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ORIGINAL RESEARCH

Same-Day Cancellation is Higher in Outpatient Pars Plana Vitrectomy for Proliferative Diabetic Retinopathy

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Purpose: Safety and efficiency of ambulatory pars plana vitrectomy (PPV) for proliferative diabetic retinopathy (PDR) patients is worthy of attention, since patients always have severe systemic diseases. The purpose of this study was to compare the incidence of same-day cancellation of PPV for PDR between outpatients and inpatients and to analyze the causes of cancellations.

Patients and Methods: This is a retrospective review of consecutive PPV procedures for PDR from January 2019 to April 2021 at either the ambulatory or the inpatient surgery center in an academic tertiary referral center. Data on patient surgery plan, same-day surgical cancellation and follow-up were recorded. Differences in cancellation rate and reasons for cancellation (e.g. medical factors, patient reasons and administrative problems) between outpatients and inpatients were compared.

Results: In total, 1810 consecutive PPV procedures of 1367 patients were identified; 1509 (83.4%) were managed as inpatient surgeries and 301 (16.6%) as outpatient surgeries. The total same-day cancellation rate was 5.2% for all patients. Although outpatients were younger (51 years vs 52 years, $P < 0.001$), had less proportion of hypertension (60.5% vs 74.0%), coronary artery disease (10.0% vs 18.8%), renal insufficiency (9.3% vs 18.0%) and cerebrovascular diseases (1.0% vs 11.4%) (all $P < 0.001$), had less proportion of patients with ASA III status (14.9% vs 27.4%, $P < 0.001$), and had higher proportion of regional anesthesia with MAC (19.9% vs 5.0%, $P < 0.001$), the cancellation proportion was significantly higher for outpatients than inpatients (12.3% vs 3.8%, $P < 0.001$). Overall, the most common reason for surgical cancellation was medical factors, occurring more frequently in outpatients than inpatients (91.9% vs 68.4%, $P = 0.012$).

Conclusion: Same-day cancellation is higher in outpatient pars plana vitrectomy for proliferative diabetic retinopathy. To reduce ambulatory surgery cancellations, it is important to strengthen the monitoring of preoperative systemic comorbidities and adjust medication if necessary.

Keywords: ambulatory surgery, same-day surgery cancellation, proliferative diabetic retinopathy, safety, efficiency

Introduction

Diabetic retinopathy (DR) is a common microvascular complication of diabetes mellitus (DM) and one of the leading causes of blindness in working-aged adults. A recent study showed that the global prevalence of non-proliferative DR (NPDR) and proliferative DR (PDR) among diabetic patients was 25.2% and 1.4%, respectively, during the period of 2015 to 2019.[1] China has the largest number of adults with DM between the ages of 20 to 79 years (116.4 million). As the number of DM cases in China continues to increase, DR is becoming more common.[2] Due to the lack of awareness of diabetic complications and imperfections in community health management, patients who visit the hospital with vision loss as the main complaint are usually in the PDR stage with retinal neovascularization, fibrous proliferation, and traction retinal detachment. The pars plana vitrectomy (PPV) is a cost-effective long-term stabilizing treatment for vision preservation in PDR patients.[3,4] With the application of less invasive instruments, such as the 23-gauge (G), 25-G and

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27-G tools, the vitrectomy incision becomes less invasive. Thus, PPV for PDR is technically feasible without hospitalization.[5]

Ambulatory PPV is beneficial for the increasingly large numbers of PDR patients as it decreases their waiting time for surgery, their medical expenses, the burden of care placed on the family and the cost burden on social health insurance. However, patients with PDR often have severe systemic macrovascular and microvascular lesions related to diabetes, such as hypertension, cerebrovascular disease, coronary artery disease, and diabetic nephropathy. Furthermore, PDR is a high-risk factor for cardiovascular and cerebrovascular problems[6,7] and increases the risk of all-cause mortality.[8] Due to issues involving poor blood pressure (BP) and/or blood glucose (BG) control and severe systemic comorbidities, most PDR patients are arranged with hospitalization, and some patients may experience PPV cancellation after the surgery is arranged. When considering whether a procedure can be developed into ambulatory surgery, the rate of surgery cancellation is an effective indicator of the efficiency of the administrative system and the quality of medical care.

