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# Oral Glucose Combined with Short-Term Intravenous Nutrition for the Prevention of Hypoglycemia after Endoscopic Colorectal Polypectomy

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## Abstract

**Objective:** To investigate the effect of oral glucose combined with short-term intravenous nutrition on the prevention of hypoglycemia after endoscopic colorectal polypectomy and to provide guidance for better management of such patients. **Methods:** 860 patients who underwent endoscopic colorectal polypectomy for colorectal polyps in the Department of Gastroenterology of the First Affiliated Hospital of Yangtze University from January 2020 to December 2021 were selected for the study. The patients were divided into experimental and control groups according to the random number table method, with 430 patients in each group. In the control group, 3 L of polyethylene glycol electrolyte dispersion was used for preoperative intestinal preparation and postoperative fasting was performed routinely for 24 h. Short-term intravenous nutrition support was provided by rehydration, and finger blood glucose was monitored at 1, 4, and 8 h after intravenous infusion or when there were symptoms such as panic and cold sweat; in the experimental group, oral glucose intervention was implemented on the basis of the control group. The incidence of postoperative hypoglycemia, quality of bowel preparation, and tolerance of patients during bowel preparation were compared between the 2 groups. **Results:** The incidence of postoperative blood glucose < 3.9 mmol/L, incidence of hypoglycemic reaction, and incidence of hypoglycemia in the experimental group were significantly lower than those in the control group, and there were no significant differences in intestinal cleanli-

ness and tolerability between the experimental and control groups. **Conclusion:** Based on the present study population, oral glucose combined with short-term intravenous nutrition can effectively prevent the incidence of hypoglycemia in patients after endoscopic colorectal polypectomy; however, this was limited to a single-center study and the number of cases was small.

## Keywords

Colorectal Polyps, Endoscopic Polypectomy, Intravenous Nutrition, Glucose, Hypoglycemia

## 1. Introduction

Colorectal cancer (CRC) is a major cancer that threatens the life and health of the population [1]. Colorectal polyps are bulging lesions that protrude from the surface of colorectal mucosa into the intestinal lumen [2]. Studies have shown that surgical removal of colorectal polyps that are prone to malignant transformation helps reduce the incidence and mortality of colorectal cancer [3]; therefore, early removal of colorectal polyps is crucial for the prevention of colorectal cancer [4]. Currently, colorectal polypectomy through endoscopy is the preferred treatment modality for colorectal polyps because of its advantages of simple operation, minimal trauma, rapid recovery, low cost, and wide applicability to the population [5]. However, in long-term clinical practice, while endoscopic colorectal polypectomy has achieved good results, postoperative hypoglycemia is a complication with a high incidence, which adversely affects the postoperative recovery of patients. Therefore, it is important to prevent and reduce the occurrence of postoperative hypoglycemia after endoscopic colorectal polypectomy. A review of the literature reveals that there are no relevant guidelines or expert consensus regarding specific measures. Therefore, this study was conducted to investigate the feasibility, safety, and efficacy of oral glucose combined with short-term intravenous nutrition for the prevention of hypoglycemia after endoscopic colorectal polypectomy in 860 patients admitted to the Department of Gastroenterology of the First Affiliated Hospital of Yangtze University to reduce the incidence of hypoglycemia after endoscopic colorectal polypectomy in clinical practice. We aim to provide a certain reference for reducing the incidence of hypoglycemia after endoscopic colorectal polypectomy.

## 2. Materials and Methods

### 2.1. Study Population

This study included 860 patients who underwent argon plasma coagulation (APC) or endoscopic mucosal resection (EMR) for colorectal polyps in the Department of Gastroenterology of the First Affiliated Hospital of Yangtze University between January 2020 and December 2021 as study subjects. The patients were divided into experimental and control groups according to the random

number table method, with 430 patients in each group. The inclusion criteria were as follows: 1) colorectal polyps treated with APC or EMR and 2) informed consent from patients and their families and signed the informed consent form. Exclusion criteria were as follows: 1) patients with diabetes; 2) patients with obvious bleeding tendency; 3) patients with mental disorders and serious cardiovascular diseases who could not cooperate; 4) patients who refused to undergo endoscopic treatment, refused to follow medical advice, were automatically discharged from the hospital, and had incomplete clinical data. The study was approved by the Ethics Committee of the First Affiliated Hospital of Yangtze University. Exclusion criteria: Those who withdrew midway or fasted for more than 24 h after surgery.

## 2.2. Study Methods

Patients in the control group were administered 3 L of polyethylene glycol electrolyte bulking regimen in divided doses for preoperative bowel preparation [6], that is, a clear liquid diet 1 d before surgery, 1 L at 8:00 pm. 1 d before surgery, and 2 L 6 h before surgery until the patient passed clear watery stools and then underwent endoscopic surgery at the endoscopy center between 8:00 am and 12:00 pm. Bowel preparation quality was rated by the operator using the Boston bowel preparation scale (BBPS) [7]. After the operation, the patients fasted for 24 h. Short-term intravenous nutritional support was provided in the form of rehydration fluids, with a basal rehydration volume of 2000 ml, specifically, a low-rate intravenous drip of 10% dextrose injection 500 ml + 5% dextrose injection 500 mL + 10% dextrose injection 500 ml + 500 mL dextrose sodium chloride injection. After 24 h, the fluid diet was opened and the mice were transitioned to a normal diet after 1 week. The nurses on duty monitored the patients' finger blood glucose at 1, 4, and 8 h after the completion of postoperative intravenous infusion or when there were symptoms such as panic and cold sweat, respectively. Diagnostic criteria of hypoglycemia [8]: blood glucose < 3.9 mmol/L was considered as hypoglycemia, or blood glucose ≥ 3.9 mmol/L, but there were hypoglycemic reactions such as hunger, panic, dizziness and cold sweat. Those who had hypoglycemia or hypoglycemic reaction during the fasting period were administered 50% glucose injection 20 - 40 ml intravenously or 10% glucose injection 250 ml intravenously, and the terminal blood glucose was retested after 30 min.

The patients in the experimental group were administered oral glucose intervention on the basis of the control group, that is, 1 d before the operation, 1 L of polyethylene glycol electrolyte dispersion plus 40 ml of oral 50% glucose solution at 8 pm on the first day, 2 L of polyethylene glycol electrolyte dispersion plus 60 ml of oral 50% glucose solution 6 h before the operation, and the rest was the same as the control group.

## 2.3. Observation Index

To observe the incidence of postoperative hypoglycemia, the quality of bowel

preparation, and tolerance of patients during bowel preparation in the two groups.

### 2.4. Statistical Analysis

SPSS 22.0 software was used for statistical analysis of the data. Mean ± SD was used to describe the data of continuous variables, and ANOVA or chi-square test was used for comparison between groups, and $P < 0.05$ was considered a statistically significant difference.

## 3. Results

### 3.1. Basic Information of Patients

A total of 860 patients were divided into the experimental and control groups according to the random number table method (n = 430). Seven patients were withdrawn in the middle of 860 cases: four cases of postoperative gastrointestinal bleeding and fasting time of more than 24 h in the control group, 426 cases were included; three cases of postoperative gastrointestinal bleeding and a fasting time of more than 24 h in the experimental group, and 427 cases were included. In the control group, there were 216 males and 210 females, aged 24 - 86 years, with a mean of (44.83) years, 348 cases undergoing APC and 78 cases undergoing EMR. In the experimental group, there were 209 males and 218 females aged 32 - 83 years, with a mean of (47.33) years, 344 cases of APC, and 83 cases of EMR. There was no statistically significant difference between the baseline data of the two groups ($P > 0.05$) (See Table 1).

### 3.2. Comparison of Postoperative Blood Glucose Values and Hypoglycemia Incidence

The mean blood glucose values at 1 h and 4 h after infusion in the experimental group were higher than those in the control group (9.23 mmol/L vs. 8.82 mmol/L, $P = 0.046$; 7.36 mmol/L vs. 7.1 mmol/L, $P = 0.048$); the mean blood glucose values at 8 h after infusion in the experimental group were higher than those in the control group. Although the difference was not statistically significant, it was still slightly higher than that of the control group (5.53 mmol/L vs. 5.35 mmol/L, $P = 0.69$). The incidence of postoperative blood glucose < 3.9 mmol/L,

Table 1. Basic information of patients in both groups.

| Group | No. of cases | Age (years, Mean ± SD) | Sex (M/F) | Endoscopic resection mode (APC/EMR) |
|---|---|---|---|---|
| Control | 426 | 44.83 ± 11.72 | 216/210 | 348/78 |
| Experimental | 427 | 47.33 ± 10.41 | 209/218 | 344/83 |
| $X^2$/t value | | 0.38 | 0.26 | 0.18 |
| P-value | | 0.63 | 0.61 | 0.67 |

Note: APC: Argon Plasma Coagulation; EMR: Endoscopic Mucosal Resection.

the incidence of hypoglycemic reaction, and the incidence of hypoglycemia were significantly lower in the experimental group than in the control group (3.75% vs. 10.09%, P = 0.000; 1.17% vs. 3.29%, P = 0.036; 4.92% vs. 13.38%, P = 0.000) (See Table 2).

