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# Characteristics of Patients in Follow-up After the Whipple Procedure in the Intensive Care Unit: Field-specific Intensive Care Experience

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## ABSTRACT

**Introduction:** Pancreaticoduodenectomy (Whipple procedure) is an important surgical intervention in terms of adverse conditions that may occur after surgery. Our aim is to determine the change in the clinical course of the patients followed in the intensive care unit (ICU) after pancreaticoduodenectomy during the follow-up period.

**Methods:** We included 37 patients followed up after the Whipple procedure from August 2021 to August 2022 in a tertiary ICU specific for liver-pancreas-biliary tract and liver transplantation.

**Results:** The vital signs and laboratory values of the patients during the follow-up were examined. Statistically decreased arterial blood lactate levels and a significant increase in arterial blood partial oxygen pressures were seen upon admission to the ICU. The highest detected arterial lactate level was correlated with the percentage change in blood creatinine.

**Conclusion:** Patients should be followed closely after the Whipple procedure. Fluid volume treatment and respiratory support play a significant role in patient recovery.

**Keywords:** Pancreaticoduodenectomy, fluid volume, intensive care

## Introduction

Pancreaticoduodenectomy, the so-called the Whipple operation, is the only potentially curative operation for neoplasms of the periampullary region of the duodenum. Allen Whipple defined this operation for periampullary carcinoma in 1935 (1). Specimens of the classical Whipple operation involves the duodenum, common bile duct, gallbladder, head of the pancreas, and antrum of the stomach.

There are some patients -dependent factors that have a negative effect on the postoperative course, such as age, comorbidities, jaundice, cholestasis, and need for biliary drainage. Additionally, intraoperative factors may also lead to negative outcomes, such as surgical technique, operation time, and amount of bleeding may also lead to negative outcomes (2). After major surgical operations, patients often require monitoring in the intensive care unit (ICU).

**Our aim in this study:** To determine out the change in the clinical course of the patients followed up in the tertiary ICU after pancreaticoduodenectomy during the follow-up period.

## Methods

Patients hospitalized in the tertiary ICU specific to liver-pancreas-biliary tract and liver transplantation from August 2021 to August 2022 were retrospectively reviewed.

Patients followed-up after the Whipple procedure were included in the study.

Patient information and laboratory values were obtained from the hospital registry system (hospital information management system), whereas vital signs and treatments were obtained from patient observation notes.

Approval was obtained from the Ethics Committee of the University of Health Sciences Turkey, Başakşehir Çam and Sakura City Hospital (approval number: 2022.12.390), where the study was conducted, for the use of data and conducting the research.

### Statistical Analysis

SPSS Statistics 20 (IBM, Armonk, NY) was used for all statistical analyses. Kolmogorov-Smirnoff analysis was used to analyze the normality of

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the study data. A paired t-test was used when comparing before and after laboratory values. Pearson correlation test was used for the correlation between the blood lactate level, the amount of fluid volume administered, and the change in blood creatinine level.

## Results

Thirty-seven patients were included in the study. Nineteen of the patients were female and 18 of them were male patients. The mean age was 61.08 (±14) years. Twenty patients had at least one comorbid disease in addition to pathology that needed surgery (Table 1). Two patients (0.5%) were transferred to the ICU as orotracheal intubated. The patients were then extubated and transferred to the service. High -flow nasal cannula oxygen therapy (YANKOT) was administered to 15 patients (40%). All three patients were taken over with inotropic therapy and stopped during their follow-up. Invasive arterial blood pressure follow-ups were performed during the follow-up of the patients in the ICU. Oxygen saturation ($SpO_2$) was monitored by non-invasive pulse oximetry, and partial oxygen pressure ($pO_2$) was monitored by arterial blood gas analysis. The mean of the highest detected systolic blood pressures was 152 (±13), and the mean of the lowest systolic blood pressure was 114 (±15). The mean of the detected high diastolic blood pressures was 76 (±4), and the mean of the lowest diastolic blood pressures was 61 (±49). The results of the hemogram and blood biochemistry tests taken when the patients were admitted to the ICU and at the 12$^{th}$ hour are shown in Table 2. The change between the blood creatinine values taken before the surgery and the blood creatinine values taken at the 12$^{th}$ h after the surgery was calculated as a percentage. A positive correlation was found between the lactate level of the patients at admission and the change in the fluid volume and blood creatinine in the ICU (Table 3).

**Table 1. Patient demographic data**

| | |
|---|---|
| Age | 61.08 (±14) |
| **Gender (%)** | |
| Male | 18 (48%) |
| Female | 19 (52%) |
| **Comorbidities (%)** | |
| DM | 7 (19%) |
| CAD | 10 (27%) |
| HT | 11 (29%) |
| CVD | 1 (2.7%) |
| Ulcerative colitis | 1 (2.7%) |
| Ankylosing spondylitis | 1 (2.7%) |
| MEN-1 | 1 (2.7%) |
| *Intensive care hospitalization day | 1 (1-7) |

*Median (range), DM: Diabetes mellitus, CAD: Coronary artery disease, HT: Hypertension, CVD: Cerebrovascular disease, MEN-1: Multiple Endocrine Neoplasia syndrome-1

