Отчет подобия

Метаданные

Название организации
National Scientific Center of Surgery named after A.N. Syzganov
Название
FATTY LIVER DISEASE AFTER PANCREATODUODENECTOMY AND TOTAL PANCREATECTOMY
Автор
Serik T.
Подразделение
National Scientific Center of Surgery named after A.N. Syzganov

Тревога

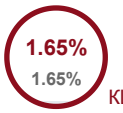
В этом разделе вы найдете информацию, касающуюся текстовых искажений. Эти искажения в тексте могут говорить о ВОЗМОЖНЫХ манипуляциях в тексте. Искажения в тексте могут носить преднамеренный характер, но чаще, характер технических ошибок при конвертации документа и его сохранении, поэтому мы рекомендуем вам подходить к анализу этого модуля со всей долей ответственности. В случае возникновения вопросов, просим обращаться в нашу службу поддержки.

Замена букв	ß	1
Интервалы	A→	0
Микропробелы	·	7
Белые знаки	ß	0
Парафразы (SmartMarks)	a	4

Объем найденных подобий

КП-ия определяют, какой процент текста по отношению к общему объему текста был найден в различных источниках.. Обратите внимание!Высокие значения коэффициентов не означают плагиат. Отчет должен быть проанализирован экспертом.

КП1



КЦ

25
Длина фразы для коэффициента подобия 2

4719
Количество слов

34022
Количество символов

Подобия по списку источников

Ниже представлен список источников. В этом списке представлены источники из различных баз данных. Цвет текста означает в каком источнике он был найден. Эти источники и значения Коэффициента Подобия не отражают прямого плагиата. Необходимо открыть каждый источник и проанализировать сожержание и правильность оформления источника.

10 самых длинных фраз — Цвет текста

ПОРЯДКОВЫЙ НОМЕР	НАЗВАНИЕ И АДРЕС ИСТОЧНИКА URL (НАЗВАНИЕ БАЗЫ)	КОЛИЧЕСТВО ИДЕНТИЧНЫХ СЛОВ (ФРАГМЕНТОВ)
1	Re_Clinical-case_Autalipov-e61e8076 [redacted] 2/18/2025 National Scientific Center of Surgery named after A.N. Syzganov (National Scientific Center of Surgery named after A.N. Syzganov)	20 0.42 %

2	THE EFFECTIVENESS OF THE FUNCTIONING OF RECONSTRUCTED HEPATIC VEINS USING VARIOUS TYPES OF MATERIALS IN TRANSPLANTATION OF THE RIGHT LOBE OF THE LIVER FROM A LIVING DONOR [redacted] 1/6/2025 National Scientific Center of Surgery named after A.N. Syzganov (National Scientific Center of Surgery named after A.N. Syzganov)	16 0.34 %
3	THE EFFECTIVENESS OF THE FUNCTIONING OF RECONSTRUCTED HEPATIC VEINS USING VARIOUS TYPES OF MATERIALS IN TRANSPLANTATION OF THE RIGHT LOBE OF THE LIVER FROM A LIVING DONOR [redacted] 1/6/2025 National Scientific Center of Surgery named after A.N. Syzganov (National Scientific Center of Surgery named after A.N. Syzganov)	16 0.34 %
4	The role of fructose in the pathogenesis of NAFLD and the metabolic syndrome Michele Mietus-Snyder,Jung Sub Lim, Jean-Marc Schwarz, Robert H. Lustig, Annie Valente;	14 0.30 %
5	Ultrasound innovations in abdominal radiology: techniques and clinical applications in pediatric imaging Le, David Q., Freeman, Colbey W., Hwang, Misun,Davis, Laura May, Adams, Caroline, Lemessa, Natae, Sultan, Laith R., Darge, Kassa, Martinez-Correa, Santiago;	10 0.21 %
6	https://www.cambridge.org/core/services/aop-cambridge-core/content/view/3C04675D03D2A17D85380ED18DFFB935/S0029665123000034a.pdf/novel_plantbased_meat_alternatives_future_opportunities_and_health_considerations.pdf	10 0.21 %
7	THE EFFECTIVENESS OF THE FUNCTIONING OF RECONSTRUCTED HEPATIC VEINS USING VARIOUS TYPES OF MATERIALS IN TRANSPLANTATION OF THE RIGHT LOBE OF THE LIVER FROM A LIVING DONOR [redacted] 1/6/2025 National Scientific Center of Surgery named after A.N. Syzganov (National Scientific Center of Surgery named after A.N. Syzganov)	10 0.21 %
8	https://cyberleninka.ru/article/n/liver-transplantation-in-syzganov-national-scientific-center-of-surgery	9 0.19 %
9	https://cyberleninka.ru/article/n/epidemiology-of-caries-in-adolescents-in-kazakhstan	9 0.19 %
10	https://cyberleninka.ru/article/n/efficacy-of-percutaneous-transhepatic-cholecystostomy-in-acute-obstructive-cholecystitis	8 0.17 %

из базы данных RefBooks (0.51 %)