### 3.3. Comparison of Intestinal Cleanliness and Tolerability of Patients

The Boston Bowel Preparedness Scale scores the colon into three segments (cecum and ascending colon, hepatic flexure, transverse colon and splenic flexure, descending colon, sigmoid colon, and rectum), with a score of 0 to 3 for each segment and a total score of 0 - 9. A score > 2 for each segment of the colon indicated adequate bowel preparation; a total score < 6 or a score < 2 for any segment of the colon was considered inadequate bowel preparation [7]. The difference in BBPS scores between the experimental and control patients was not statistically different (6.46 vs. 6.34, P = 0.729). In terms of tolerability, adverse reactions (such as nausea, vomiting, abdominal pain, bloating, cold sweats, hunger, dizziness, fatigue, and palpitations) during bowel preparation were recorded using a questionnaire after completion of bowel preparation in the two groups. Again, there was no statistical difference in the overall incidence of adverse reactions between patients in the experimental and control groups (12% vs. 16%, P = 0.09).

## 4. Discussion

Endoscopic colorectal polypectomy has the advantages of minimal trauma and rapid recovery and is currently the preferred treatment for colorectal polyps. However, clinical experience and relevant literature reports [9] [10] [11] have shown that due to preoperative bowel preparation and general fasting during the perioperative period, the incidence of postoperative hypoglycemia, such as dizziness, panic, and weakness, is as high as 8.98% - 12.50%, which seriously affects the efficacy and recovery of patients. Chen *et al.* [12] showed that age ≥ 60 years, combined type II diabetes, no preoperative rehydration, preoperative fasting time ≥ 10 h, preoperative waiting time ≥ 12 h, preoperative mental stress, and

**Table 2.** Comparison of postoperative blood glucose values and incidence of hypoglycemia between two groups of patients.

| Group | No. of cases | Blood glucose 1 h after infusion (Mean ± SD, mmol/L) | Blood glucose 4 h after infusion (Mean ± SD, mmol/L) | Blood glucose 8 h after infusion (Mean ± SD, mmol/L) | Blood glucose < 3.9 mmol/L (cases) | Hypoglycemic reaction (cases) | Incidence of hypoglycemia (%) |
|---|---|---|---|---|---|---|---|
| Control | 426 | 8.82 ± 1.02 | 7.10 ± 0.63 | 5.35 ± 0.29 | 43 (10.09%) | 14 (3.29%) | 57 (13.38%) |
| Experimental | 427 | 9.23 ± 1.08 | 7.36 ± 0.53 | 5.53 ± 0.58 | 16 (3.75%) | 5 (1.17%) | 21 (4.92%) |
| $X^2$/t value | | 2.027 | 2.007 | 0.28 | 13.34 | 4.38 | 18.38 |
| P-value | | 0.046 | 0.048 | 0.69 | 0.000 | 0.036 | 0.000 |

preoperative late sleep time < 6 h were independent risk factors for hypoglycemia in patients after colonoscopic polypectomy. Effective nursing interventions can reduce the occurrence of postoperative hypoglycemia in patients with colon polyps.

In this study, the incidence of postoperative blood glucose < 3.9 mmol/L, incidence of hypoglycemic reaction, and incidence of hypoglycemia in the experimental group were significantly lower than those in the control group, and there was no significant difference between the experimental and control groups in terms of intestinal cleanliness and tolerance. The incidence of hypoglycemia in patients who underwent endoscopic colorectal polypectomy was reduced.

The major limitation of this study is the fact that it was carried out in a single-center thus, a small number of cases. Therefore, we recommend future study to validate its feasibility by accumulating data from multi-centers and large sample sizes.

## 5. Conclusion

As has been demonstrated in this paper, oral glucose combined with short-term intravenous nutrition can effectively reduce the incidence of hypoglycemia in patients after endoscopic colorectal polypectomy, without affecting the intestinal cleanliness and tolerance of patients. This provides a strong reference for us to better prevent the occurrence of hypoglycemia after endoscopic colorectal polypectomy, and a basis for future multi-center study.

## Conflicts of Interest

The authors declare no conflicts of interest.

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# Analysis of Clinical Characteristics and Risk Factors of *Pseudomonas aeruginosa* Bloodstream Infection in 55 Cases

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## Abstract

**Objective:** *Pseudomonas aeruginosa* bloodstream infection presents a severe challenge to hospitalized patients. To investigate the clinical characteristics, risk factors and drug resistance of *Pseudomonas aeruginosa* bloodstream infection. **Methods:** Clinical data and laboratory results of patients with *Pseudomonas aeruginosa* bloodstream infection in the First Affiliated Hospital of Yangtze University from January 2019 to December 2022 were retrospectively analyzed. The factors associated with infection and death were analyzed by univariate analysis. **Results:** A total of 55 patients were enrolled in this study, The 28-day mortality rate was 14.5%. Univariate analysis showed that high procalcitonin, low albumin, ICU admission, central venous catheterization, indwelling catheter, and mechanical ventilation were associated with death. Multivariate Logistic regression analysis showed that hypoproteinemia and central venous catheters were independent risk factors for death in patients with *Pseudomonas aeruginosa* bloodstream infection. **Conclusions:** The drug resistance of *P. aeruginosa* bloodstream infection is not high, but the fatality rate is high. The combination of hypoalbuminemia after the onset of the disease and the use of central vein catheters can lead to increased mortality, suggesting that clinical identification of high-risk patients as early as possible, reducing the use of catheters, preventing the occurrence of *P. aeruginosa* bloodstream infection and improving the prognosis.

## Keywords

*Pseudomonas aeruginosa*, Bloodstream Infections, Resistance, Risk Factors

## 1. Introduction

*Pseudomonas aeruginosa* is widely distributed in nature as a conditional pa-

thogen and can be normally colonized in the skin, respiratory tract, and gastrointestinal tract of humans and animals. *P. aeruginosa* is a Gram-negative non-fermenting bacillus that can cause serious hospital-acquired infections, especially in immunocompromised and neutropenic patients [1] [2]. In recent years, the clinical prognosis of patients with *P. aeruginosa* infection has improved with the widespread use of anti-pseudomonas antibiotics. Unfortunately, the emergence of drug-resistant *P. aeruginosa* due to natural and acquired drug resistance is of increasing concern [3] [4]. Hospital-acquired infections due to this bacterium are more common in lower respiratory tract infections, abdominal infections, and bloodstream infections, among which bloodstream infections are fatal, and their infection can prolong the patient's hospital stay, increase hospital costs, and trigger multi-organ failure in patients with a poor prognosis and mortality rates ranging from 18% to 61% [5]. Poor outcomes of the bloodstream infections caused by *P. aeruginosa* could be explained by its virulence and the underlying diseases or conditions of the patients. The previous studies revealed that the prognosis could be closely associated with the severity of underlying diseases and delayed usages of effective antibiotics [5] [6]. In this study, we retrospectively analyzed the clinical features, risk factors, and laboratory characteristics of *Pseudomonas aeruginosa* bloodstream infections to provide a basis for clinical diagnosis and treatment.

## 2. Materials and Methods

### 2.1. General Clinical Data

Patients with positive blood culture of *P. aeruginosa* bloodstream infection from January 2019 to December 2022 in various departments of the First Affiliated Hospital of Yangtze University were collected, and only the first isolated strain of *P. aeruginosa* was selected in the same patient with multiple isolations. Inclusion criteria: 1) Inpatients ≥ 18 years old with complete clinical information; 2) 1 or more positive blood cultures for *P. aeruginosa* and clinical evidence of the corresponding infection; 3) Multiple infections were taken for the first infection. *Pseudomonas aeruginosa* bloodstream infection was defined as more than one positive blood culture for *P. aeruginosa* and the presence of clinical signs and symptoms of its corresponding bloodstream infection, and the possibility of bloodstream infection and contamination by other pathogens was excluded.

Record all clinical information of the patients, including: 1) Patient's gender and age. 2) Underlying diseases, including hypertension, diabetes mellitus, solid tumors, cardiovascular diseases, hematologic diseases, anemia, hypoproteinemia, chronic kidney diseases, septic shock, and severe pneumonia. 3) Whether admitted to intensive care unit (ICU) with related invasive operations (including indwelling gastric tube, indwelling urinary catheter, central venous placement, mechanical ventilation, other site drainage tube), history of surgery, history of antimicrobial drug use. 4) 28-day survival of patients.

Exclusion criteria: 1) Outpatients. 2) Those with incomplete case information.

This study was approved by the Ethics Committee of the First Affiliated Hospital of Yangtze University with approval number KY202377.

### 2.2. Bacterial Identification and Drug Sensitivity Test Methods

The strains were cultured and isolated according to the National Clinical Laboratory Practice (4th edition). Blood specimens from patients with suspected bloodstream infection were cultured using a BACTECTM FX automatic blood culture instrument (BD, USA). Positive specimens of strains were transferred to blood agar plates and chocolate agar plates. Antimicrobial susceptibility tests were performed using the Phoenix-100 (BD, USA), and it was interpreted according to the Clinical and Laboratory Standards Institute (CLSI) document M100-S32. The quality control strain was *Pseudomonas aeruginosa* ATCC 27853.

