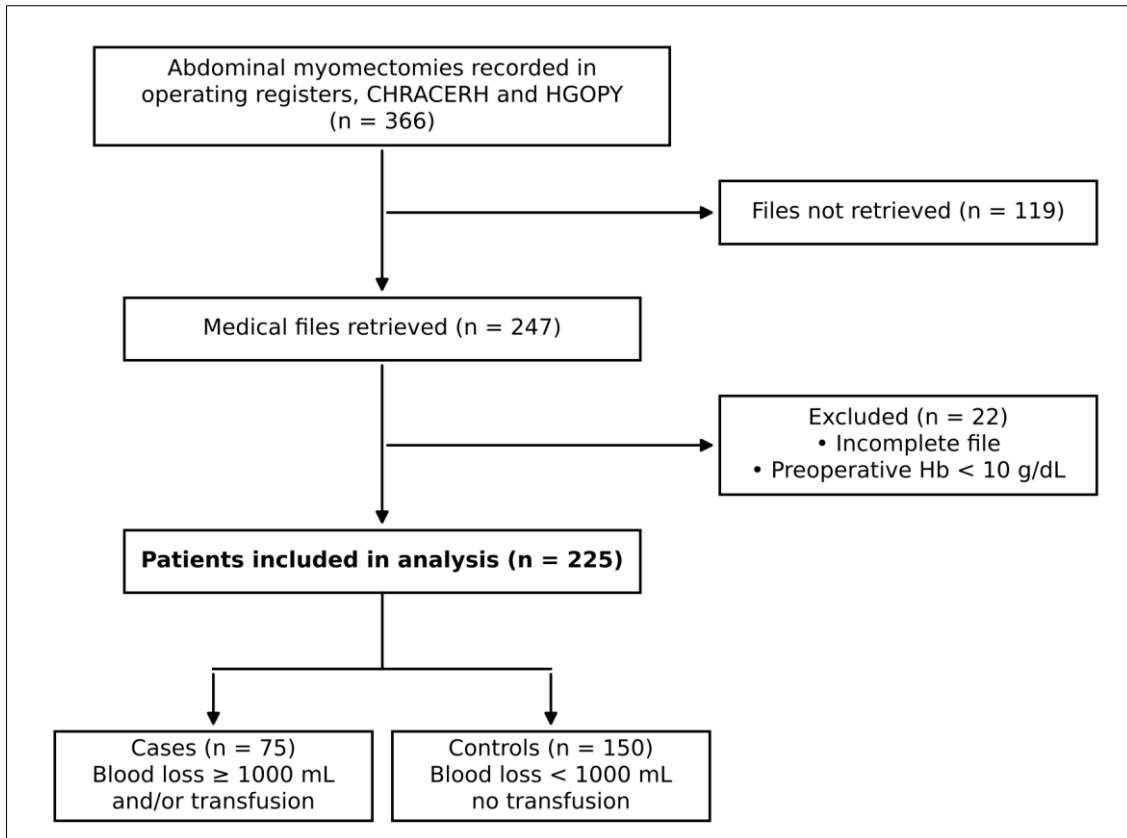


Figure 1: Flow chart of patient selection. CHRACERH, Yaoundé Teaching Hospital for Endoscopic Surgery and Human Reproduction; HGOPY, Yaoundé Gynaeco-Obstetric and Paediatric Hospital; Hb, haemoglobin

Table 1: Sociodemographic characteristics of cases and controls

Characteristic	Cases (n = 75)	Controls (n = 150)	Crude OR (95% CI)	p value
Age, years				
≤ 30	15 (20.0)	25 (16.7)	1.25 (0.61–2.54)	0.538
31–40	40 (53.3)	86 (57.3)	0.85 (0.49–1.48)	0.569
> 40	20 (26.7)	39 (26.0)	1.03 (0.55–1.94)	0.915
Marital status				
Married	35 (46.7)	71 (47.3)	0.97 (0.56–1.70)	0.925
Educational level				
Primary	2 (2.7)	0 (0.0)	NE	0.110 ^a
Secondary	8 (10.7)	24 (16.0)	0.63 (0.27–1.47)	0.280
Tertiary	65 (86.7)	126 (84.0)	1.24 (0.56–2.74)	0.599

Data are presented as n (%). Percentages are calculated within each group.

CI, confidence interval; NE, not estimable (zero cell); OR, odds ratio.

p values from the χ^2 test unless otherwise indicated. ^aFisher's exact test.

Bivariate analysis

Ten clinical and operative variables were associated with severe haemorrhage (Table 2). Among patients with a previous laparotomy, previous myomectomy predominated among cases (25/35; 71.4%) compared with controls (10/21; 47.6%; $p = 0.075$). Age at menarche, indication for surgery, surgeon's experience, type of anaesthesia and use of an isthmus tourniquet were not associated with severe haemorrhage (Table 3).