Same-day cancellation occurs in 0.5% to 14.3% of patients,[9–13] and the wide range might be due to social factors, hospital administration, different surgical types, and different surgical settings.[9,14–16] Ophthalmic surgery is a relatively mild procedure, with less disruption of physiological function, minimal bleeding and almost no severe postoperative pain. A study by Matzek reported an ophthalmic surgery cancellation rate of 5.5%, which was lower than that of major surgeries, such as orthopedic surgery (9.7%), thoracic and cardiovascular surgery (9.2%) and neurosurgery (10.5%), in a general hospital.[10] Cataract surgery is a relatively simple ophthalmic surgery, but its cancellation rate is as high as 12%, and most of the cancellation is related to poorly controlled systemic diseases.[26] Currently, there is no literature examining the cancellation of PPV for PDR patients with complicated comorbidities, nor study comparing the difference in same-day cancellations between outpatient and inpatient PPVs for PDR patients. We carried out this retrospective study with a large cohort of PDR patients cared for by the same team of ophthalmic specialists to investigate the difference in surgery cancellation between inpatients with hospitalization and outpatients without hospitalization, to identify the main cause of surgery cancellation and provide more clinical indications for preventive interventions to reduce same-day surgery cancellations for these patients.

Materials and Methods

Study Design and Subjects

The Ethics Committee of Beijing Tongren Hospital, Capital Medical University provided ethical approval for this study on November 4th, 2021 (protocol number, TRECKY2021-183). The requirement for written informed consent was waived since this was a retrospective study. This study complied with the Declaration of Helsinki, and all patients' data was maintained with confidentiality.

We retrospectively reviewed the perioperative clinical information of all PDR patients who were scheduled for the first surgery of PPV with gas (C_3F_8) or silicone oil tamponade and secondary surgery of PPV with silicone oil removal, with/without cataract surgery in our hospital from January 1, 2019, to April 30, 2021. All patients scheduled for ambulatory surgery or inpatient surgery were included. We chose this period because PDR-related surgery was almost suspended due to the outbreak of COVID-19 from January 2020 to April 2020, and we intended to count the number of surgeries in the year before and after the COVID-19 outbreak. Cases meeting the following inclusion criteria were enrolled in this study: (1) PDR patients who were scheduled for first PPV or secondary PPV with silicone oil removal, with/without cataract surgery in the ambulatory surgery center (outpatient) or in the inpatient surgery center (inpatient) in our hospital and (2) patients with detailed perioperative records, including medical history, laboratory results, perioperative consultation, and information on scheduling surgery. The exclusion criteria were as follows: (1) minor surgery such as intravitreal injection for PDR patients, (2) emergency surgery, or (3) patients who were converted to other surgical procedures on the day of surgery. For example, cataract phacoemulsification extraction is considered necessary before PPV. If a patient had two operations at different times (for example, PPV was performed first followed by PPV with silicone oil removal several months later), we considered the procedures as two separate operations.