### 2.3. Statistical Methods

SPSS 23.0 statistical software and WHONET 5.6 were used. The measurement data conforming to normal distribution were expressed as mean ± standard deviation with t-test; variables not conforming to normal distribution were tested with Wilcoxon rank sum test; the count data were expressed as number of cases and percentages, and rates were compared with $\chi^2$ test or Fisher's exact test. Logistic regression analysis was performed for risk factors, and differences were considered statistically significant at $P < 0.05$.

## 3. Results

### 3.1. Drug Susceptibility Testing

In vitro antimicrobial susceptibility tests showed 100% sensitivity to polymyxin B and amikacin; the resistance rate to imipenem and meropenem was low, only 3.6%; the resistance rates to quinolones antibacterial drugs was the highest, as shown in Table 1.

### 3.2. Clinical Characteristics

The average age of the 55 patients with *P. aeruginosa* bloodstream infection was (65.2 ± 12.7) years, 17 cases were under 60 years old and 38 cases were over 60 years old; 45 cases (81.8%) were male and 10 cases (18.2%) were female. The distribution of departments was mainly from urology 12 cases (21.8%), hematology 11 cases (20%), and ICU 10 cases (18.2%).

### 3.3. Underlying Diseases

Fifty-one patients (92.7%) were combined with at least 1 underlying disease, mainly including: hypertension in 26 cases (47.3%), diabetes mellitus in 12 cases (21.8%), and hematologic tumors in 11 cases (20.0%), as shown in Table 2.

**Table 1.** Susceptibility of 55 cases of *Pseudomonas aeruginosa* to antibacterial drugs.

| Antibacterial drugs | *Pseudomonas aeruginosa* (n = 55) | | |
|---|---|---|---|
| | Resistance (%) | Intermediary (%) | Susceptibility (%) |
| Ciprofloxacin | 12.7 | 9.1 | 78.2 |
| Amantadine | 10.9 | 16.4 | 72.7 |
| Piperacillin | 7.3 | 9.1 | 83.6 |
| Ceftazidime | 5.5 | 5.5 | 89.1 |
| Cefepime | 5.5 | 14.5 | 80 |
| Gentamicin | 5.5 | 1.8 | 92.7 |
| Levofloxacin | 5.5 | 9.1 | 85.5 |
| Piperacillin/tazobactam | 3.6 | 3.6 | 92.7 |
| Imipenem | 3.6 | 10.9 | 85.5 |
| Meropenem | 3.6 | 0 | 96.4 |
| Amikacin | 0 | 0 | 100 |
| Polymyxin B | 0 | 0 | 100 |

**Table 2.** The risk factors for mortality of 55 cases of *Pseudomonas aeruginosa* bloodstream infection.

| Variable | Death (n = 8) | Survival (n = 47) | *P* value |
|---|---|---|---|
| Age (years) | 69.5 ± 10.7 | 64.5 ± 12.9 | 0.303 |
| Male/case (%) | 5 (62.5) | 40 (85.1) | 0.125 |
| Underlying disease | | | |
| Diabetes mellitus | 2 | 10 | 1.000 |
| Hypertension | 4 | 22 | 0.867 |
| Chronic renal insufficiency | 0 | 6 | 0.577 |
| Hematologic tumor | 2 | 9 | 1.000 |
| Solid Tumors | 2 | 5 | 0.580 |
| Brain disease | 2 | 7 | 0.844 |
| History of gout | 1 | 1 | 0.272 |
| History of surgery | 4 | 19 | 0.905 |
| Laboratory tests | | | |
| C-reactive protein (mg/L) | 171.9 ± 90.6 | 107.6 ± 95.9 | 0.086 |
| Calcitoninogen (μg/L) | 39.5 ± 34.9 | 14.9 ± 28.1 | 0.032 |
| Peripheral blood leukocyte count ($\times 10^9$/L) | 11.3 ± 9.9 | 10.9 ± 8.7 | 0.899 |
| Hemoglobin (g/L) | 94.8 ± 31.6 | 108.2 ± 32.3 | 0.280 |

**Continued**

| | | | |
|---|---|---|---|
| Albumin (g/L) | 30.2 ± 1.3 | 39.2 ± 4.3 | 0.000 |
| Positive alarm time (h) | 14.9 ± 9.7 | 21.6 ± 15.3 | 0.235 |
| Number of cases of recurrent bacteremia | 2 | 5 | 0.580 |
| Admission to ICU | 5 | 10 | 0.047 |
| Indwelling catheter | 7 | 19 | 0.029 |
| Central venous catheter | 8 | 23 | 0.007 |
| Mechanical ventilation | 4 | 2 | 0.001 |
| Surgical procedures performed | 7 | 24 | 0.125 |
| Antimicrobial exposure | 8 | 46 | 1.000 |

### 3.4. Receiving Invasive Treatment before Bloodstream Infection

94.5% of patients received at least 1 or more invasive operations within 14 d, mainly including: central venous placement in 31 cases (56.4%), urinary catheter in 26 cases (47.3%), performing surgical procedures in 31 cases (56.4%), and mechanical ventilation in 6 cases (10.9%), as shown in Table 2.

### 3.5. Clinical and Laboratory Characteristics of Bloodstream Infection

#### 3.5.1. Clinical Manifestations

55 patients had fever in 55 cases (100%), septic shock in 14 cases (25.5%), multiple organ failure in 10 cases (18.2%) and gastrointestinal bleeding in 5 cases (9.1%), as shown in Table 2.

#### 3.5.2. Laboratory Test Results

Peripheral blood leukocytes were 10.9 ± 8.8 (0.26 - 40.56) × $10^9$/L, hemoglobin was 106.2 ± 32.2 (71 - 151) g/L, calcitoninogen was 18.4 ± 30.1 (0.12 - 100) μg/L, C-reactive protein was 116.9 ± 97.9 (1.97 - 425.8) mg/L, serum albumin 37.9 ± 5.1 (27.4 - 44.3) g/L, as shown in Table 2.

#### 3.5.3. Plural Bacterial Bloodstream Infection

Among the 55 patients, 7 cases were combined with other pathogenic bacteria, including 4 cases of other Gram-negative bacilli (1 case each of *Enterobacter cloacae*, *Serratia marcescens*, *Klebsiella pneumoniae* and *Escherichia coli*) and 3 cases of positive cocci (1 case each of *Enterococcus faecalis*, *Enterococcus faecium* and *Staphylococcus aureus*), as shown in Table 2.

### 3.6. Treatment Regimen

All patients were treated with antimicrobial drugs at the time of infection symptoms, 24 cases (43.6%) used carbapenems, 18 cases (32.7%) used cephalosporins, 10 cases (18.2%) used quinolones, and 19 cases (34.5%) were combination regimens, including 12 cases of carbapenem-containing combination regimens, 5

cases of levofloxacin-containing combination regimens, and 2 cases were combined with polymyxin B.

### 3.7. Prognostic Regression

The 28-day mortality rate was 14.5% (8 patients' deaths). Univariate analysis between the death and survival groups showed that high calcitoninogen levels, hypoalbuminemia, ICU admission, central venous catheter, indwelling catheter, and mechanical ventilation were associated with poor patient prognosis, with a statistically significant difference between the two groups ($P < 0.05$). Further Multivariate Logistic regression analysis of factors with statistical differences in single factors showed that hypoalbuminemia and central venous catheter were independent risk factors for death from bloodstream infection in patients with *P. aeruginosa*, as shown in Table 3.

## 4. Discussions

*Pseudomonas aeruginosa* is a specialized aerobic conditionally pathogenic bacterium, which accounted for 7.96% in the 2021 CHINET data in China [6]. In a study reported by Wang Pan *et al.* [7], *P. aeruginosa* ranked 5th in bloodstream infections with a percentage of 6.72%. However, in a study by Chen *et al.* [8], *Pseudomonas aeruginosa* ranked 5th for bloodstream infections with a percentage of 3.6%. Bloodstream infections can prolong patients' hospital stay, increase clinical costs, and pose a challenge to clinical care.

In this study, the resistance of *Pseudomonas aeruginosa* to common antimicrobial drugs was low, with the highest resistance rate of 12.7% to levofloxacin and 0 to polymyxin B and amikacin, which was significantly lower than the resistance data of *Pseudomonas aeruginosa* [6] [7] [9]. However, polymyxin B is expensive, has toxicity to nerves and kidneys, and has some heterogeneous resistance [10], which often requires the combination of other antimicrobial drugs. Aminoglycosides have ototoxicity and nephrotoxicity and were often not used alone in pulmonary and bloodstream infections. *Pseudomonas aeruginosa* resistance mechanisms are complex and may be related to the production of various enzymes, decreased membrane permeability, expression of efflux pumps, altered target sites, and bacterial biofilm production [11]. Due to the widespread clinical use of carbapenems and some new $\beta$-lactamase inhibitor combinations such as ceftazidime-avibactam, resistances were largely increasing, clinics should also be alert to their resistance.

