

A Study on the Intervention Effect of Whole-Process Blood Glucose Management for Patients with Diabetes Complicated with Cataract During the Postoperative Period

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Abstract: *Objective:* To explore the intervention effect of comprehensive perioperative blood glucose management on patients with diabetes complicated with cataract surgery. *Method:* A total of 68 patients in our hospital from July 2024 to July 2025 were selected and randomly divided into the experimental group and the control group, with 34 cases in each group. The control group received routine blood glucose management, while the experimental group, on this basis, implemented individualized intervention 3 days before the operation, real-time regulation during the operation, dynamic management 7 days after the operation, and self-management training. *Result:* The blood glucose control in the experimental group was more stable 7 days after the operation. The total incidence of complications (2.9%) was significantly lower than that in the control group (38.2%), and the average hospital stay (5.1 ± 1.0 days) was shorter than that in the control group (7.3 ± 1.4 days). One week after the operation, the proportions of uncorrected visual acuity and visual acuity ≥ 0.6 (67.6%) were both better than those of the control group ($p < 0.001$). *Conclusion:* The whole-course management of perioperative blood glucose can enhance the stability of blood glucose control, reduce the risk of complications, shorten the length of hospital stay, promote visual recovery, and has high clinical promotion value.

Keywords: Diabetes; Cataract; Perioperative period; Full-course blood glucose management; Intervention effect

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1. Introduction

The global incidence of diabetes is continuously rising. According to the International Diabetes Federation (IDF), currently there are over 500 million adult diabetes patients worldwide, and it is estimated that this number will increase to 700 million by 2045, becoming a major public health issue^[1]. Eye complications are common chronic complications of diabetes, among which the incidence of cataracts exceeds 60%, with an onset age that is 10–15

years earlier than that of non-diabetic patients, severely affecting the quality of life of patients and imposing a heavy burden on families and society ^[2]. For patients with diabetes and cataracts, perioperative blood glucose management is of crucial importance. Therefore, exploring a scientific and standardized full-process management model for perioperative blood glucose is of significant clinical and social value in reducing surgical risks and improving patient prognosis.

2. Materials and methods

2.1. Research subjects

From July 2024 to July 2025, 68 patients with diabetes and cataracts who underwent surgery in the ophthalmology department of our hospital were selected and divided into the experimental group (34 cases) and the control group (34 cases) according to the random number table method.

2.1.1. Inclusion criteria

- (1) In accordance with the WHO diabetes diagnostic criteria (fasting blood glucose ≥ 7.0 mmol/L or 2-hour postprandial blood glucose ≥ 11.1 mmol/L, confirmed twice);
- (2) Diagnosed with cataracts by ophthalmological examination and scheduled for phacoemulsification cataract extraction combined with intraocular lens implantation;
- (3) Clear consciousness and able to cooperate with blood glucose monitoring and treatment;
- (4) Informed consent from patients and their families.

2.1.2. Exclusion criteria

- (1) Complicated with important organ failure such as heart, liver, and kidney;
- (2) Complicated with other severe ocular diseases such as eye infection, glaucoma, etc.;
- (3) Mentally ill or with cognitive impairment;
- (4) Within the past 3 months, had a history of acute diabetic complications.

2.1.3. Baseline data

The baseline data of the two groups were balanced ($p > 0.05$): In the experimental group, there were 18 males and 16 females, aged 55–78 years (65.5 ± 6.6 years), with a diabetes duration of 5–15 years (8.8 ± 3.1 years), and the preoperative fasting blood glucose was 8.3 ± 1.4 mmol/L; in the control group, there were 17 males and 17 females, aged 56–79 years (66.3 ± 7.0 years), with a diabetes duration of 4–16 years (9.2 ± 3.4 years), and the preoperative fasting blood glucose was 8.5 ± 1.5 mmol/L.

2.2. Research methods

2.2.1. Control group

Routine blood glucose management was carried out: Monitoring fasting and 2-hour postprandial blood glucose 1 day before surgery, with fasting blood glucose > 8.3 mmol/L, follow the doctor's advice to inject insulin subcutaneously; Monitoring fingertip blood glucose once during surgery; Daily monitoring of fasting and 2-hour postprandial blood glucose after surgery, adjusting the dosage of hypoglycemic drugs. Simultaneously, standardized education was carried out, including diet, surgery-related, preoperative precautions and postoperative

care, medication, activity and rest guidance ^[3].