Presurgical Evaluations and Scheduling

In the ophthalmic clinic, the patient's history of previous photocoagulation, cataract phacoemulsification extraction, and intravitreal injection of vascular endothelial growth factor inhibitors (anti-VEGF) was recorded. All patients underwent comprehensive ophthalmic examinations. Corrected bilateral visual acuity (VA), intraocular pressure (IOP), the extension of the fibrovascular membrane, and dense vitreous hemorrhage in the operated eye were recorded. All cases scheduled for surgery were arranged to have a preoperative evaluation in the internal medicine clinic. The internal medicine clinic was responsible for evaluating systemic diseases, such as the control of hypertension, diabetes, coronary heart disease, and renal insufficiency. Patients with the unstable systemic disease were transferred to corresponding specialists, such as cardiologists, endocrinologists or nephrologists. After the internal medicine evaluation, patients who needed general anesthesia or regional anesthesia with monitored anesthesia care (MAC) visited the preoperative anesthesia clinic, where they underwent evaluations for anesthesia, such as assessments of the airway condition, control of systemic disease, and the daily medications taken. Anesthesiologists suggested that all PDR patients with American Society of Anesthesiologists (ASA) III or IV status should receive hospitalization. Anesthesiologists arranged the anesthesia method (general anesthesia or regional anesthesia with MAC) according to the surgeon's requirement and the patient's systemic status. The ophthalmic surgeon arranged the date of surgery after they checked the preoperative evaluation record, and they arranged for inpatient surgery with hospitalization or outpatient ambulatory surgery (defined as same-day admission and discharge within 24 h) depending on the patient's general condition, the anesthesiologist's suggestion, and the complexity of the eye condition, followed by the patient's requirements, the number of inpatient beds, and medical insurance factors. Whether for ambulatory surgery or hospitalization surgery, most PDR patients received intravitreal injection of VEGF inhibitors (conbercept or ranibizumab) 3 to 7 days prior to the surgery according to the ophthalmologist's judgment and preference to promote less bleeding and better membrane dissection.

Surgical Arrangement and Cancellation

All PPV surgeries for both PDR outpatients and PDR inpatients were performed by a team of specialists in DR ophthalmology, including sixteen experts in our hospital. The surgery arrangement process of our hospital is as follows: the ophthalmologist automatically applies for PPV to the operation center through the electronic medical record system before 12 pm on the day before the operation. The application for surgery after 12 pm needs to be manually reviewed by the head of the operating center, and the application can be submitted no later than 3 pm. Same-day surgery cancellation is defined as surgery that is scheduled in the final surgery list (generated at 3 p.m. on the previous day) but subsequently canceled on the day of surgery.

All outpatients arrived at the ophthalmic day ward as required on the day of surgery. Then, the ward nurse checked the relevant information about the operation and measured the patient's noninvasive BP and heart rate (HR). If the patient's systolic arterial pressure (SBP) was > 180 mm Hg and/or diastolic arterial pressure (DBP) was > 110 mm Hg and BP did not decrease after resting for half an hour, the surgeon arranged a physician consultation from the inpatient department to control the patient's BP, and retained or canceled the surgery according to the opinions reached by consultation and the results of the treatment. If the fasting BG was > 10 mmoL or if the random BG was > 12 mmoL, the surgeon canceled the surgery and arranged for an endocrine consultation. If the patient has sudden symptoms such as hypoglycemia, dizziness, headache or discomfort in the waiting area before surgery, the ophthalmologist consulted with the physician and the anesthesiologist to assess whether additional medical treatment was required and whether the surgery needed to be canceled. BP, BG, and other uncomfortable symptom management on the day of surgery were the same for inpatients as for outpatients. In cases of incomplete preoperative consultations or examinations or other situation that makes surgery unsuitable, the ophthalmologist canceled the surgery and reported to the operation center. When an outpatient or inpatient arrived at the operating room, if the SBP was > 180 mm Hg and/or the DBP was > 110 mm Hg and the BP did not decrease after rest followed by intravenous administration of midazolam 2~3 mg for 10~30 minutes, the surgeon canceled the operation and arranged for internal medicine consultation.

The surgery center is responsible for registering the same-day cancellation cases, including information on the patient's name, sex, age, type of scheduled surgery, anesthesia type, operator name, and reason for the cancellation,

and for verifying the reason by telephone the day after the operation to ensure that the registered reason for the cancellation is objective and accurate.