Table 3. Multivariate Logistic regression analysis of independent risk factors for prognosis of *Pseudomonas aeruginosa* bloodstream infection.

| Risk factor | *P* value | OR (95% CI) |
|---|---|---|
| Hypoproteinemia | 0.001 | 3.978 (1.768 - 8.953) |
| Central venous catheter | 0.038 | 4.485 (1.083 - 18.577) |

*Pseudomonas aeruginosa* bacteremia is a life-threatening infection in patients hospitalized with severe underlying conditions. *P. aeruginosa* bloodstream infections are generally clinically complex, with more than 90% of patients having serious underlying conditions, including diabetes, malignancy, and chronic renal failure [9]. Previous studies have shown that chronic renal failure, ICU admission, mechanical ventilation, and central venous catheter placement are risk factors for death from *P. aeruginosa* bloodstream infection [12]. Su *et al.* [13], reported that patients with MDR *P. aeruginosa* bloodstream infection had higher admission to the ICU, mechanical ventilation, poor prognosis, APACHE II score, and combined surgical procedures than the non-MDR *P. aeruginosa* bloodstream infection group. Patients who developed *P. aeruginosa* bloodstream infections in this study tended to have one or more underlying diseases that reduced the body's immunity, and approximately 100% of patients underwent various invasive procedures, all of which increased the risk of bloodstream infections. High calcitoninogen, low albumin, ICU admission, central venous line placement, indwelling catheter, and mechanical ventilation were associated with patient death. Multivariate Logistic regression analysis showed that hypoproteinemia and central venous line placement were independent risk factors for death in patients with *P. aeruginosa* bloodstream infection, similar to other studies in China [9] [14]. Because of the small number of cases of multi-drug resistant *P. aeruginosa* bloodstream infections in this study, no comparison of clinical characteristics and laboratory results between patients with resistant and sensitive *P. aeruginosa* bloodstream infections was performed.

The use of initial antimicrobial drugs may play a key role in the development of *P. aeruginosa* bloodstream infections, while overdose of $\beta$-lactams and fluoroquinolones is an independent risk factor for *P. aeruginosa* bloodstream infections [15]. According to the report [16], delayed application of sensitive antimicrobial drugs increased the 30-d morbidity and mortality rate in patients with *P. aeruginosa* bloodstream infections. The most used antimicrobial drugs are carbapenems, cephalosporins, and fluoroquinolones, which have been used with good efficacy. In this study 8 patients died with a mortality rate of 14.5%, which is lower than the mortality rates of 26.5% [17], 28.4% [18], 22.8% [19] reported in some domestic and foreign studies, probably because the number of cases of multi-drug resistant *P. aeruginosa* bloodstream infections in this study was low, and then reasonable treated with antimicrobial drugs, a good efficacy was achieved. In addition, a study [17] showed that combination antimicrobial therapy had no significant favorable effect on patient healing and that the mortality rate of patients treated with combination therapy was 35.6%, which was higher than that of monotherapy (19.8%, $P < 0.05$), but there was no statistical difference in mortality between combination therapy and monotherapy in this study because of the little cases of deaths.

In conclusion, *P. aeruginosa* bloodstream infections have a high morbidity and mortality rate, and hypoproteinemia and the use of central venous catheter were independent risk factors for death, and such patients should be actively

identified and prevented clinically, and targeted therapy should be administered as early as possible to reduce mortality.

This study has several limitations. 1) This was a single-centre study with a small number of cases, which may be biased; 2) The source of infection was not traced and the results may be affected. We will need to collect more cases from multiple centres at a later stage.

## Conflicts of Interest

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

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# Effect of Lumbar Spinal Point Injection on Sitting Function in Children with Cerebral Palsy

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## Abstract

**Objective:** To observe the effect of lumbar spinal point injection on sitting function in children with cerebral palsy. **Method:** Sixty-two children with post-confirmed cerebral palsy were randomly divided into control group and treatment group, 31 each. The control group was given conventional rehabilitation treatment, and the treatment group was given lumbar chiropspinal acupoint injection on the basis of the treatment method of the control group. After 3 consecutive courses of treatment, the sitting score of the two groups before and after treatment (GMFM88) was used to evaluate the sitting score before and after treatment. **Outcome:** Before treatment, the two groups were evaluated and the differences were not statistically significant ($p > 0.05$), which was comparable. The two groups (GMFM88) after treatment had significantly increased the differential values, and the difference was statistically significant compared with the same group before treatment ($p < 0.05$ or $p < 0.01$), and the sitting area score in the treatment group was more significant, and the difference was statistically significant compared with the control group after treatment ($p < 0.05$ or $p < 0.01$). **Conclusion:** Conventional rehabilitation combined with lumbar spinal point injection can effectively improve the sitting motor function of children with cerebral palsy.

## Keywords

Children with Cerebral Palsy, Lumbar Segmentation of Spinal Points, Acupuncture Point Injection, Gross Motor Function (Sitting Area)

## 1. Introduction

Cerebral palsy (CP) is mainly manifested as abnormal posture and movement, and at the same time affects children's health of a class of brain injury diseases, is

one of the diseases with a very high rate of disability in children, such diseases bring a heavy burden to the family and society of the child, the annual incidence is about 2.48% [1]. The clinical manifestations are a group of persistent central motor and postural developmental disorder activity restriction syndromes, accompanied by hearing, speech, and intellectual disabilities, which is a syndrome of non-progressive brain damage and developmental defects caused by various factors of the brain [2]. The gross motor (sitting) function level of children with cerebral palsy is one of the important conditions that directly affect whether the child can crawl and stand alone in the future, and it is also an important reference condition for participating in social activities in adulthood.

## 2. Information and Methodology

### 2.1. General Information

A retrospective analysis was conducted on the clinical data of 62 children with cerebral palsy (aged 0 - 3 years) who underwent rehabilitation treatment in our hospital from December 2019 to July 2022, and divided into two groups with 31 cases in each group according to random numbers. Control group (given conventional rehabilitation), treatment group (combined with lumbar spinal point injection on the basis of conventional rehabilitation), 19 males and 12 females in the control group; Age 3 months 3 years, mean age (2.16 ± 0.52) years; There were 15 males and 16 females in the treatment group; Age 0 months 3 years, mean age (1.95 ± 0.65) years; The basic data of the two groups were not statistically significant ($p = 0.05$), and the differences were comparable. There was no significant difference in age, sex and GMFM-88 items (sitting ability) between the two groups of children with cerebral palsy ($p > 0.05$), which was comparable.

### 2.2. Diagnostic Criteria

1) Central dyskinesia persists, and brain injury is non-progressive; 2) The diagnosis and classification conform to the definition, diagnosis and classification criteria of cerebral palsy discussed and approved by the National Pediatric Cerebral Palsy Rehabilitation Academic Conference [3].

### 2.3. Inclusion Criteria

1) This study was approved by the Hospital Ethics Committee. 2) The children met the relevant diagnostic criteria for cerebral palsy [4]. 3) Each parent is aware of the content of the study, and informs the adverse situation and various reactions after injection and signs the relevant consent form.

### 2.4. Exclusion Criteria

1) Congenital heart disease. 2) The study cannot be completed due to various reasons. 3) Those with immune diseases and bleeding tendency. 4) Patients with severe malnutrition, physical weakness, etc. who are not suitable for acupoint

injection. 5) Movement disorders caused by cranial mass lesions and various progressive diseases.

## 2.5. Methods

62 children with cerebral palsy after diagnosis were randomly divided into control group and treatment group, 31 each. The control group was given conventional rehabilitation treatment, the treatment group was given lumbar spinal point injection on the basis of the treatment method of the control group, and the two groups were given 1 course of treatment for 20 days, and the rest of 1 course was 7 days, and after 3 consecutive courses of treatment, the sitting score before and after treatment (GMFM88) was used to evaluate the sitting score of the two groups before and after treatment and evaluate the efficacy.

1) Control group uses conventional rehabilitation methods. a) Core muscle strength training. The children's rehabilitation therapist conducted Vojta posture press pressure, roller leg split sitting training and Bobath ball assisted sitting ability training to exercise the child's lower back and trunk strength and pelvic area separation, stability and limb conversion coordination. b) Traditional medicine manipulation of the motherland: Repeated massage from bottom to top along the solar bladder meridian and pulse of the foot and bladder by lifting and pinching, holding, percussion, etc., to promote low back muscle strength training. c) Reflex inhibition of abnormal posture manipulation: Ueda Masa: pelvis and hip part separation method, separation of the child's overall posture and lower limb rigid pattern. d) Key point adjustment strengthens the child's motor control and induces correct movements. The above treatment: 1 time a day, 40 min each time, 20 days for 1 course of treatment, 1 course of rest for 7 days, continuous treatment for 3 courses.

2) Treatment group On the basis of the control group, with the lumbar chiropractic acupoint injection, vitamin B12 0.25 mg, vitamin B1 75 mg, 1 ml of 0.9% sodium chloride injection was added, and the three drugs were mixed for a total of 3 mL for acupoint injection. Take the acupoint: "waist segment huatuo clamp ridge point"; Operation method: the child takes the prone position, the parent stabilizes the child's hip joint, the doctor routinely disinfects the skin of the selected acupuncture point, directly pierces the needle with acupuncture and moxibustion needle holding technique, slightly lifts up and down to urge gas, does not twist and turn after qi, according to the child's physical development into the needle 1 - 2 cm, after redrawing no blood began to bolus the solution, 0.5 mL per acupuncture point, each time select the lumbar segment of the ridge point left and right 3 acupuncture points for injection, after the needle is removed, use a sterile cotton ball to press the local area for 1 min. 1 time every other day, 3 times a week, 20 days for 1 course of treatment, 1 course of treatment at the end of 7 days, continuous treatment for 3 courses.

