









Pancreaticoduodenectomy in a Hemodialysis Patient: First Report From Kazakhstan with a Brief Literature Review

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Abstract: Major abdominal surgeries including pancreatic resection are rarely performed in patients on chronic dialysis due to perioperative morbidity associated with end-stage renal disease. This case report presents a 71-year-old female on hemodialysis with pancreatic head cancer who underwent successful pancreaticoduodenectomy. The patient had the following severe comorbidities: type 2 diabetes mellitus, hypertension, and chronic kidney disease. Therefore, meticulous preoperative preparation, intraoperative care and postoperative management including hemodialysis and nutritional support were performed. Postoperative recovery was uneventful, bowel function was restored on day 5, and the patient was discharged in good condition. This case provides the feasibility of pancreaticoduodenectomy (also known as Whipple procedure) in carefully monitored patients, particularly those on dialysis, despite the increased risk of complications like cardiovascular, immune, and coagulation disorders. Brief literature review confirms that patients with end-stage renal disease can be considered for abdominal surgery with acceptable morbidity and mortality in complex surgical procedures.

Keywords: hemodialysis, end-stage renal disease, pancreatic head cancer, pancreaticoduodenectomy, Whipple procedure

Introduction

Chronic renal failure is a progressive condition commonly caused by hypertension, diabetes mellitus, glomerulonephritis, drug toxicity, or heavy metal exposure. In critical renal dysfunction, such patients need dialysis that severely limit the applicability of abdominal surgery. However, recent advances in surgical treatment and perioperative care greatly improved survival outcomes in these patients.^{1,2} Therefore, these patients are much more likely to undergo surgery for other diseases, including major abdominal surgery.^{3,4} Nevertheless, those who have been diagnosed with end-stage renal disease (ESRD) remain at elevated risk of cardiovascular complications and may also have impaired immune system and coagulation, which significantly affect recovery from major abdominal surgery.^{5,6} As a result, a significant proportion of end-stage renal failure patients subjected to various non-elective abdominal surgeries die due to peri- and post-operative bleeding complications.⁷ The ESRD as a comorbidity is associated with twice longer in-hospital stay and 2-to-3 times higher peri- and post-operative mortality in patients subjected to endovascular aneurysm repair.⁸ In patients with ESRD, which have hemodialysis or hemofiltration and were subjected to laparoscopic ventral hernia repair, the risk of post-operative pneumonia and sepsis was significantly higher.⁹ However, in selected ESRD patients with carefully evaluated post-operative risks, the outcomes of laparoscopic abdominal surgery may be beneficial.¹⁰ In addition, the post-operative outcomes and complications may depend on the preceding history of hemodialysis. For example, one report showed that three patients with ESRD and having dialysis for (on average) >7 years may survive the surgery, while one of the patients died 21 months later from another disease.¹¹ Nevertheless, the considerations about overall risk are likely contributing to persisting reluctance of using major abdominal surgery in such patients.

In the Central Asia, the applicability of this surgical approach for such specific patients is extremely limited due to the high risk of negative outcomes and, in particular, because of the lack of highly experienced surgeons as well as due to the difficulties related to the transportation of dialysis patients to the clinical setting. This report presents the case of a 71-year-old female supported by hemodialysis and diagnosed with pancreatic head cancer who had severe comorbidities (diabetes mellitus type 2, chronic hypertension, chronic kidney disease), and who underwent a successful pancreaticoduodenectomy.

Case Presentation

The 71-year-old female patient of Kazakh nationality was admitted to the surgical department of National Scientific Medical Center, Astana, Kazakhstan, complaining of prolonged nausea, vomiting after eating or drinking, persistent thirst, unstable hemodynamics, and a weight loss of 20 kg in the past month. Urine output was 200–300 mL/day indicating oliguria. Hyperglycemia episodes and general weakness were noted. The patient was on permanent dialysis for approximately 5 years before treatment.

Abdominal CT scans (Figure 1) showed the following: i) hepatomegaly, ii) dilation of common bile duct up to 22.9 mm wide, intrahepatic ducts up to 8.2 mm wide, iii) mass in the head of the pancreas sized $4.7 \times 3.3 \times 3.8$ cm, iv) Wirsung Stasis (Wirsung duct up to 7.7 mm wide), v) chronic atrophic pancreatitis, vi) pancreatic cysts up to 6.6 mm in diameter, and vii) cysts of both kidneys, 10.0 mm and 8.0 mm in diameter on the right and left, respectively. Stenosis of the renal arteries on both sides was found. Percutaneous transhepatic cholangiostomy was performed.