The details for the same-day cancellation cases registered at our surgery center were obtained. According to the literature, we classified the reasons for same-day cancellation in our hospital roughly into three categories: (1) patient reasons, (2) medical factors, and (3) administrative problems.[17] Patient reasons refer to patients who do not attend their hospital appointments or refuse surgery. Medical reasons refer to the deterioration of patients' health, such as hypertension, hyperglycemia or other cardiovascular and cerebrovascular events. Administrative problems include staff shortages due to various reasons, lack of surgical equipment and unrealistic surgery schedules due to lack of operation room or long waiting times.

Post-Cancellation Management

Follow-up data over the next year for all canceled cases, including medical adjustment, additional waiting periods, next preoperative evaluation, next surgery type (hospitalization or ambulatory surgery), next anesthesia type, and whether rescheduled surgeries were completed, were all recorded.

Statistical Analysis

Statistical analyses were carried out with IBM SPSS 24 software (SPSS Inc., Chicago, IL, USA). Qualitative data are presented as numbers and percentages. Demographic data were evaluated for normality with the Kolmogorov–Smirnov test. Patients with and without surgical cancellation were compared according to demographic and clinical characteristics by Pearson's chi-square test or Fisher's exact test for categorical variables, while continuous variables were compared using *t*-tests (normally distributed) or Mann-Whitney *U*-tests (nonnormally distributed).

Results

Patient Demographics

A total of 1810 consecutively scheduled PDR operations of 1367 patients who underwent the first surgery of PPV or secondary surgery of PPV with silicone oil removal, with/without cataract surgery, were identified from January 2019 to April 2021. Of these, 1509 (83.4%) cases were managed as inpatients, and 301 (16.6%) cases were managed as outpatients. Outpatient surgery increased significantly after the COVID-19 outbreak (Figure 1). Patient demographics, comorbid disease, types of surgical procedures, ASA grade, and anesthetic methods are summarized in Table 1. In the comparison of the demographics of each group, outpatients were younger (51yr versus 52 yr, $P < 0.001$), had less proportion of hypertension (60.5% vs 74.0%, $P < 0.001$), coronary artery disease (10.0% vs 18.8%, $P < 0.001$), renal insufficiency (9.3% vs 18.0%, $P < 0.001$) and cerebrovascular diseases (1.0% vs 11.4%, $P < 0.001$), had a lower

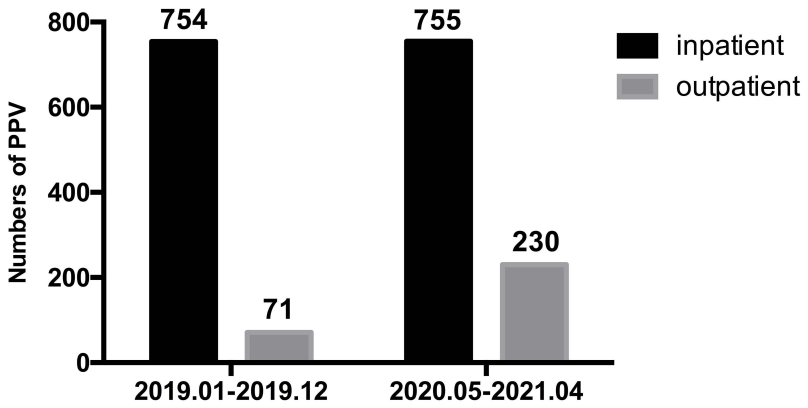

Figure 1 Numbers of pars plana vitrectomy (PPV) performed one year before COVID-19 outbreak (January, 2019 to December, 2019) and after COVID-19 outbreak (May, 2020 to April, 2021).