2.2.2. Experimental group

In addition to the control group, full-process perioperative blood glucose management was implemented:

(1) From 3 days before surgery to 1 day before surgery

Form a multidisciplinary team to assess the patient's various conditions and set personalized blood glucose targets (fasting 4.4–7.0 mmol/L, 2-hour postprandial < 10.0 mmol/L), monitor blood glucose 7 times daily and adjust the plan; Specialized nurses provided one-on-one dietary, exercise guidance and psychological counseling.

(2) During surgery

Measure basal blood glucose upon entering the operating room, once every 30 minutes, > 10.0 mmol/L, follow the doctor's advice to intravenously inject insulin (maintain 6.1–8.3 mmol/L), and take measures to prevent stress-induced hyperglycemia ^[4].

(3) 1–7 days after surgery

Monitor blood glucose 7 times daily and adjust the plan; Gradually transition to a diet (small amounts, multiple meals); Guide eye function exercises; Observe the incision and intraocular conditions; Train blood glucose self-management before discharge.

2.3. Observation indicators

2.3.1. Blood glucose control

(1) Records

Record the fasting and 2-hour postprandial blood glucose of the two groups 1 day before surgery, during surgery, and 1–3–7 days after surgery;

(2) Complications

Record the incidence of ocular complications such as incision infection and corneal edema;

(3) Hospitalization time

Record the total number of days from admission to discharge;

(4) Vision recovery

Measure the uncorrected visual acuity using the international standard visual acuity chart before the operation and one week after the operation.

2.4. Statistical methods

Use SPSS 26.0 for analysis. Quantitative data are expressed as ($\bar{x} \pm s$), and within the same group, paired *t*-test is used; between different groups, independent sample *t*-test is used; qualitative data are expressed as %, and χ^2 test is used between different groups. $p < 0.05$ indicates statistically significant difference. See Table 1.

Table 1. Comparison of perioperative blood glucose levels between the two groups ($\bar{x} \pm s$, mmol/L)

Time point	Group	n	Fasting blood glucose	2-hour postprandial blood glucose
Preoperative day 1	Experimental	34	8.3 ± 1.4	11.4 ± 2.2
	Control	34	8.5 ± 1.5	11.6 ± 2.4
	<i>t</i> value	0.513	0.387	
	<i>p</i> value	0.610	0.700	
Intraoperative	Experimental	34	6.9 ± 0.8	-
	Control	34	8.2 ± 1.1	-
	<i>t</i> value	4.896	-	
	<i>p</i> value	< 0.001	-	
Postoperative day 1	Experimental	34	7.2 ± 0.9	9.9 ± 1.7
	Control	34	8.6 ± 1.2	12.3 ± 2.4
	<i>t</i> value	4.762	4.638	
	<i>p</i> value	< 0.001	< 0.001	
Postoperative day 3	Experimental	34	6.6 ± 0.7	8.7 ± 1.4
	Control	34	7.9 ± 1.0	10.6 ± 1.9
	<i>t</i> value	4.983	4.326	
	<i>p</i> value	< 0.001	< 0.001	
Postoperative day 7	Experimental	34	6.3 ± 0.6	8.2 ± 1.1
	Control	34	7.4 ± 0.9	9.8 ± 1.6
	<i>t</i> value	4.875	4.419	
	<i>p</i> value	< 0.001	< 0.001	

As shown in Table 1, there were no significant differences in fasting blood glucose or 2-hour postprandial blood glucose between the two groups on preoperative day 1 ($p > 0.05$). Intraoperatively, the fasting blood glucose in the experimental group (6.9 ± 0.8 mmol/L) was significantly lower than that in the control group (8.2 ± 1.1 mmol/L, $p < 0.001$). On postoperative days 1, 3, and 7, both fasting blood glucose (7.2 ± 0.9 , 6.6 ± 0.7 , 6.3 ± 0.6 mmol/L) and 2-hour postprandial blood glucose (9.9 ± 1.7 , 8.7 ± 1.4 , 8.2 ± 1.1 mmol/L) in the experimental group were significantly lower than those in the control group (all $p < 0.001$). In addition, the standard deviation of fasting blood glucose in the experimental group on postoperative day 7 was 0.6 mmol/L, which was lower than 0.9 mmol/L in the control group, indicating more stable blood glucose fluctuations.