Past medical history revealed insulin-dependent diabetes mellitus. Also, chronic kidney disease (CKD), diabetic nephropathy, arterial hypertension were present for 19 years. Laboratory tests showed that creatinine level was at $1171.30 \mu\text{mol/L}$ (the normal range for females is 49 to $90 \mu\text{mol/L}$). There was also anemia with hypocalcemia: erythrocytes – $2.35 \times 10^{12}/\text{L}$, hemoglobin – 71.00 g/L , calcium level in blood plasma – 1.8 mmol/L .

A consultation was held, and a decision was made to perform surgical treatment for vital indications. In the preoperative period, two hemodialysis sessions were performed four and two days before surgery. Also, taking into account the remarkable anemia (hemoglobin – 71 g/L), a transfusion of one dose of washed red blood cells (Blood Component, 260 mL) four days before surgery and just after hemodialysis session was performed. The day before the operation, the results were the following: erythrocytes $2.91 \times 10^{12}/\text{L}$, hemoglobin – 87.00 g/L , creatinine – $542.78 \mu\text{mol/L}$.

The patient was taken for surgery. Laparotomy and revision were performed. During revision, the tumor of the head of the pancreas was up to $4.0 \times 3.0 \times 3.0$ cm. Taking into account the preoperative and intraoperative data, the situation corresponded to a malignant neoplasm of the head of the pancreas. Pancreaticoduodenectomy was performed. The duration of surgery was 280 minutes and it went without complications.

On the next day after surgery, control blood tests were taken. Creatinine level was $364.02 \mu\text{mol/L}$, hemodialysis was recommended. During the postoperative period, the levels of glucose and electrolytes were carefully monitored. The patient was receiving the following treatment: antibacterial therapy (meropenem 500 mg twice a day), gastro-protective therapy (omeprazole 40 mg intravenously), anticoagulation therapy (enoxaparin injection i.p. 40 mg),

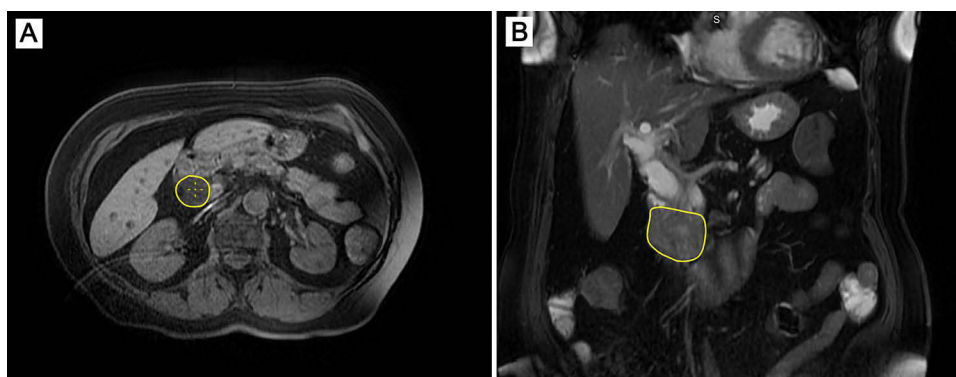


Figure 1 Preoperative imaging findings (CT, July 2024). Abdominal CT revealed a mass in the head of the pancreas measuring $4.7 \times 3.3 \times 3.8$ cm, with signs of local invasion and compression of the surrounding structures (shown as the yellow contour). (A) - axial CT plane, (B) - frontal CT plane.

parenteral feeding, pain management and correction of electrolyte abnormalities, which were strictly monitored by taking arterial blood gas and electrolyte analysis four times a day. In the early postoperative period, mild hyponatremia was observed, which was corrected by the administration of 10% sodium chloride (200 mL). The patient's blood pressure was strictly monitored, in perioperative period patient received oral moxonidine and bisoprolol under pulse and blood pressure control.