Table 1 Demographics of PDR Inpatients and Outpatients Receiving PPV

	Inpatient (n = 1509)	Ambulatory (n = 301)	P value*
Male sex n (%)	884 (58.6%)	182 (60.5%)	0.544
Age (yr)	52 (44–59)	51 (42–57)	0.034
BMI (kg/m^2)	25.4 (23.2–28.1)	25.5 (23.4–27.0)	0.828
Comorbid disease n (%)			
Hypertension	1117 (74.0%)	182 (60.5%)	< 0.001
Coronary heart disease	283 (18.8%)	30 (10.0%)	< 0.001
PTCA history	147 (9.7%)	12 (4.0%)	0.001
Renal insufficiency	270 (18.0%)	28 (9.3%)	< 0.001
End-stage renal disease	59 (3.9%)	2 (0.7%)	0.004
Cerebrovascular diseases	172 (11.4%)	3 (1.0%)	< 0.001
Mental disease	78 (5.2%)	8 (2.7%)	0.062
Thyroid disease	20 (1.3%)	2 (0.7%)	0.339
ASA grade n (%)			< 0.001
I–II	1096 (72.6%)	256 (85.1%)	
III	413 (27.4%)	45 (14.9%)	
Type of surgery n (%)			0.003
PPV	1219 (80.8%)	220 (73.1%)	
Silicone oil removal	290 (19.2%)	81 (26.9%)	
Type of anesthesia n (%)			< 0.001
General anesthesia	1426 (95.0%)	241 (80.1%)	
Reginal anesthesia with MAC	83 (5.0%)	60 (19.9%)	

Notes: Data are presented as n (%) or median (25th and 75th percentile). *P values were calculated by Chi-square or Fisher's exact test for categorical variables and the Mann-Whitney *U*-tests for nonnormally distributed continuous variables.
Abbreviations: PDR, proliferative diabetic retinopathy; PPV, pars plana vitrectomy; BMI, body mass index; PTCA, percutaneous trans luninal coronary angioplasty; ASA, American Society of Anesthesiologists Physical Status; MAC, monitored anesthesia care.

proportion of ASA III grade (14.9% versus 27.4%, $P < 0.001$), had a lower proportion of general anesthesia (80.1% versus 95.0%, $P < 0.001$) and had a higher proportion of PPV with silicone oil removal (26.9% versus 19.2%, $P = 0.003$).

Surgery Cancellations and Reasons

Ninety-four (5.2%) of the 1810 operations, including procedures of 57 inpatients and 37 outpatients, experienced same-day cancellations (Table 2). The same-day cancellation proportion was significantly higher for outpatients than for inpatients (12.3% vs 3.8%, $P < 0.001$). When the reasons for cancellation were compared, outpatients had a significantly higher proportion of medical factors than inpatients (91.9% vs 68.4%, $P = 0.012$). Of the 94 cancellations, uncontrolled hypertension (BP > 180/110 mmHg) occurred in 22 (38.6%) inpatient cases and 21 (56.8%) outpatient cases, making this the most common reason for surgical cancellation for both inpatients and outpatients. Hyperglycemia occurred in 5 (8.8%) inpatient cases and 4 (10.8%) outpatient cases, making this the second most common reason for surgical cancellation. Four inpatient cases had symptoms of cardiac insufficiency, 2 inpatient cases had a history of cerebral

Table 2 Reasons for Same-Day Cancellation Categorized as Medical, Patient and Administrative

Reasons	Inpatient (n = 57)	Ambulatory (n = 37)	P value*
Medical n (%)	39 (68.4%)	34 (91.9%)	0.012
Patient n (%)	8 (14.0%)	3 (8.1%)	
Administrative n (%)	10 (17.5%)	0 (0.0%)	
Medical			–
Uncontrolled hypertension	22 (38.6%)	21 (56.8%)	
Hyperglycemia	5 (8.8%)	4 (10.8%)	
Cardiac insufficiency	4 (7.0%)	0 (0.0%)	
Angina	0 (0.0%)	2 (5.4%)	
Cerebral ischemia	2 (3.5%)	0 (0.0%)	
Hyperkalemia	2 (3.5%)	1 (2.7%)	
Required additional consultation	3 (5.3%)	5 (13.5%)	
Infection or fever	1 (1.8%)	1 (2.7%)	
Patient			
Patient rejection	4 (7.0%)	1 (2.7%)	
Patient no-show	0 (0.0%)	2 (5.4%)	
No family care	2 (3.5%)	0 (0.0%)	
NBM violations	2 (3.5%)	0 (0.0%)	
Administrative			
Scheduling problems	6 (10.5%)	0 (0.0%)	
Procedure no longer required	4 (7.0%)	0 (0.0%)	