Multivariable analysis

Four factors remained independently associated with severe haemorrhage: previous laparotomy (aOR 5.56; 95% CI 2.28–13.54), uterine size ≥ 20 weeks (aOR 5.14; 95% CI 1.92–13.76), largest fibroid ≥ 10 cm (aOR 3.27; 95% CI 1.33–7.94) and BMI ≥ 30 kg/m² (aOR 2.62; 95% CI 1.03–6.65) (Table 2). Midline incision, operative time and the number of fibroids or uterine incisions lost significance; intramural location was at the threshold of significance, with a very wide confidence interval.

Table 2: Clinical and operative factors associated with severe haemorrhage during abdominal myomectomy: bivariate and multivariable logistic regression analysis

			Bivariate analysis		Multivariable analysis ^a	
Variable	Cases (n = 75)	Controls (n = 150)	Crude OR (95% CI)	p	aOR (95% CI)	p
Patient characteristics						
Previous laparotomy	35 (46.7)	21 (14.0)	5.38 (2.81–10.26)	<0.001	5.56 (2.28–13.54)	<0.001
BMI ≥ 30 kg/m ²	30 (40.0)	26 (17.3)	3.18 (1.70–5.95)	<0.001	2.62 (1.03–6.65)	0.042
Nulliparity	67 (89.3)	112 (74.7)	2.84 (1.25–6.45)	0.010	2.66 (0.85–8.26)	0.091
Fibroid characteristics						
Uterine size ≥ 20 weeks ^b	48 (64.0)	23 (15.3)	9.82 (5.14–18.76)	<0.001	5.14 (1.92–13.76)	0.001
Largest fibroid ≥ 10 cm	49 (65.3)	43 (28.7)	4.69 (2.59–8.48)	<0.001	3.27 (1.33–7.94)	0.009
Intramural fibroid(s)	73 (97.3)	132 (88.0)	4.98 (1.12–22.05)	0.020	6.87 (1.00–47.12)	0.050
≥ 12 fibroids removed	40 (53.3)	30 (20.0)	4.57 (2.50–8.37)	<0.001	2.35 (0.85–6.47)	0.098
Operative characteristics						
Midline skin incision	26 (34.7)	12 (8.0)	6.10 (2.86–13.02)	<0.001	1.32 (0.45–3.91)	0.612
≥ 4 uterine incisions	38 (50.7)	29 (19.3)	4.29 (2.33–7.87)	<0.001	1.42 (0.56–3.60)	0.453
Operative time > 3 h	20 (26.7)	5 (3.3)	10.55 (3.77–29.48)	<0.001	2.95 (0.73–11.84)	0.126

Data are presented as n (%). Bold values indicate independent associations ($p < 0.05$) in the multivariable model.

aOR, adjusted odds ratio; BMI, body mass index; CI, confidence interval; OR, odds ratio.

^aBinary logistic regression including the 10 variables listed (all variables with $p < 0.05$ on bivariate analysis). For each variable, the reference category is absence of the characteristic.

^bUterine size assessed by abdominal palpation and expressed as weeks-of-gestation equivalent.

Outcome

The in-hospital outcome was unfavourable in two cases (2.7%): one return to theatre for haemostatic

hysterectomy and one acute kidney injury requiring haemodialysis. No deaths were recorded.

Table 3: Clinical and operative variables not associated with severe haemorrhage

Variable	Cases (n = 75)	Controls (n = 150)	Crude OR (95% CI)	p value
Indication for surgery				
Symptomatic fibroids without infertility	27 (36.0)	43 (28.7)	1.40 (0.78–2.52)	0.263
Infertility alone	17 (22.7)	47 (31.3)	0.64 (0.34–1.22)	0.174
Type of anaesthesia^a				
General	56 (74.7)	100 (66.7)	1.47 (0.79–2.74)	0.220
Regional	15 (20.0)	45 (30.0)	0.58 (0.30–1.13)	0.110
Surgeon's experience, years since specialist qualification				
< 5	21 (28.0)	43 (28.7)	0.97 (0.52–1.79)	0.917
5–9	11 (14.7)	35 (23.3)	0.56 (0.27–1.19)	0.129
≥ 10	43 (57.3)	72 (48.0)	1.46 (0.83–2.54)	0.187
Haemostatic measure				
Isthmic (pericervical) tourniquet	35 (46.7)	87 (58.0)	0.63 (0.36–1.11)	0.108

Data are presented as n (%). p values from the χ^2 test. Age at menarche was also not associated with severe haemorrhage (data not shown).