Taking into account the patient's stage 5 chronic kidney disease, chemotherapy was contraindicated, and patient did not receive it. Hypoproteinemia with total protein level of 46.99 g/L was noted in the postoperative period, and therefore albumin transfusion was performed. Taking into account the anemia conditions (erythrocytes – 2.70 10¹²/L, hemoglobin – 81.00 g/L, hematocrit – 24.70%), a blood transfusion was performed. Hemodialysis was performed 3 days before the operation, and then three hemodialysis sessions were performed in the postoperative period: 2nd, 9th, and 13th days after the operation. Intestinal function was restored on the 5th day after the operation, early enteral nutritional support was performed through a jejunostomy. Electrolytes were normalized on the 10th day, the hemoglobin level has reached 96 g/L, and there were no indications for blood transfusion; creatinine level was 546.20 µmol/L by the time of discharge. The patient was discharged on day 14 post-surgery in a satisfactory condition for further outpatient treatment.

Final histopathology revealed endo-exocrine cancer of the head of the pancreas with ulceration, invasion into the muscular layer of the duodenum, formation of a mucinous cyst, metastasis to regional lymph nodes. The focal erosions were also observed with chronic cholangitis, papillitis, and serous-hemorrhagic omentitis.

Five months later, the patient underwent an MRI of the abdominal organs, which showed soft tissue consolidation in the postoperative area as well as ascites (Figure 2). On 7 months post-operative follow-up, the MRI of the abdominal organs (Figure 3) revealed negative dynamics due to multiple focal liver lesions, most likely metastatic (mts). Significant ascites persisted. By summer 2025, the patient was alive according to the available information in national healthcare registry, but we were unable to perform diagnostic observations for further complications as well as progression of the oncological lesions.

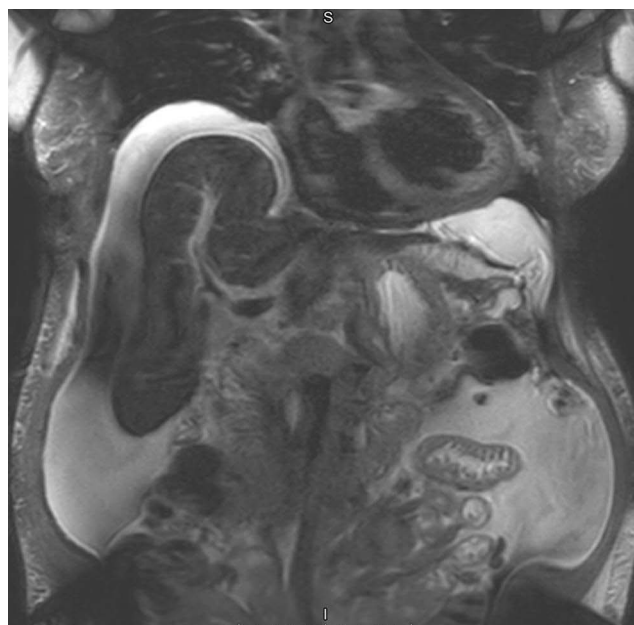


Figure 2 MRI follow-up 5 months postoperatively (February 2025). Findings indicate soft tissue consolidation in the postoperative area. Ascites is also noted.

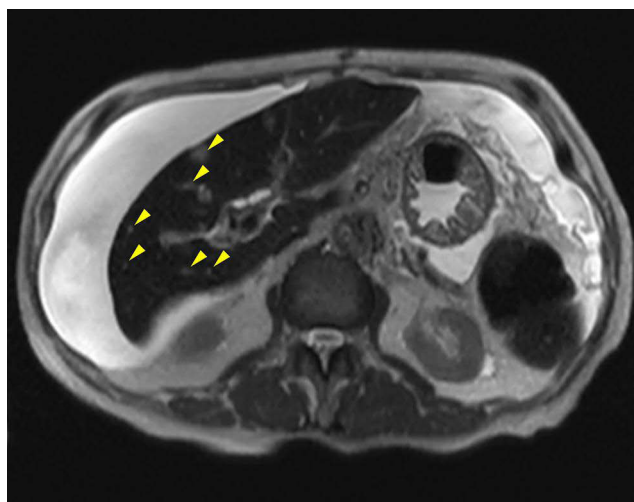


Figure 3 MRI follow-up 7 months postoperatively (the end of April, 2025). Findings indicate negative dynamics due to multiple focal liver lesions, most likely metastatic (mts, shown by yellow pointers). Significant ascites persists.