Notes: Data are presented as n (%). *P values were calculated Fisher's exact test for categorical variables.
Abbreviation: NBM, nothing by mouth.

ischemia and had significant neurological symptoms, 2 outpatient cases suffered angina several days before surgery, 2 inpatients and 1 outpatient needed emergency hemodialysis due to hyperkalemia. In addition, 3 inpatients and 5 outpatients required further internal consultation because of unstable systemic diseases.

Outcomes Following Surgery Cancellation

Thirty-six (63.2%) inpatients operations and 30 (81.1%) outpatients operations that had previously been canceled were rescheduled (Table 3). All 36 inpatient cases complete the surgery after the first cancellation. Surgery was successfully completed in 28 outpatient cases, among whom 11 outpatients were switched to inpatient surgeries for better perioperative care. Surgery was not completed for two outpatients who were rescheduled for inpatient surgery, and were cancelled again because control of systemic disease was still poor. The median amount of additional waiting days for rescheduled surgery among outpatients was significantly higher than that among inpatients (14.0 vs 7.0, $P < 0.001$). Three inpatients and 1 outpatient who were originally scheduled for general anesthesia received regional anesthesia with MAC instead, and 1 outpatient who was originally scheduled for regional anesthesia with MAC was switched to general anesthesia. One inpatient whose first surgery was canceled was admitted to the intensive care unit because of cardiac insufficiency after completing the rescheduled surgery.

Table 3 Follow-Up of Same-Day PPV Cancellation

	Inpatient (n = 57)	Ambulatory (n = 37)	P value*
Rescheduled surgery n (%)	36 (63.2%)	30 (81.1%)	0.063
Additional waiting time (day)	7.0 (4.3–10.8)	14.0 (7.0–39.5)	< 0.001
Changed to inpatient surgery n (%)	–	11 (29.7%)	–
Rescheduled anesthesia type n (%)			–
GA changed to MAC	3 (5.3%)	1 (2.7%)	
MAC changed to GA	0 (0.0%)	1 (2.7%)	
Unanticipated ICU admission n (%)	1 (1.8%)	0 (0.0%)	–

Notes: Data are presented as n (%). **P* values were calculated Fisher's exact test for categorical variables.
Abbreviations: PPV, pars plana vitrectomy; GA, general anesthesia; MAC, monitored anesthesia care.

Discussion

With the rapid increase of ambulatory PPV, the number of patients with comorbidities has increased. For efficient and safe ambulatory PPV, the surgeon should consider appropriate patient selection and avoid surgery cancellation. In our study, we found that same-day PPV cancellation of PDR surgery for both outpatients and inpatients occurs in 5.2% of procedures performed at our surgery center. Although the outpatient group was younger and comprised fewer comorbid diseases, easier procedures and more regional anesthesia with MAC, the cancellation rate for this group was 12.3%, more than three times higher than that of inpatients (3.8%). The most common reason overall for surgical cancellation was medical factors, which occurred more frequently in outpatients than in inpatients (91.9% vs 68.4%). This is to be expected and has great significance for clinical decision-making, as both ophthalmic surgeons and anesthesiologists are involved in deciding the type of eye surgery, the suitability of the patient for ambulatory surgery, and how same-day cancellation can be avoided.