CI, confidence interval; OR, odds ratio.

^aType of anaesthesia was not recorded for 4 cases and 5 controls.

DISCUSSION

In this Cameroonian case–control study, four factors identifiable before skin incision predicted severe haemorrhage during abdominal myomectomy: previous laparotomy, uterine size ≥ 20 weeks, dominant fibroid ≥ 10 cm and obesity. No factor related to the operative technique or to the surgeon remained independently associated. The haemorrhagic risk therefore depends

primarily on the patient and her fibroid disease, which makes it predictable at consultation.

A high haemorrhagic risk specific to the African profile

The case–control design does not allow an incidence to be calculated, but series from the subregion put the issue in perspective. In Ilorin, 27.1% of abdominal myomectomies resulted in a blood loss

exceeding 1000 mL and 58.2% of patients were transfused [6]. In the trial by Afolabi *et al.*, also in Nigeria, mean blood loss exceeded 850 mL and 55% to 60% of patients received intraoperative transfusion [7]. At the CHRACERH, in uteri of 18 weeks' mean size carrying about ten fibroids, Borassi Mbensa *et al.*, reported a mean blood loss of 490 mL, no loss > 1000 mL and a transfusion rate of 20.8% [4].

These figures exceed those reported in high-income settings: in a London series of 200 abdominal myomectomies restricted to uteri ≥ 16 weeks, 24.5% of patients were transfused [9]. The difference mainly reflects the disease being treated: in Yaoundé as in Accra, operated uteri measure 18 to 22 weeks and carry 10 to 20 nodules [3–5]. It is compounded by an uncertain blood supply, as the WHO African Region collects only about half of the blood it needs [10].

Previous laparotomy: the strongest factor

Previous laparotomy increased the odds of severe haemorrhage 5.6-fold. In 71% of the cases concerned, it was a previous myomectomy, making operated fibroid recurrence a high-risk situation in our setting. Adesina *et al.*, found previous gynaecological surgery to be a predictor of transfusion (OR 8.05) [6], and Pundir *et al.*, reported greater blood loss after repeat than after primary myomectomy (mean 1023 vs 579 mL) and a higher rate of major complications other than transfusion (40% vs 5%) [9].

The most likely mechanism involves adhesions. At the CHRACERH, Kasia *et al.*, showed at second-look laparoscopy that a uterus > 12 weeks, more than two uterine incisions and more than five fibroids removed were associated with the most severe adnexal adhesions [3]. A second laparotomy therefore encounters a remodelled pelvis, where dissection and exposure of the uterus prolong the procedure and increase bleeding. Conversely, the Ghanaian trial by Agyabeng *et al.*, which excluded any previous abdominal surgery, reported transfusion rates of only 2.5% to 5% [5]; this selection probably explains part of this low rate.

Uterine volume and size of the dominant fibroid

A uterus ≥ 20 weeks increased the odds 5.1-fold, in agreement with Pundir *et al.*, at the same threshold [9] and with Adesina *et al.*, from 16 weeks [6]. In Addis Ababa, uterine size was also among the determinants of complications of abdominal myomectomy [14]. The Ghanaian trial provides a complementary argument: adding misoprostol to the tourniquet significantly reduced blood loss only beyond 18 weeks [5], suggesting that preventive measures are most useful in this subgroup.

A dominant fibroid ≥ 10 cm remained associated independently of uterine volume (aOR 3.27), as in the series by Vargas *et al.*, in laparoscopic and robotic-assisted myomectomy (dominant myoma > 10

cm: OR 2.83; 95% CI 1.34–5.87) [15]. The vascularity of a large fibroid and the size of the bed to be closed explain this association. The comparison with the CHRACERH is telling: in the trial by Borassi Mbensa *et al.*, in which the largest fibroid measured 8.3 cm on average, no patient lost more than 1000 mL [4].

Number and location of fibroids

The number of fibroids removed (≥ 12) lost significance after adjustment, whereas Pundir *et al.*, Vargas *et al.*, and the Addis Ababa team associated it with bleeding [9,14,15]. Two explanations are plausible. The number of fibroids is strongly correlated with uterine volume, which captures most of the effect in the model. In addition, multilobed or degenerated fibroids were often recorded as a single nodule in operative reports, underestimating the true number.

Intramural location was at the threshold of significance (aOR 6.87; 95% CI 1.00–47.12). This very wide interval reflects its near-universality: more than 95% of patients in the Yaoundé and Accra trials had intramural fibroids [4,5], and it is the most common type in sub-Saharan Africa [16]. A variable present in almost all patients discriminates poorly; the number and depth of intramural fibroids would be more informative, as shown by Sizzi *et al.*, in laparoscopic myomectomy [17].