Discussion

The number of patients with end-stage renal disease (ESRD) who need the long-term dialysis has been increasing in recent years.¹² The most important chronic diseases that contribute to the increase are diabetes mellitus,^{13,14} CKD,¹⁵ and hypertension¹⁶ – the prevalence for all these diseases is steadily increased worldwide. This substantiate that the number of major surgical treatments in the patients requiring dialysis has also significantly increased.

The concomitant and/or post-operative complications are greatly affecting the outcome of surgical treatment in these patients. Among the most affecting, one would list cardiovascular complications, dysfunctions in vascular system resulting in hypo- and hypertension, diabetes mellitus, disorders in blood system, and disorders in immune responses.^{17,18} ESRD patients have coagulation disorders associated with uremic platelet, fibrinogen, and thrombin dysfunction,^{19,20} and are thus susceptible to bleeding. Immune function impairments like immune senescence and chronic inflammation are also occurring as the total amount of lymphocytes and phagocytes may change in parallel with the alterations in their activity.²¹ This leads to an increased risk of post-surgical infection and inflammation. In addition, the complications of pulmonary system may develop at higher risk.^{22,23} For example, the patients on hemodialysis have a higher incidence of complications in the postoperative period, in particular myocardial infarction, pneumonia, bleeding, septicemia, compared with the control group.²⁴ Also, patients on dialysis have a much higher 30-day postoperative mortality.¹² The duration of hospitalization and stay in intensive care are also higher in dialysis patients, partly due to infection-related complications.^{3,25} The same results were shown in a meta-analysis, where morbidity in the postoperative period was evaluated in the patients on chronic dialysis.¹⁸ According to their data, the risk of myocardial infarction and stroke was 2–5 times higher in patients on dialysis, regardless of the type of surgery performed. It has also been found that combined hypertension and diabetes in chronic dialysis patients resulted in higher postoperative risk of stroke, pneumonia, and septicemia, compared to the patients without diabetes or hypertension (but those may have one of the diseases).²⁴ In addition, diabetes mellitus in aged patients provides increased chance of myocardial infarction associated with chronic dialysis compared to younger patients; similarly, the risk of stroke is higher in aged patients with coronary artery disease.³

Collectively, these data show that the presence of non-dialysis comorbidities (eg, diabetes mellitus) in aged patients contribute significantly to the elevated risks of poor outcome of surgical treatment. In other words, dialysis itself is not a dominating factor in perioperative morbidity in these patients.^{3,18} However, if we consider hepatic and pancreatic surgery, such operations are still rare in ESRD patients.^{25,26} This may be explained by the concern about operative and perioperative risks in such patients.²⁷ Despite the improved safety of hepato-pancreatic resections in last years, such surgical treatments remain risky in terms of post-treatment morbidity and severe complications even in the patients without severe pre-operative comorbidities.²⁵ In addition, substantial peri- and early post-operative fluid shifts are the

common concerns in hepato-pancreatic resections, thus contributing to the complications related to the inability to accommodate to these fluids shifts. Therefore, pancreatic surgery is still one of the most complex surgeries, and there are many factors that influence the prognosis. Among the factors, renal failure plays a great role in the elevated risk of postoperative complications that may include cardiac arrest and require blood transfusion, as well as septic shock may develop. Many studies reported that such patients, ie, those with renal disorders, have two-fold longer period of in-hospital stay compared to the patients without renal dysfunction.^{3,27-29}

Another large study analyzed the outcomes of ESRD patients who have undergone hepatic or pancreatic resections between 2005 and 2011.²⁵ It was found that despite greater severity of postoperative course in the ESRD patients, liver and pancreatic resections are not excessively life-threatening in the selected ESRD patients: perioperative mortality rates were similar in ESRD and non-ESRD patients. On the other hand, ESRD patients subjected to pancreaticoduodenectomy developed major complications (respiratory disorders, sepsis) twice more frequently. It is likely that the lack of tolerance for long and complex surgery, due to the impaired physiological functions, contributes to the overall process.