## 2.6. Efficacy Observation Indicators

After three courses of treatment, GMFM-88 is suitable for the evaluation of

children with various types of cerebral palsy [5], mainly with the large exercise sitting area as the main assessment area; 10% < completed action; 2 points, 90% < completed action; 3 points, 100% completion of the action. Higher score levels indicate higher gross movements (sitting level energy zones). Changes in sitting ability in GMFM-88 items before and after treatment were assessed and compared.

### 2.7. Statistical Methods

The measurement data were expressed by mean ± standard deviation (X ± S), and the t-test was used for the between-group comparison, and the paired t-test was used for the before-and-after comparison.

## 3. Results

1) Compared with the effect of the treatment group and the control group, it was found that the effective rate of the treatment group was significantly higher than that of the control group, and the effect of the control group was also improved to different degrees, and the difference was statistically significant ($p < 0.05$), as shown in Table 1 for details.

2) The GMFM-88 sitting energy zone assessment scores of the pretreatment group and the control group were not statistically significant ($p > 0.05$), which were comparable. The GMFM-88 sitting energy zone assessment scores in the treatment group and the control group were significantly increased after treatment, and the difference was statistically significant ($p < 0.05$ or $p < 0.05$) compared with the same group before treatment, and the difference was significantly higher than that in the treatment group after treatment ($p < 0.05$ or $p < 0.05$), as shown in Table 2.

**Table 1.** Comparison of treatment group and control group [n (%)].

| Constituencies | n | excellent | effective | void | Total efficiency |
|---|---|---|---|---|---|
| Treatment group | 31 | 21 (67.74) | 9 (29.03) | 2 (3.11) | 30 (96.77) |
| Control group | 31 | 13 (41.94) | 12 (38.71) | 6 (19.35) | 25 (80.7) |
| $X^2$ | - | 13.44 | 2.1 | 12.97 | 12.973 |
| p | - | <0.01 | >0.05 | <0.01 | <0.01 |

Note: - indicates this vacancy.

**Table 2.** Comparison of GMFM-88 items (sitting energy zone) scores between treatment group and control group ( $\bar{x} \pm s$ ).

| Constituencies | n | Before treatment | After treatment |
|---|---|---|---|
| Treatment group | 31 | 30.8 ± 4.4 | 62.4 ± 7.4 |
| Control group | 31 | 31.2 ± 4.7 | 51.9 ± 7.9 |
| t | - | 0.37 | 4.32 |
| p | - | >0.05 | <0.01 |

Note: - indicates this vacancy.

## 4. Discussion

Combined with the confirmed cerebral palsy children admitted to our hospital from December 2019 to July 2022, the average age is between 1 - 3 years old, in the early rehabilitation of cerebral palsy, age belongs to the category of early treatment, of which cerebral palsy is located in the brain, but can involve the trunk and limbs, and its manifestations are mainly motor dysfunction, posture abnormalities, etc., which will not only have a serious impact on the growth and development of the child, but also cause a huge burden on its family and society [6]. At present, there are many treatments in the clinical treatment of pediatric cerebral palsy, but their treatment efficacy is often uneven, so it is particularly important to explore a safe and effective treatment.

At present, the treatment of cerebral palsy in China is basically based on conventional rehabilitation, conventional rehabilitation includes sports therapy, vojta, physical therapy and traditional motherland massage techniques, etc., lumbar Huatuo chiropractic acupoint injection therapy is a new treatment, is a combination of Western medicine and traditional Chinese medicine, mainly refers to the child's treatment drug through its lesion-related parts for acupoint injection treatment, usually can continue to stimulate the waist segment Huatuo spinal acupuncture point to play a corresponding role, The effect of acupuncture treatment can be exerted by emphasizing and qi and blood unclogging meridian treatment at the same time, waist segment Huatuo chirospinal acupoint injection is based on the positioning injection method redefined by modern Chinese medicine Taidou Mr. Li Ding and the theory of back Yu point, Huatuo clamp spinal point is located in the cervical spine, under the thoracic vertebrae 0.5 inches from the side of the spine, a total of 36 acupuncture points, the chiroptic point in the back of the vein and the foot solar bladder meridian in the two meridians, and the corresponding connection has a certain specificity. Once the meridians in the "Yang Vein are abnormalized", the twelve meridians and motor functions of the whole body will be functionally impaired, so the Du pulse and related meridian lesions can affect the spinal points, and there are corresponding pathological reaction points on the spinal points. Therefore, acupoint injection of waist Huatuo clamp spinal point can not only adjust the epidermis, repair damaged nerves, regulate muscle coordination, but also balance yin and yang, adjust internal organs, regulate qi and blood. At the same time, the spine is a sensory and motor nerve impulse transmission pathway [7] [8] [9]. Strengthening acupressure not only strengthens the child's lower back, but also down-regulates limb muscle tension and relieves low back spasm and weakness [10] [11].

In this study, it was found that the combination of lumbar spinal point injection can effectively improve the function of GMFM-88 (sitting) energy zone, which is a kind of preliminary preparation for whether children with cerebral palsy can obtain more advanced motor mode ability, and plays an important role in improving the gross motor function of children with cerebral palsy through lumbar Huatuo chiropractic acupoint injection and conventional rehabilitation treatment.

Combined with the above, conventional rehabilitation training combined with lumbar Huatuo chiroptic acupoint injection is beneficial to improve the function of the (sitting) energy zone in the gross motor ability of children with cerebral palsy, with good efficacy, safety and reliability, and is worthy of promotion in the field of pediatric rehabilitation.

## Conflicts of Interest

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

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# Oral Glucose Combined with Short-Term Intravenous Nutrition for the Prevention of Hypoglycemia after Painless Endoscopic Gastric Polypectomy

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## Abstract

**Objective:** To explore the application effect of oral glucose combined with short-term intravenous nutrition in preventing postoperative hypoglycemia after painless endoscopic gastric polyp resection, and to provide guidance for better management of patients undergoing such procedures. **Methods:** A total of 886 patients who underwent painless endoscopic gastric polyp resection in the Department of Gastroenterology, the First Affiliated Hospital of Yangtze University, from January 2020 to December 2021, were selected as the study subjects. According to the random number table method, they were divided into an experimental group and a control group, with 443 cases in each group. Patients in the control group were subjected to routine fasting and water restriction for 8 hours before surgery, and routine fasting for 24 hours after surgery. Short-term intravenous nutrition support was provided through fluid supplementation, and finger blood glucose levels were monitored at 1 hour, 4 hours, and 8 hours after completion of intravenous infusion, or when symptoms such as palpitations and cold sweats occurred. The experimental group received oral administration of 5% glucose solution (500 ml) 2 hours before surgery based on the procedures of the control group. The incidence of preoperative discomfort (hunger, thirst, and fatigue), residual gastric fluid volume, and postoperative hypoglycemia were compared between the two groups. **Results:** The incidence of postoperative blood glucose < 3.9 mmol/L and hypoglycemia in the experimental group was significantly

lower than that in the control group (4.29% vs. 8.80%, P = 0.007; 6.09% vs. 12.42%, P = 0.001). There were no significant differences between the experimental and control groups in terms of residual gastric fluid volume and incidence of reflux aspiration (26.36 ± 3.41 ml vs. 24.83 ± 4.66 ml, P = 0.86; 0.45% vs. 0.68%, P = 0.654). **Conclusion:** Based on the study population, oral glucose combined with short-term intravenous nutrition can effectively prevent the incidence of hypoglycemia in patients undergoing painless endoscopic gastric polyp resection. However, due to the limitations of a single-center study and a small number of cases, its feasibility needs to be further validated with more data from multi-center and large-sample cases.

## Keywords

Gastric Polyps, Endoscopic Polyp Resection, Anesthesia, Intravenous Nutrition, Glucose, Hypoglycemia

## 1. Introduction

Gastric polyps (GPs) are elevated lesions formed by the proliferation of gastric mucosal epithelial cells that protrude into the gastric cavity [1] [2]. The incidence rate is between 0.5% and 23% [3]. Certain pathological types, especially adenomatous polyps, carry a certain risk of malignant transformation and are recognized as precancerous lesions [4]. Currently, painless endoscopic gastric polyp resection is a preferred treatment method, as it can alleviate patient anxiety and discomfort. It offers advantages such as simplicity of operation, minimal invasiveness, rapid recovery, low cost, and suitability for a wide range of patients.

Preoperative fasting and fluid restriction can reduce gastric contents and decrease the risk of complications such as reflux and aspiration during anesthesia and surgery [5]. However, prolonged perioperative fasting and fluid restriction can lead to hypoglycemia and other discomforts like thirst and hunger [6]. Literature review reveals that there is limited research on preventing and reducing postoperative hypoglycemia after painless endoscopic gastric polyp resection, and the available evidence is of low quality. Therefore, this study focuses on 886 patients treated with painless endoscopic gastric polyp resection in the Department of Gastroenterology at the First Affiliated Hospital of Yangtze University. The aim is to investigate the feasibility, safety, and effectiveness of using oral glucose combined with short-term intravenous nutrition to prevent postoperative hypoglycemia after painless endoscopic gastric polyp resection. This study aims to provide valuable insights for clinically reducing the incidence of postoperative hypoglycemia after painless endoscopic gastric polyp resection.