Obesity

A BMI ≥ 30 kg/m² increased the odds 2.6-fold, as in the Turkish series by Çinar *et al.*, [18]. Adiposity hampers exposure and exteriorisation of the uterus and prolongs the procedure. Obesity is also a risk factor for fibroids and is associated with larger uteri. Notably, the Ghanaian trial excluded women with a BMI > 35 kg/m² because of surgical difficulty [5], confirming that African teams already perceive this risk.

Operative factors: markers of difficulty rather than causes

Midline incision (crude OR 6.10) and operative time > 3 h (crude OR 10.55) were no longer significant after adjustment. The choice of a midline incision is indeed dictated by a large uterus or a previous scar; in Accra, 28.7% of myomectomies were performed through a subumbilical midline incision [5]. Likewise, a prolonged operative time reflects difficulty, as in Ilorin (> 4 h) [6] and in the series by Catanzarite *et al.*, (> 3 h) [19]. These variables are consequences of the patient's profile rather than independent causes.

The isthmus tourniquet was not associated with a significant reduction in severe haemorrhage (OR 0.63; $p = 0.108$). Yet the reviews by Kongnyuy and Wiysonge, both Cameroonian authors, found that a Foley catheter tied around the cervix, the technique used in our centres, reduced blood loss by about 240 mL (mean difference –240.7 mL; 95% CI –359.6 to –121.8), and that pericervical tourniquets reduced the need for transfusion (OR 0.09; 95% CI 0.01–0.84), albeit on low-quality

evidence [20,21]. Two explanations coexist. A reduction of this magnitude may not be sufficient to keep very large uteri below the 1000 mL threshold. More importantly, reperfusion bleeding may occur when the tourniquet is released: Borassi Mbensa *et al.*, described two haemorrhages occurring at its removal [4].

These data argue for combined rather than single measures. At the CHRACERH, rectal misoprostol and the tourniquet were equally effective [4], as in Nigeria [7], and their combination was superior to the tourniquet alone for uteri ≥ 18 weeks in Accra [5]. Triple tourniquets and ligation of the ascending branches of the uterine arteries also reduce blood loss [22,23]. Confounding by indication remains possible, as the tourniquet may have been reserved for uteri judged to be at highest risk.

The surgeon's experience was not associated with the risk. In these two referral centres, abdominal myomectomy is a routine procedure and 71% of surgeons had at least five years of experience; the learning effect is probably achieved early.

Practical implications

The four factors identified can be collected at consultation: history, weight and height, palpation and ultrasound. A patient presenting several of them should have compatible blood reserved before surgery. She should also receive medical preparation when the uterus exceeds 20 weeks or the fibroid 10 cm, as GnRH analogues reduce uterine volume and blood loss [24]. A combined haemostatic strategy (tourniquet and misoprostol) and scheduling in a referral centre complete this management [4,5]. Prospective validation of these factors as a preoperative score would be useful.

Strengths and limitations

This study is one of the first in Cameroon to investigate, using multivariable analysis, the determinants of haemorrhage during abdominal myomectomy. It involved two referral centres and a sample size exceeding the calculated minimum.

Its limitations are those of a retrospective study. Almost one-third of the files (119/366) could not be retrieved, exposing the study to selection bias. Intraoperative blood loss was estimated visually and uterine size by palpation, two measurements subject to inter-observer variability. The composite outcome included transfusion, the indication for which was not standardised. Preoperative treatments (GnRH analogues, misoprostol) were not reliably documented. Finally, with 75 events for 10 variables entered, the model falls short of the recommended ratio of 10 events per variable [25], so the adjusted ORs should be interpreted as cautious estimates.

CONCLUSION

In Yaoundé, severe haemorrhage during abdominal myomectomy is associated with four preoperative clinical factors: previous laparotomy, uterus ≥ 20 weeks, dominant fibroid ≥ 10 cm and BMI ≥ 30 kg/m². These simple criteria should trigger blood reservation, medical preparation aimed at reducing uterine volume, and a combined haemostatic strategy. Prospective Cameroonian studies are needed to validate a risk score and to compare preventive methods in our practice settings.

Declarations

Ethics approval: Institutional Ethics Committee for Research of the Faculty of Medicine and Biomedical Sciences, University of Yaoundé I (*[clearance number and date]*); authorisations from the management of the CHRACERH and the HGOPY.

Competing interests: The authors declare no competing interests.

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Authors' contributions: PAAS: conception, data collection and analysis, drafting of the manuscript. JDKN: supervision, conception, critical revision. EB and EJNUM: co-supervision, interpretation of results, critical revision. All authors read and approved the final version.

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Data availability: The data are available from the corresponding author upon reasonable request.

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