At now, there is little information on how renal failure affects outcomes after pancreatic resection. For example, according to a single-center study, which encompassed 1061 patients with renal insufficiency, the postoperative outcomes after pancreatic resection were worse if a patient had the preoperative creatinine level of ≥ 1.8 mg/dL.³⁰ This high-risk factor has also been associated to the significantly elevated risk of respiratory failure. In addition, the risk of post-surgical complications was found to be associated with CKD, if staged as severe (stage 4 or 5).³⁰ It should be noted that the sample size may affect the statistical significance, as more patients who underwent Whipple procedures had serum creatinine levels ≥ 1.8 mg/dL, ie, 159.16 mmol/L (n = 19) compared with those classified as severe CKD (n = 9). Additionally, a higher proportion of patients with severe CKD had stage 5 CKD and therefore were already dialysis-dependent before surgery and continued scheduled hemodialysis after surgery. Authors also suggested that the fluid balance was better managed in severe CKD patients due to early planned hemodialysis after surgery. It may have contributed to a weaker association with complications or respiratory failure. In addition, the time between hemodialysis and surgery also affects postoperative complications. As shown by a retrospective cohort study,²⁸ the patients received hemodialysis on the day of surgery had lower 90-day mortality. This study also showed that the interval between dialysis and surgery directly affects the risk of 90-day mortality. However, age was found to be a non-contributing factor to the postoperative morbidity in the patients with CKD subjected to pancreatic resection.³¹

Our patient had a number of factors that increased the risk of postoperative complications, including arterial hypertension, diabetes mellitus, and a creatinine level of 1171.30 $\mu\text{mol/L}$. In this case, adequate perioperative preparation and postoperative monitoring were critical. Surgery on the pancreas itself is associated with a high level of risks, and in patients on hemodialysis, these risks increase many times over. Therefore, patients with CKD stage IV–V are taken with great caution for extensive operations. For example, when searching for literature, no articles were found describing the performance of pancreaticoduodenal resection in patients on hemodialysis in Kazakhstan. However, examples from the world literature, as well as the example of our patient, demonstrate that with careful preparation of the patient this complex surgical treatment may be proposed with relatively low risk of post-operative mortality.

We should note limitations of our study. First, this is a single case in our clinic and therefore neither specific patient's conditions nor post-operative outcomes can be interpreted from cohort-based point of view (generalization is limited). To attain needed level of interpretation for applicability and selection criteria for patients (based on risk assessment for individual patients), further studies or case series should be run or reported to validate the feasibility and safety of this approach in patients with severe renal disorders requiring permanent hemodialysis. Second, in our patient, we noted the negative progression in the form of metastatic-like spread of lesion. In this specific case, it is probable that the patient started to develop the metastatic progress (negative entity) prior to the surgery (positive entity), and the combined outcome superimposes these two entities. Considering the results of follow-up imaging of our patient, we can conclude that although the elective surgery can be performed safely in CKD and ESRD patients (assuming adequate pre-, intra-, and post-operative care), the progression of the cancer cannot be prevented without adjuvant chemotherapy. Again, more cases should be accumulated to evaluate the overall success rate of the surgery in these high-risk patients, including oncological patients.

Conclusions

To date and as far as we know, no clinical cases or papers describing the performance of pancreaticoduodenal resection in patients on hemodialysis in Kazakhstan are available. On the other hand, examples from the world literature, as well as this clinical case of our patient (being first reported in Kazakhstan), demonstrate that with careful pre-, peri-, and post-operative care of the patient, this operation is feasible and may both augment overall survival of patients and improve their life quality. The success of this surgical treatment in the specific patients requires multimodal personalized approach involving many specialists like surgeon, oncologist, anesthesiologist, nephrologist, internist, gastroenterologist, etc.

Data Sharing Statement

All data generated or analysed during this study are included in this published article.

Ethics Approval and Consent to Participate

This study itself as well as the institutional publication consent form for patients was approved by the local ethical board of the National Scientific Medical Center. All methods and treatments were performed accordingly to the relevant guidelines and regulations.

Consent for Publication

Written informed consent was obtained from the patient.

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Author Contributions

All authors significantly contributed to the study, including the conception development, study design, execution, data acquisition, data analysis/interpretation. They equally took part in the preparation of draft of the manuscript, revising or critically reviewing the manuscript. The authors confirm their final approval of the published version and the journal to which the paper has been submitted, and agree to be accountable for all aspects of the study.