## 2. Materials and Methods

### 2.1. Study Population

The study collected data from 886 patients who underwent painless endoscopic

procedures, either argon plasma coagulation (APC) or endoscopic mucosal resection (EMR), for gastric polyps in the Department of Gastroenterology at the First Affiliated Hospital of Yangtze University between January 2020 and December 2021. Using a random number table method, the patients were divided into an experimental group and a control group, each consisting of 443 cases. Inclusion criteria: 1) Patients treated with APC or EMR for gastric polyps between January 2020 and December 2021; 2) Age ≥ 18 years; 3) American Society of Anesthesiologists (ASA) classification of grade I or II; 4) No contraindications for APC or EMR; 5) Patients provided informed consent themselves or through their family members. Exclusion criteria: 1) Patients with poorly controlled diabetes; 2) Allergic to propofol, midazolam, or other anesthesia drugs; 3) Unable to tolerate anesthesia due to severe respiratory, cardiovascular, or cerebrovascular diseases; 4) Patients with upper gastrointestinal obstruction, gastric emptying disorders, or gastroesophageal reflux; 5) Coagulation disorders; 6) Use of antiplatelet or anticoagulant drugs within one week before surgery; 7) Patients with mental disorders unable to cooperate; 8) Refusal of endoscopic treatment, noncompliance with medical instructions, voluntary discharge, or incomplete clinical data. The study was approved by the Ethics Committee of the First Affiliated Hospital of Yangtze University. Exclusion criteria: Withdrawal during the study or postoperative fasting exceeding 24 hours.

## 2.2. Study Methods

Patients in the control group underwent routine fasting and fluid restriction for 8 hours before the procedure, and the painless endoscopic gastric polyp resection was performed in the endoscopy center between 8:00 AM and 12:00 PM the next day. The endoscopy center nurses recorded patients' discomfort symptoms such as hunger, thirst, and fatigue 10 minutes before anesthesia. They also recorded the amount of gastric fluid aspirated before the endoscopic gastric polyp resection. Anesthesiologists documented complications such as reflux and aspiration during the procedure. After the procedure, patients received short-term intravenous nutrition support through fluid supplementation for 24 hours, with a basic fluid replacement of 2000 ml. This included slow intravenous infusion of 10% glucose solution (500 ml), 5% glucose solution (500 ml), 10% glucose solution (500 ml), and glucose-sodium chloride solution (500 ml). A liquid diet was started after 24 hours, transitioning to a regular diet after one week. Duty nurses monitored finger blood glucose levels in the postoperative period at 1 hour, 4 hours, and 8 hours after completion of intravenous infusion, or when symptoms like palpitations and cold sweats occurred. Hypoglycemia diagnosis criteria [7]: Blood glucose < 3.9 mmol/L or blood glucose ≥ 3.9 mmol/L with symptoms of hypoglycemia such as hunger, palpitations, dizziness, and cold sweats. Patients experiencing hypoglycemia or hypoglycemic reactions during fasting were administered intravenous glucose as directed by the medical team (20 - 40 ml of 50% glucose solution or 250 ml of 10% glucose solution) and had peripheral blood glucose retested after 30 minutes.

In the experimental group, patients underwent an 8-hour preoperative fasting period, followed by a one-time oral administration of 500 ml of 5% glucose solution 2 hours before the procedure. Postoperatively, patients underwent routine fasting for water intake for 24 hours, and short-term intravenous nutrition support was provided through fluid supplementation. The basic fluid supplementation volume was set at 2000 ml and included a combination of intravenous infusions, including 10% glucose injection (500 ml), 5% glucose injection (500 ml), 10% glucose injection (500 ml), and glucose-sodium chloride injection (500 ml). The procedure was similar in the control group.

### 2.3. Outcome Measures

The study observed and recorded the incidence of preoperative discomfort symptoms (hunger, thirst, and fatigue), residual gastric fluid volume, and the incidence of postoperative hypoglycemia in both groups.

### 2.4. Statistical Analysis

Statistical analysis was performed using SPSS 22.0 software. Parametric or non-parametric tests were used based on the distribution of quantitative data. Continuous variables were presented as Mean ± SD. Between-group comparisons were analyzed using analysis of variance or chi-square tests, with a significance level of $P < 0.05$ indicating statistical significance.

## 3. Results

### 3.1. Patient Demographics

According to the principles of randomization, the enrolled subjects meeting the inclusion criteria were assigned consecutive numbers based on their visit sequence. Using a random number table method, they were randomly divided into an experimental group and a control group, totaling 886 patients, with 443 cases in each group. In the control group, there were 216 males and 227 females; the age ranged from 26 to 87 years with a mean age of (42.82 ± 10.66) years; 352 cases underwent APC, and 91 cases underwent EMR. In the experimental group, there were 223 males and 220 females; the age ranged from 31 to 83 years with a mean age of (46.36 ± 10.42) years; 348 cases underwent APC, and 95 cases underwent EMR. There were no statistically significant differences in basic demographics between the two groups ($P > 0.05$) (see Table 1).

### 3.2. Comparison of Postoperative Blood Glucose Levels and Hypoglycemia Incidence

The average blood glucose levels in the experimental group were higher than those in the control group at 1 hour and 4 hours after completing the intravenous infusion (8.92 ± 1.21 mmol/L vs. 9.73 ± 1.38 mmol/L, $P = 0.036$; 8.06 ± 0.65 mmol/L vs. 7.80 ± 0.66 mmol/L, $P = 0.043$). Although the average blood glucose level in the experimental group 8 hours after completing the intravenous infusion

**Table 1.** Basic information of patients in both groups.

| Group | No. of cases | Age (years, Mean ± SD) | Sex (M/F) | Endoscopic resection mode (APC/EMR) |
|---|---|---|---|---|
| Control | 443 | 42.82 ± 10.66 | 216/227 | 352/91 |
| Experimental | 443 | 46.36 ± 10.42 | 223/220 | 348/95 |
| $X^2$/t value | | 0.48 | 0.221 | 0.109 |
| P-value | | 0.66 | 0.638 | 0.741 |

Note: APC: argon plasma coagulation; EMR: endoscopic mucosal resection.

was not statistically significant compared to the control group, it was still slightly higher than the control group (5.36 ± 0.62 mmol/L vs. 5.15 ± 0.49 mmol/L, P = 0.76). The incidence of hypoglycemic reactions after the procedure was slightly lower in the experimental group compared to the control group, but the difference was not statistically significant (1.81% vs. 3.61%, P = 0.098). The incidence of blood glucose < 3.9 mmol/L and hypoglycemia in the experimental group was significantly lower than that in the control group (4.29% vs. 8.80%, P = 0.007; 6.09% vs. 12.42%, P = 0.001) (see Table 2).

### 3.3. Comparison of Preoperative Discomfort Symptoms, Residual Gastric Fluid Volume, and Complications

The incidence of preoperative hunger and thirst symptoms in the experimental group was significantly lower than that in the control group (7.67% vs. 14.00%, P = 0.002; 9.48% vs. 17.38%, P = 0.001). Similarly, the incidence of preoperative fatigue symptoms in the experimental group was slightly lower than that in the control group (8.13% vs. 8.58%, P = 0.808), but the difference was not statistically significant. There were no statistically significant differences between the two groups in terms of residual gastric fluid volume (26.36 ± 3.41 ml vs. 24.83 ± 4.66 ml, P = 0.86) or the incidence of reflux aspiration (0.45% vs. 0.68%, P = 0.654) (See Table 3 and Table 4).

## 4. Discussion

Painless endoscopic gastric polyp resection is favored as the primary treatment for gastric polyps due to its advantages such as minimal invasiveness and rapid recovery. However, clinical experience and relevant research [8] [9] have indicated that prolonged fasting and fluid restriction can lead to noticeable discomfort symptoms such as thirst and hunger in patients. The results of this study demonstrate that the incidence of preoperative hunger and thirst symptoms in the experimental group was significantly lower than that in the control group (7.67% vs. 14.00%, P = 0.002; 9.48% vs. 17.38%, P = 0.001), reaffirming the aforementioned viewpoint. Additionally, extended fasting and fluid restriction can lead to hypoglycemic reactions characterized by dizziness, palpitations, and fatigue, which can significantly affect patient outcomes and recovery. In this

**Table 2.** Comparison of postoperative blood glucose values and incidence of hypoglycemia between two groups of patients.

| Group | No. of cases | Blood glucose 1 h after infusion (Mean ± SD, mmol/L) | Blood glucose 4 h after infusion (Mean ± SD, mmol/L) | Blood glucose 8 h after infusion (Mean ± SD, mmol/L) | Blood glucose < 3.9 mmol/L (cases) | Hypoglycemic reaction (cases) | Incidence of hypoglycemia (%) |
|---|---|---|---|---|---|---|---|
| Control | 443 | 8.92 ± 1.21 | 7.80 ± 0.66 | 5.15 ± 0.49 | 39 (8.80%) | 16 (3.61%) | 55 (12.42%) |
| Experimental | 443 | 9.73 ± 1.38 | 8.06 ± 0.65 | 5.36 ± 0.62 | 19 (4.29%) | 8 (1.81%) | 27 (6.09%) |
| $X^2$/t value | | 2.326 | 2.807 | 1.38 | 7.380 | 2.741 | 10.536 |
| P-value | | 0.036 | 0.043 | 0.76 | 0.007 | 0.098 | 0.001 |