A comprehensive and thorough preoperative evaluation by a clinical specialist is the most effective preventive intervention for the same day of surgical cancellation. Several studies have reported that inpatient cases have much higher cancellation rates than outpatient cases.[16,18] Epstein et al reported that the inpatient cancellation incidence on the day of surgery was 11.8%.[19] They attributed the high cancellation rate of inpatients to the limited preoperative evaluation time, since most canceled inpatients were scheduled the day before surgery. Franklin et al reported that outpatients who received a preoperative clinical or virtual evaluation by phone can achieve a cancellation rate of $\leq 2\%$.[16] In our study, we found that even though our PDR patients received care from the same preoperative evaluation group and surgical group, and our outpatients had a better overall systemic condition and less complicated surgical procedures, the surgery cancellation rate for outpatients was more than three times higher than that of inpatients. Since most PDR patients received intravitreal injection of VEGF inhibitors prior to the surgery, unanticipated surgical cancellation may lead to progression of the tractional detachment. It is worth paying addressing why the cancellation rate is high in this group and whether this type of surgery can be safely performed without hospitalization.

Poor control of comorbidities, particularly hypertension and hyperglycemia, is the major cause of PPV cancellation for PDR patients in our study. This phenomenon is more common in outpatients, even though all patients underwent the same standard preoperative internal medicine and anesthesia evaluation. Poor control of BG and BP is a risk factor for delayed vitreous rebleed,[20] and preoperatively uncontrolled hypertension is strongly associated with peri-operative cardiovascular death and cerebrovascular adverse events.[21] Ophthalmic surgery is generally considered a low-risk surgery, and the surgical risk is closely related to the patient's underlying disease. Both our ophthalmologists and anesthesiologists agree that good control of the patient's BP and BG avoids perioperative adverse events and leads to a better surgical outcome. However, the question is why the patients, especially among outpatients, have acceptable BP and BG control during preoperative consultation but have abnormalities before surgery. Inappropriate activation of the

renin–angiotensin–aldosterone system (RAAS) and sympathetic nervous system (SNS), mitochondrial dysfunction, oxidative stress, and inflammation play major roles in the development of insulin resistance and type 2 diabetes-induced hypertension.[22] During the preoperative period, there is a "white-coat effect" of hypertension, possibly due to activation of the hypothalamic–pituitary–adrenal axis and the sympathetic–adrenal medullary system and the RAAS, leading to increased secretion of adrenocorticotropic hormone, cortisol, norepinephrine, epinephrine, and angiotensin, which may manifest as higher BP. Schonberger et al observed significantly higher preoperative office BP levels than home BP levels, and they confirmed that elevated preoperative BP values usually correspond to poorly controlled or even undiagnosed hypertension.[23] The incidence of poorly controlled or even undiagnosed hypertension in our patients, especially outpatients, might be relatively high because there are fewer opportunities for BP monitoring by a professional before surgery; this issue needs further study. Additionally, for outpatients, same-day surgery means taking a long trip to the hospital, having an irregular diet and sleeping at a hotel near the hospital before surgery, getting up early on the day of surgery and going through the tedious hospitalization procedures. All these additional activities exacerbate the patient's nervousness and anxiety, lead to physical exhaustion, and further increase BP and BG. Based on our results, we recommend enhanced preoperative BP and BG monitoring for all PDR patients undergoing PPV surgery to reduce the risk of same-day surgical cancellation due to poor BP or BG, especially for outpatients. If possible, healthcare providers should provide outpatients with a comfortable preoperative preparation process, ensure good preoperative sleep, and reduce preoperative physical and mental exertion. Preoperative medicine to relieve anxiety or control BP might be considered if necessary.

More outpatients than inpatients completed the surgery after a longer additional time for rescheduling. For these outpatients, preoperative medication adjustment and intensive medical management for half a month was effective to control hypertension and hyperglycemia in our study. Among our PDR inpatients, severe coronary heart disease, diabetic cardiomyopathy, cerebral infarction, and other systemic instability diseases are the largest barriers because both patients and ophthalmic surgeons are unwilling to risk serious cardiovascular and cerebrovascular events during the perioperative period. Some of them received intravitreal injection of VEGF inhibitors and regular follow-up. In addition, unanticipated ICU admission for PDR patients after surgery is not uncommon in our hospital. We think that a multidisciplinary preoperative evaluation team, including ophthalmologists, anesthesiologists, physicians and appropriate specialists, is needed to conduct appropriate preoperative evaluations of PDR patients and to develop appropriate measures to prevent perioperative hypertension, hyperglycemia and other cardiovascular and cerebrovascular events.