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Disclosure

The authors declare that they have no competing financial interests or personal relationships (known or putative) that could have appeared to influence the study reported in this manuscript.

References

1. Neild GH. Life expectancy with chronic kidney disease: an educational review. *Pediatr Nephrol.* 2017;32(2):243–248. doi:10.1007/s00467-016-3383-8
2. Johansen KL. Life expectancy gains for patients with ESRD. *Clin J Am Soc Nephrol.* 2018;13(1):11–12. doi:10.2215/CJN.12831117
3. Palamuthusingam D, Nadarajah A, Johnson DW, Pascoe EM, Hawley CM, Fahim M. Morbidity after elective surgery in patients on chronic dialysis: a systematic review and meta-analysis. *BMC Nephrol.* 2021;22(1):97. doi:10.1186/s12882-021-02279-0
4. Khair M, Palamuthusingam D, Hawley CM, et al. Gynecological surgery in patients with kidney failure on chronic kidney replacement therapy: a binational data linkage study of morbidity and mortality outcomes. *Int J Gynaecol Obstet.* 2025;170(2):865–874. doi:10.1002/ijgo.70064
5. Ahmadmehrab S, Tang WHW. Hemodialysis-induced cardiovascular disease. *Semin Dial.* 2018;31(3):258–267. doi:10.1111/sdi.12694
6. Yang TO, Chuang YF, Chiu YL. T-cell aging in end-stage renal disease: an evolving story with CMV. *Med Microbiol Immunol.* 2019;208(3–4):281–287. Erratum in: *Med Microbiol Immunol.* 2019;208(6):885. doi:10.1007/s00430-019-00620-x. doi:10.1007/s00430-019-00596-8
7. Zhou Done J, Ostertag-Hill CA, Ziegler O, Vithiananthan S. Major perioperative bleeding in patients on dialysis undergoing nonelective abdominal surgeries. *J Surg Res.* 2025;305:356–366. doi:10.1016/j.jss.2024.11.029
8. Komshian S, Farber A, Patel VI, et al. Patients with end-stage renal disease have poor outcomes after endovascular abdominal aortic aneurysm repair. *J Vasc Surg.* 2019;69(2):405–413. doi:10.1016/j.jvs.2018.04.031
9. Gurien SD, Chung P, Nofi CP, Coppa GF, Sugiyama G. Laparoscopic ventral hernia repair postoperative complications in end stage renal disease patients. *JSLS.* 2022;26(1):e2021.00086. doi:10.4293/JSLS.2021.00086