**Table 3.** Comparison of preoperative discomfort between two groups of patients.

| Group | No. of cases | Hunger (cases) | Thirst (cases) | Lack of energy (cases) |
|---|---|---|---|---|
| Control | 443 | 62 | 77 | 38 |
| Experimental | 443 | 34 | 42 | 36 |
| $X^2$/t value | | 9.159 | 11.891 | 0.059 |
| P-value | | 0.002 | 0.001 | 0.808 |

**Table 4.** Comparison of the amount of residual gastric juice and complications in the two groups.

| Group | No. of cases | Amount of residual gastric juice (Mean ± SD, ml) | Reflux misaspiration (Cases) |
|---|---|---|---|
| Control | 443 | 24.83 ± 4.66 | 3 |
| Experimental | 443 | 26.36 ± 3.41 | 2 |
| $X^2$/t value | | 0.78 | 0.201 |
| P-value | | 0.86 | 0.654 |

study, the experimental group exhibited significantly lower rates of blood glucose < 3.9 mmol/L and hypoglycemia compared to the control group (4.29% vs. 8.80%, P = 0.007; 6.09% vs. 12.42%, P = 0.001).

Furthermore, there were no significant differences between the experimental and control groups in terms of residual gastric fluid volume and the incidence of reflux aspiration (26.36 ± 3.41 ml vs. 24.83 ± 4.66 ml, P = 0.86; 0.45% vs. 0.68%, P = 0.654). These findings indicate that a one-time oral administration of 5% glucose solution (500 ml) 2 hours before the procedure, combined with short-term postoperative intravenous nutrition, can effectively reduce the occurrence of postoperative hypoglycemia in endoscopic gastric polyp resection without increasing the risk of complications such as reflux aspiration.

However, this study has some limitations. One of them is the relatively small sample size and the single-center nature of this study, which could potentially impact the generalizability and statistical power of the findings. With a limited

number of participants, the study's ability to detect small but meaningful effects may be compromised, and the results may not be fully representative of the broader population. Additionally, the small sample size might lead to a higher susceptibility to random variations, making it challenging to draw robust conclusions and potentially limiting the ability to identify subtle associations or differences. Also, this study lacks post-discharge follow-up data and cost-effectiveness analysis. Thus, assessment of the long-term efficacy as well as the economic implications in comparisons was not ascertained. Therefore, further accumulation of data from larger sample sizes and multiple centers, with longer follow-up post-discharge and cost analysis is needed to verify its long-term efficacy, safety, feasibility and cost effectiveness compared to other preventive strategies.

## 5. Conclusion

In conclusion, the administration of a one-time oral dose of 5% glucose solution (500 ml) 2 hours before the procedure, combined with short-term postoperative intravenous nutrition, effectively reduces the incidence of preoperative discomfort symptoms such as hunger and thirst, as well as the occurrence of postoperative hypoglycemia after endoscopic gastric polyp resection. This approach does not increase the risk of anesthesia-related complications, providing a strong reference for preventing postoperative hypoglycemia in painless endoscopic gastric polyp resection. However, given that this study was a single-center study with a small number of cases, its feasibility need to be validated by accumulating data from multi-centers and large samples of cases.

## Conflicts of Interest

All authors declare no conflicts of interest.

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# Ultrasound Traced the Embolization of Lower Extremity Artery to Left Ventricular Thrombus: A Case Report

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## Abstract

This paper reports a case of a 38-year-old young man with a lower extremity arterial thrombus diagnosed by ultrasound, which was traced back to the left ventricular thrombus. By reviewing the relevant literature, the relationship between lower extremity arterial thrombosis and left ventricular thrombosis is described, and which examination method is the most valuable in the diagnosis of thrombosis is discussed.

## Keywords

Ultrasound, Left Ventricular Thrombus, Arterial Embolism

## 1. Introduction

With the development of chest pain centers in hospitals at all levels, most patients with myocardial infarction can get immediate treatment, and the incidence of complications related to myocardial infarction has been greatly reduced. Left ventricular thrombosis is one of the complications after myocardial infarction. When the left ventricular thrombus falls off, it can easily embolize the brain, internal organs and limbs. The patient initially presented with symptoms of acute limb ischemia, and ultrasonography revealed the presence of a lower extremity arterial thrombus which was subsequently traced back to the left ventricular thrombus. Due to the patient's carelessness and the delay in treatment, the prognosis for this patient was unfavorable.

## 2. Case Report

A 38-year-old man whose right lower limb had been painful and swollen for 1

day came to our outpatient. We found embolism (Figure 1) in the right popliteal artery, anterior tibial artery, and posterior radial artery when we performed the lower extremity vascular ultrasound. We began to wonder why the embolism was occurring in the arteries at such a young age and where it came from. Unfortunately, he didn't come to our hospital until 15 days later with pain and numbness in his right lower limb.

After the patient was hospitalized, the doctor inquired about his medical history, and found that the patient had chest pain 1 month ago, and denied the history of infectious diseases such as hypertension, coronary heart disease, diabetes, hepatitis, and tuberculosis. During physical examination, swelling, pain and numbness of the right lower limb were found, and temperature of the skin decreased significantly, mainly below the knee joint. The pulse of the right popliteal artery and dorsal foot artery was not touched, and the left lower limb was normal. Blood coagulation analysis showed FIB 3.55 g/l, APTT 20.90 s, DD 3.39 mg/l, fibrin degradation products 7.60 μg/nl. Myocardial enzyme showed hypersensitive troponin I 4.87 pg/ml, B type natriuretic peptide 10.11 pg/ml. The ECG results showed sinus rhythm, abnormal Q wave in the lower and anterior wall leads, differences in indoor conduction and changes in ST segment (Figure 2). Because the patient was so young and had chest pain in the past, we began to wonder if the patient had a myocardial infarction. As expected, when we gave the patient a color ultrasound, we found a slightly high echo mass in the left ventricular apex (Figure 3), which is likely to be a thrombus. In addition, the patient's lower extremity artery CTA results showed soft plaque (Figure 4) in the middle and lower segment of the right femoral artery, lumen occlusion. The lower segment vessels were not developed, and some peripheral collateral vessels were developed.

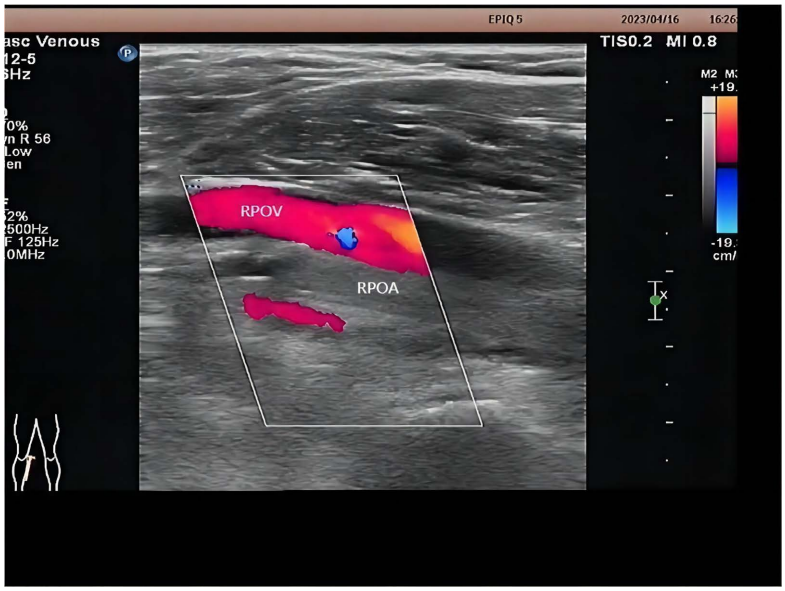


Figure 1. Ultrasound: hypoechoic filling was observed in the right popliteal artery without obvious blood flow signal.