Preoperative anesthesia evaluation is designed to optimize the medical condition of a patient before surgery, make an anesthetic plan, and is effective for reducing unanticipated surgery cancellations. So far, there is no evidence of the best type of anesthesia for ambulatory PPV surgery, but it is usually performed under general anesthesia or regional anesthesia with MAC. Compared with general anesthesia, regional anesthesia with MAC provides faster functional recovery, better pain control, and fewer complications, such as intraoperative hypotension.[24] However, studies have shown that two-thirds of patients heard the surgeons talking and that one-third of patients reported objects moving during PPV with MAC.[25] In terms of analgesic eye relaxation and the surgical eye position, the satisfaction of patients and surgeons with regional anesthesia was only one-fourth that with general anesthesia. Surgery in cases when regional anesthesia is imperfect can lead to pain and severe hemodynamic fluctuations in PDR patients. More outpatients underwent regional anesthesia with MAC, and cancellation was higher among outpatients in our study; however, we cannot determine whether anesthesia type is associated with same-day cancellation. The choice of anesthesia method is complicated by the preferences of the surgeon and patient, and the recommendation of the anesthesiologist. In general, the ophthalmologist arranges general anesthesia when the surgical procedure is expected to be complex and long, the patient's cooperation is poor, and the patient does not want to experience the surgical procedure. Regional anesthesia with MAC is considered more often in our outpatients, since they tend to be arranged for easier procedures such as silicone oil removal. In our study, patients for regional anesthesia with MAC needed to meet similar preoperative evaluation criteria for general anesthesia. The main reasons for surgery cancellation of outpatients were mainly hypertension and hyperglycemia. We believe that the patient's medical condition is the main reason for the cancellation of ambulatory surgery.

Limitations

Our study has some limitations that should be noted. First, we found that uncontrolled hypertension was the main reason for same-day cancellation of PPV in PDR patients. However, we were unable to identify the high-risk factors for the cancellation of PPV due to hypertension because this was a retrospective study and the diagnosis and treatment of hypertension were not described in detail in the cases. In addition, some patients might have undiagnosed hypertension before surgery. Further prospective studies are needed to predict which patients are more likely to develop preoperative hypertension and to intervene early to reduce the rate of same-day PPV cancellation. Second, scheduling a patient for outpatient surgery or inpatient surgery is influenced by multiple factors in our hospital and does not depend solely on the patient's systemic disease status. Ophthalmologists play a leading role in scheduling the surgical type regarding hospitalization versus non-hospitalization; however, they do not have uniform standards. The recommendations of physicians and anesthesiologists are complementary, because they only recommend patients with highly medical problems, such as severe coronary heart disease, cognitive dysfunction, or renal failure requiring dialysis, for hospitalization. This may have biased our results. We had 11 outpatients who switched to inpatient surgery for better perioperative care after the first same-day cancellation, and 2 eventually gave up PPV surgery because of serious cardiovascular disease. To reduce the same-day cancellation rate of PPV in PDR outpatients, multidisciplinary discussions are needed on inclusion criteria for these outpatients.

Conclusion

Ambulatory PPV for PDR is increasing, and same-day cancellation is higher in outpatients than in inpatients. The main reason for outpatient cancellation is uncontrolled diabetic related systemic diseases, which can be effectively treated after intensive medical management. One factor to reduce ambulatory PPV cancellation is to strengthen the monitoring of preoperative systemic comorbidities and adjust medication if necessary.

Data Sharing Statement

The raw data supporting the conclusions of this article will be available by the authors, without undue reservation. After the article is published, readers can contact the corresponding author to obtain data by email.

Acknowledgments

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Disclosure

The authors report no conflicts of interest in this work.

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