10. Abdul-Malak OM, Yuo T, Makaroun M, Tzeng E, Liang N. Outcomes after elective abdominal aortic aneurysm repair have improved over time in patients on dialysis. *Ann Vasc Surg.* 2022;86:94–103. doi:10.1016/j.avsg.2022.05.016
11. Uchida H, Shibata K, Kai S, Iwaki K, Ohta M, Kitano S. Pylorus-preserving pancreaticoduodenectomy in patients undergoing chronic hemodialysis. *Surg Today.* 2008;38(12):1152–1154. doi:10.1007/s00595-008-3746-2
12. Song S, Cho C, Park SY, et al. Cause of postoperative mortality in patients with end-stage renal disease. *Anesth Pain Med.* 2022;17(2):206–212. doi:10.17085/apm.21080
13. Pavkov ME, Collins AJ, Coresh J, Nelson RG. Kidney Disease in Diabetes. In: Cowie CC, Casagrande SS, Menke A, et al. editors *Diabetes in America*. 3rd. Bethesda (MD):National Institute of Diabetes and Digestive and Kidney Diseases (US);2018:CHAPTER 22.
14. Cheng HT, Xu X, Lim PS, Hung KY. Worldwide Epidemiology of Diabetes-Related End-Stage Renal Disease, 2000-2015. *Diabetes Care.* 2021;44(1):89–97. doi:10.2337/dc20-1913
15. Clements JM, Rosca M, Cavallin C, et al. Type 2 diabetes and chronic conditions disparities in medicare beneficiaries in the state of michigan. *Am J Med Sci.* 2020;359(4):218–225. doi:10.1016/j.amjms.2020.01.013
16. Wang Z, Yang T, Fu H. Prevalence of diabetes and hypertension and their interaction effects on cardio-cerebrovascular diseases: a cross-sectional study. *BMC Public Health.* 2021;21(1):1224. doi:10.1186/s12889-021-11122-y
17. Nasr R, Chilimuri S. Preoperative evaluation in patients with end-stage renal disease and chronic kidney disease. *Health Serv Insights.* 2017;10:1178632917713020. doi:10.1177/1178632917713020
18. Gäckler A, Rohn H, Lisman T, et al. Evaluation of hemostasis in patients with end-stage renal disease. *PLoS One.* 2019;14(2):e0212237. doi:10.1371/journal.pone.0212237
19. Pavlou EG, Georgatzakou HT, Fortis SP, et al. Coagulation Abnormalities in Renal Pathology of Chronic Kidney Disease: the Interplay between Blood Cells and Soluble Factors. *Biomolecules.* 2021;11(9):1309. doi:10.3390/biom11091309
20. Ducloux D, Legendre M, Bamoulid J, Saas P, Courivaud C, Crepin T. End-stage renal disease-related accelerated immune senescence: is rejuvenation of the immune system a therapeutic goal? *Front Med.* 2021;8:720402. doi:10.3389/fmed.2021.720402
21. Shaik L, Thotamgari SR, Kowtha P, et al. A spectrum of pulmonary complications occurring in end-stage renal disease patients on maintenance hemodialysis. *Cureus.* 2021;13(6):e15426. doi:10.7759/cureus.15426
22. Gembillo G, Calimeri S, Tranchida V, et al. Lung dysfunction and chronic kidney disease: a complex network of multiple interactions. *J Pers Med.* 2023;13(2):286. doi:10.3390/jpm13020286
23. Pollock C, James G, Garcia Sanchez JJ, et al. Cost of end-of-life inpatient encounters in patients with chronic kidney disease in the united states: a report from the DISCOVER CKD retrospective cohort. *Adv Ther.* 2022;39(3):1432–1445. doi:10.1007/s12325-021-02010-3
24. Palamuthusingam D, Nadarajah A, Pascoe EM, et al. Postoperative mortality in patients on chronic dialysis following elective surgery: a systematic review and meta-analysis. *PLoS One.* 2020;15(6):e0234402. doi:10.1371/journal.pone.0234402
25. Barbas AS, Speicher PJ, Clary BM. Hepatic and pancreatic resection in patients with end-stage renal disease: a propensity analysis. *HPB.* 2014;16(11):1016–1022. doi:10.1111/hpb.12281
26. Inoue Y, Tsuchimoto Y, Asai A, et al. Effects of chronic kidney disease on outcomes of hepatic resection. *J Gastrointest Surg.* 2021;25(5):1323–1326. doi:10.1007/s11605-020-04835-9
27. Teraoku H, Morine Y, Ikemoto T, et al. Short- and long-term outcomes of pancreatectomy in patients with hemodialysis. *J Med Invest.* 2023;70(1.2):105–109. doi:10.2152/jmi.70.105
28. Fielding-Singh V, Vanneman MW, Grogan T, et al. Association between preoperative hemodialysis timing and postoperative mortality in patients with end-stage kidney disease. *JAMA.* 2022;328(18):1837–1848. doi:10.1001/jama.2022.19626
29. Tamura S, Kanemoto H, Fujita A, et al. The impact of preoperative renal insufficiency on the outcomes of patients with pancreatic cancer undergoing pancreaticoduodenectomy. *Langenbecks Arch Surg.* 2024;409(1):338. doi:10.1007/s00423-024-03531-5
30. Squires MH 3rd, Mehta VV, Fisher SB, et al. Effect of preoperative renal insufficiency on postoperative outcomes after pancreatic resection: a single institution experience of 1061 consecutive patients. *J Am Coll Surg.* 2014;218(1):92–101. doi:10.1016/j.jamcollsurg.2013.09.012
31. Antoniak D, Are C, Vokoun C, Samson K, Smith L, Shiffermiller J. The relationship between age and chronic kidney disease in patients undergoing pancreatic resection. *J Gastrointest Surg.* 2018;22(8):1376–1384. doi:10.1007/s11605-018-3743-8

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