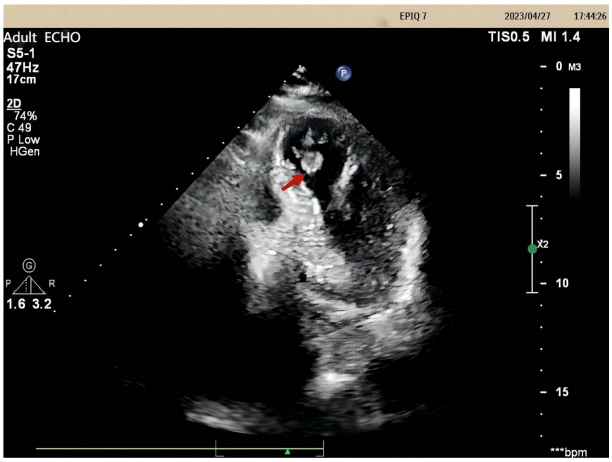


**Figure 2.** TTE: a slightly hyperechoic mass about 18 * 10 mm in size was seen at the apex of the left ventricle.

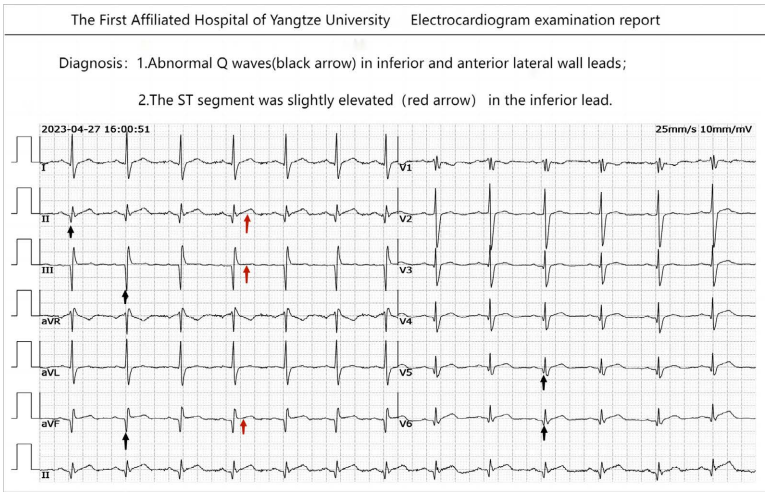


**Figure 3.** ECG: sinus rhythm, abnormal Q wave in the lower and anterior wall leads, differences in indoor conduction and changes in ST segment.

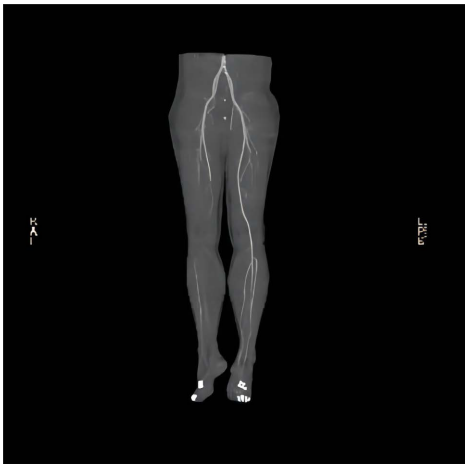

**Figure 4.** CTA: see the right femoral lower-middle section calcium soft spot, lumen out-of-the-way, did not see its period of vascular imaging, part of the collateral vessels around development.

Therefore, the patient underwent an emergency balloon thrombectomy via a femoral artery incision, successfully removing the embolus with a total length of 10 cm. Postoperative pathological findings confirmed that the embolus was a thrombus (Figure 5). After operation, the patient was treated with anticoagulant and vasodilator therapy, and oral analgesics were used to relieve symptoms. But the patient still had intermittent pain in the right sole, which was difficult to tolerate after prolonged activity, and no other special discomfort was reported. One month later, CTA of the lower extremity arteries in the outpatient clinic showed soft plaque in the middle and lower segment of the right femoral artery, with lumen occlusion, and its lower segment vessels were not observed. A soft plaque was seen in the middle and upper segment of the right peroneal artery, and some of the lumen was poorly developed (Figure 6). After several follow-up visits, the patient still complained of pain and weakness in the right lower limb.

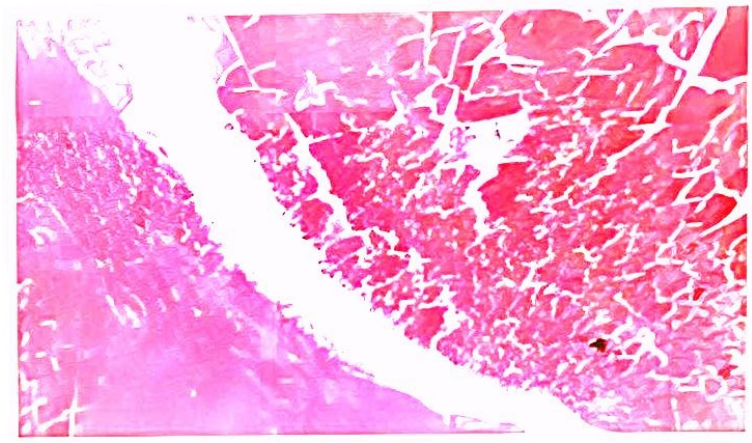

Figure 5. Postoperative pathology showed that the embolus was thrombus.

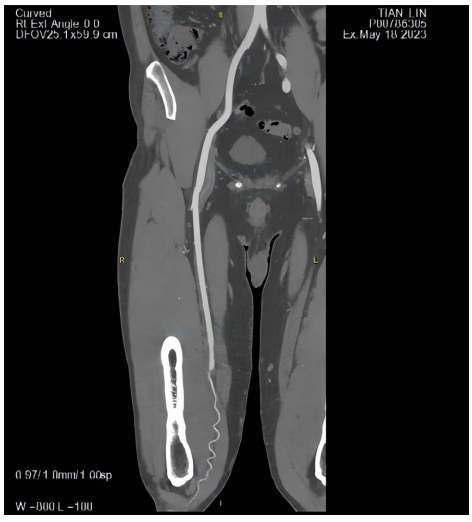


Figure 6. CTA one month after surgery: soft plaque in the middle and lower segment of the right femoral artery, with lumen occlusion, and its lower segment vessels were not observed. A soft plaque was seen in the middle and upper segment of the right peroneal artery, and some of the lumen was poorly developed.

## 3. Discussion

Emboli in lower extremity arterial embolism mainly come from cardiogenic sources. The most common cardiogenic cause is atrial fibrillation, followed by rheumatic heart disease and myocardial infarction at present [1]. It is a clinical emergency, common femoral artery, popliteal artery, and common iliac artery are the most common sites of occurrence. Its typical clinical signs and symptoms are pain, numbness, dyskinesia, pulselessness and pallor. With the increase of the elderly population in our country, its incidence is also increasing, however it rarely happens in young people. In similar cases that have been reported, the youngest patient is 50 years old [2] [3]. The present patient was a young man aged 38 years with no history of any disease. Arterial embolism of the lower extremity was caused by a detached embolus that formed after a myocardial infarction. This young patient had no typical symptoms of chest pain and no previous underlying medical conditions. Because of his low awareness and attention to myocardial infarction, when the left ventricular thrombus was found on ultrasound, the myocardial infarction markers of the patient returned to normal, with only pathological Q waves in the lower and anterior walls remaining on the ECG.

Although the incidence of left ventricular thrombosis after myocardial infarction is reduced with thrombolysis, it is still as high as 40%, especially in patients with large-scale myocardial infarction. Studies have shown that TTE is recommended to be reexamined within 72 hours and 1 to 2 weeks for patients with high-risk characteristics who did not find left ventricular thrombus on initial transthoracic echocardiography [4].

TTE is currently the most commonly used imaging test for evaluating left ventricular thrombosis. TTE has high diagnostic accuracy for LV thrombus after acute MI with specificity in the range of 95% to 98% offset by relatively low sensitivity (21% - 35%) [5]. The low sensitivity of TTE in monitoring left ventricular thrombosis may lead to the occurrence of missed thrombosis, which may be caused by insufficient display of apical view, small thrombus, poor acoustic window and other reasons. With the use of ultrasound contrast material to increase the clarity of endocardial visualization, the sensitivity increases to approximately 64%, and the specificity is similar to that of TTE [6]. The left ventricular thrombus is mostly located in the apex, and the apical view is not well visualized on ultrasound scan. As a consequence, when we examine the patient after myocardial infarction, we must scan multiple ultrasound sections and angles to avoid missed diagnosis. Ultrasound is a commonly used means of clinical disease examination, which can clearly display the disease site and peripheral signs, color Doppler ultrasound can visually show whether there is blood perfusion in the tissue, both of them have unique advantages in the diagnosis and differentiation of lower extremity arterial thrombosis and left ventricular thrombosis.

## 4. Conclusion

With the poor prognosis reported in this patient, we should emphasize the value

of ultrasound in the early diagnosis of thrombosis, especially in patients with myocardial infarction, whose heart should be monitored regardless of whether the symptoms are prominent. Early detection and early treatment can effectively improve the prognosis of patients with thrombosis.

## Statement

The study doesn't directly contact with the patient, only review imaging and pathological data of patients, not as an aid in the diagnosis and any commercial purposes, and the results of the study will remove any participant identify characters, ensure privacy don't leak out. The Ethics Committee of our hospital has proposed an application for exempting the informed consent of the subjects and has been approved.

## Conflicts of Interest

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

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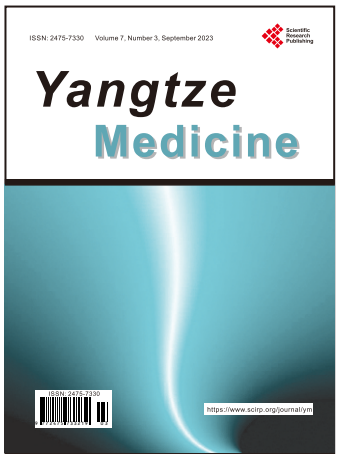


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