## Discussion

In our study, we examined patients followed in the ICU after the Whipple procedure. The Whipple procedure is perhaps the most associated with perioperative morbidity and mortality of all surgical procedures. The available data on the process and results in the ICU are insufficient (2). For this reason, we think that the contribution of the results of the field-specific ICU to the literature is important. In our study, the mean age of the patients was 61, which is consistent with the literature. Karim et al. (3). The mean age in the study was 55.9 years. In the study by Weinberg et al. (4), the mean age was found to be 67. Comorbidities accompanying the patients were also consistent with earlier studies (5). After the operation, high -flow nasal cannula oxygen therapy (YANKOT) support was provided to 14 patients. In studies, the need for respiratory support and reintubation rates decreased in the post-operative period with YANKOT treatment (6). We think that the use of YANKOT is a reason why we did not find low saturation in our study. Additionally, a

**Table 2. Laboratory values in the intensive care unit follow-up**

| Laboratory values | 0. hour | 12. hour | p-values |
|---|---|---|---|
| Hemoglobin (g/dL) | 11.4±1.8 | 11.19±1.7 | 0.158 |
| Platelets ($10^9$/L) | 258.4±76.2 | 247.3±81.4 | 0.315 |
| AST (U/L) | 171±213 | 132±134 | 0.115 |
| ALT (U/L) | 155.3±180.9 | 153.2±154.7 | 0.850 |
| Creatinine (mg/dL) | 0.87±0.2 | 0.83±0.2 | 0.403 |
| Blood lactate *(mmol/L) | 4.2±3.2 | 1.8±0.9 | 0.014 |
| $pO_2$ (mmHg) | 102.6±23.2 | 147.4±31.9 | <0.01 |

*Lactate level in arterial blood gas, AST: Aspartate aminotransferase, ALT: Alanine aminotransferase, $pO_2$: Partial oxygen pressure

**Table 3. Correlation of blood lactate level at admission to the intensive care unit, amount of fluid volume therapy, and blood creatinine**

| | | Highest blood lactate level | Percentage of changes in blood creatinine |
|---|---|---|---|
| Percentage of changes in blood creatinine | Pearson's r | 0.631 | - |
| | p-value | 0.021 | - |
| Amount of Fluid volume delivered | Pearson's r | 0.786 | 0.721 |
| | p-value | < .001 | 0.012 |

significant increase was found when the arterial $pO_2$ level at the arrival of the patients to the ICU was compared with the level at the 12$^{th}$ h. Since the patients were in the ICU, respiratory supports were applied quickly and desaturation was not allowed. Thus, the patient was stabilized in terms of breathing during the hours when the sedation effect and pain control were just started. Considering the highest arterial blood lactate level saw at the time of admission to the ICU, a positive correlation was found between the amount of fluid volume administered and the arterial blood lactate level. The increase in the arterial blood lactate level reflects the development of anaerobic metabolism. This is the result of uncontrolled high production or reduced elimination (7).

The need for higher fluid volume in patients with higher arterial blood lactate levels can be explained by the need to increase the amount of intravascular fluid volume.

### Study Limitations

The positive correlation between the increase in blood creatinine values and arterial blood lactate values is also particularly important in these patients. This result can be accepted as a sign that the kidney functions of patients with high arterial blood lactate levels may also be impaired. Our study was a single-center study. Patient data were also obtained by retrospective scanning. Additionally, the available data only covers the ICU follow-up. These are the limitations of our study.

## Conclusion

Patients should be followed closely after the Whipple procedure, fluid volume therapy and respiratory support seem to play a significant role in the recovery of these patients. Conducting multicenter and randomized controlled studies on the subject may supply patient-specific fluid volume therapy and respiratory support determination.

**Ethics Committee Approval:** Approval was obtained from the Ethics Committee of the University of Health Sciences Turkey, Başakşehir Çam and Sakura City Hospital (approval number: 2022.12.390), where the study was conducted, for the use of data and conducting the research.

**Informed Consent:** Retrospective study.

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## References

1. Changazi SH, Ahmed Q, Bhatti S, Siddique S, Abdul Raffay E, Farooka MW, et al. Whipple Procedure: A Five-Year Clinical Experience in Tertiary Care Center. Cureus 2020; 12: e11466.
2. Udhayachandhar R, Otokwala J, Korula PJ, Rymbai M, Chandy TT, Joseph P. Perioperative factors impacting intensive care outcomes following Whipple procedure: A retrospective study. Indian J Anaesth 2020; 64: 216-21.
3. Karim SAM, Abdulla KS, Abdulkarim QH, Rahim FH. The outcomes and complications of pancreaticoduodenectomy (Whipple procedure): Cross sectional study. Int J Surg 2018; 52: 383-7.
4. Weinberg L, Wong D, Karalapillai D, Pearce B, Tan CO, Tay S, et al. The impact of fluid intervention on complications and length of hospital stay after pancreaticoduodenectomy (Whipple's procedure). BMC Anesthesiol 2014; 14: 35.
5. Warrillow SJ, Weinberg L, Parker F, Calzavacca P, Licari E, Aly A, et al. Perioperative fluid prescription, complications and outcomes in major elective open gastrointestinal surgery. Anaesth Intensive Care 2010; 38: 259-65.
6. Lu Z, Chang W, Meng SS, Zhang X, Xie J, Xu JY, et al. Effect of high-flow nasal cannula oxygen therapy compared with conventional oxygen therapy in postoperative patients: a systematic review and meta-analysis. BMJ Open 2019; 9: e027523.
7. Vincent JL, Quintairos E Silva A, Couto L Jr, Taccone FS. The value of blood lactate kinetics in critically ill patients: a systematic review. Crit Care 2016; 20: 257.