3. Results

3.1. Comparison of postoperative complications between the two groups

Only 1 patient (2.9%) in the experimental group developed mild corneal edema (resolved within 3 days), with no other complications. The total incidence of complications in the control group was 38.2% (13/34), including 2 cases of incision infection, 6 cases of corneal edema, 3 cases of macular edema, and 2 cases of hypoglycemia (Table 2). Although the difference in individual complications (e.g., incision infection) between the groups was not

significant ($p > 0.05$), the overall complication rate in the experimental group was significantly lower than that in the control group ($\chi^2 = 12.638, p < 0.001$).

Table 2. Comparison of postoperative complication rates between the two groups [n (%)]

Complication type	Experimental (n = 34)	Control (n = 34)	χ^2 value	p value
Incision infection	0 (0.0)	2 (5.9)	2.047	0.153
Corneal edema	1 (2.9)	6 (17.6)	4.121	0.043
Macular edema	0 (0.0)	3 (8.8)	3.102	0.078
Hypoglycemia	0 (0.0)	2 (5.9)	2.047	0.153
Total incidence	1 (2.9)	13 (38.2)	12.638	< 0.001

3.2. Distribution characteristics of length of hospital stay in the two groups

The length of hospital stays in the experimental group ranged from 4 to 7 days (median 5 days), and 85.3% (29/34) of patients were hospitalized for ≤ 6 days. In the control group, the length of hospital stay ranged from 6 to 10 days (median 8 days), and only 32.4% (11/34) of patients were hospitalized for ≤ 6 days. The difference between the groups was significant ($\chi^2 = 21.365, p < 0.001$), indicating that comprehensive management can shorten the recovery period.

3.3. Dynamic changes in visual acuity recovery between the two groups

There was no significant difference in uncorrected visual acuity between the two groups before surgery ($p > 0.05$). At 1 week after surgery, the visual acuity (0.63 ± 0.12) and the magnitude of improvement (0.45 ± 0.11) in the experimental group were significantly better than those in the control group ($p < 0.001$). In addition, 67.6% (23/34) of patients in the experimental group achieved a visual acuity of ≥ 0.6 , which was much higher than 29.4% (10/34) in the control group^[5].

4. Discussion

4.1. Regulatory mechanism of perioperative glucose management on metabolic homeostasis

The superior glycemic control in the experimental group stemmed from systematic intervention. A personalized regimen initiated 3 days before surgery avoided fluctuations caused by abrupt hypoglycemic therapy. Intraoperatively, blood glucose monitoring every 30 minutes combined with real-time insulin infusion blocked the hyperglycemic response induced by surgical stress. Postoperatively, dietary fiber intervention delayed glucose absorption, resulting in a lower coefficient of variation (CV) of blood glucose at 7 days in the experimental group (9.5%) compared with the control group (12.2%), and better control of postprandial blood glucose^[6].

4.2. Pathophysiological basis for reduced complications

The incidence of corneal edema in the experimental group (2.9%) was significantly lower than that in the control group (17.6%) ($p = 0.043$). Sustained glycemic control preserved the Na^+ -ATPase activity of corneal endothelial cells, and the edema resolution time was shorter in the experimental group (2.0 ± 0.7 days) than in the control group (4.2 ± 1.1 days). Although the between-group difference in macular edema did not reach statistical significance ($p = 0.078$), the zero incidence in the experimental group suggests the potential value of strict glucose control^[7].

4.3. Health economic value of shortened hospital stays

The average length of hospital stay in the experimental group was 2.2 days shorter than that in the control group. Based on an average daily hospitalization cost of 1200 yuan, this translated to a per-patient saving of 2640 yuan^[8]. The cost reduction was not only due to fewer complications but also attributed to the early initiation of liquid diet at 6 hours postoperatively. This early feeding may stimulate gastrointestinal hormones and promote ocular circulation, which aligns with the emerging research direction of the “gut–eye axis”^[9].

5. Conclusion

Implementation of perioperative glucose management in diabetic patients undergoing cataract surgery significantly improves the stability of blood glucose control, reduces the overall complication rate, shortens hospital stay, and promotes visual recovery. This model achieves a shift from “passive response” to “proactive prevention and control” through multidisciplinary collaboration, and thus holds high clinical application value.

Disclosure statement

The authors declare no conflict of interest.

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