ПОРЯДКОВЫЙ НОМЕР	НАЗВАНИЕ	КОЛИЧЕСТВО ИДЕНТИЧНЫХ СЛОВ (ФРАГМЕНТОВ)
Источник: Paperity - abstrakty		
1	The role of fructose in the pathogenesis of NAFLD and the metabolic syndrome Michele Mietus-Snyder,Jung Sub Lim, Jean-Marc Schwarz, Robert H. Lustig, Annie Valente;	14 (1) 0.30 %
Источник: Paperity		
1	Ultrasound innovations in abdominal radiology: techniques and clinical applications in pediatric imaging Le, David Q., Freeman, Colbey W., Hwang, Misun,Davis, Laura May, Adams, Caroline, Lemessa, Natae, Sultan, Laith R., Darge, Kassa, Martinez-Correa, Santiago;	10 (1) 0.21 %

из домашней базы данных (1.46 %)

ПОРЯДКОВЫЙ НОМЕР	НАЗВАНИЕ	КОЛИЧЕСТВО ИДЕНТИЧНЫХ СЛОВ (ФРАГМЕНТОВ)

1	THE EFFECTIVENESS OF THE FUNCTIONING OF RECONSTRUCTED HEPATIC VEINS USING VARIOUS TYPES OF MATERIALS IN TRANSPLANTATION OF THE RIGHT LOBE OF THE LIVER FROM A LIVING DONOR [redacted] 1/6/2025 National Scientific Center of Surgery named after A.N. Syzganov (National Scientific Center of Surgery named after A.N. Syzganov)	49 (4) 1.04 %
2	Re_Clinical-case_Autalipov-e61e8076 [redacted] 2/18/2025 National Scientific Center of Surgery named after A.N. Syzganov (National Scientific Center of Surgery named after A.N. Syzganov)	20 (1) 0.42 %

из программы обмена базами данных (0.00 %)

ПОРЯДКОВЫЙ НОМЕР	НАЗВАНИЕ	КОЛИЧЕСТВО ИДЕНТИЧНЫХ СЛОВ (ФРАГМЕНТОВ)

из интернета (1.53 %)

ПОРЯДКОВЫЙ НОМЕР	ИСТОЧНИК URL	КОЛИЧЕСТВО ИДЕНТИЧНЫХ СЛОВ (ФРАГМЕНТОВ)
1	https://cyberleninka.ru/article/n/liver-transplantation-in-syzganov-national-scientific-center-of-surgery	25 (4) 0.53 %
2	https://cyberleninka.ru/article/n/efficacy-of-percutaneous-transhepatic-cholecystostomy-in-acute-obstructive-cholecystitis	15 (2) 0.32 %
3	https://cyberleninka.ru/article/n/good-scientific-management-as-the-basis-for-successful-realization-of-scientific-projects-in-medicine	13 (2) 0.28 %
4	https://www.cambridge.org/core/services/aop-cambridge-core/content/view/3C04675D03D2A17D85380ED18DFFB935/S0029665123000034a.pdf/novel_plantbased_meat_alternatives_future_opportunities_and_health_considerations.pdf	10 (1) 0.21 %
5	https://cyberleninka.ru/article/n/epidemiology-of-caries-in-adolescents-in-kazakhstan	9 (1) 0.19 %

Список принятых фрагментов (нет принятых фрагментов)

ПОРЯДКОВЫЙ НОМЕР	СОДЕРЖАНИЕ	КОЛИЧЕСТВО ИДЕНТИЧНЫХ СЛОВ (ФРАГМЕНТОВ)

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Conflict of Interest The authors declare no conflicts of interest. The study was conducted objectively without external influence.

CLINICAL CASE

FATTY LIVER DISEASE AFTER PANCREATODUODENECTOMY AND TOTAL PANCREATECTOMY

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Annotation

Pancreatoduodenectomy(PD)is the onlytreatmentmethod for patientswithtumors of the pancreaticheadandperiampullaryregion. It is knownthatsomelong-term livingpatientsdevelopexocrinepancreaticinsufficiency(EPI)aftersurgery.Oneof the consequencesof EPIisfattyliver disease(FLD),which,according to research,occurs in 7.8%-40.0% of patientsafterPD.We here reporttwo clinicalcases of womenaged67and62years who underwentPDandtotalpancreatectomy(TP)forcancerof pancreatic head andintraductalpapillary mucinousneoplasm of the mainduct of the pancreas(IPMN).After operation, theydevelopedrapidlyprogressiveFLD with nopreviousliverdisease,whichledtodeathfromliverfailureon 20daysand3monthsaftersurgery. It is believedthatseveremalnutritioncausedby EPI,postoperativeeatingdisorders, andexacerbation of diabetesmellituswere the mainfactorscontributing to therapiddeterioration of the condition.Thisclinicalcasehighlights the possibility of developinglife-threateningFLDwithseverefibrosisafterPDandTP. It is importanttocarefullymonitorthecondition of the liver,aswell as regularlyevaluate the nutrition of patients, followed by preventivereplacement of pancreaticenzymesandensuringadequatenutritionaftertheseoperations.

Key words: pancreatoduodenectomy, fatty liver disease, pancreatic cancer, liver failure, exocrine pancreatic insufficiency.

Introduction

Pancreatoduodenectomy (PD) is the only possible treatment for patients with tumors of the pancreatic head and periampullary zone. Because of the malignant potential of these tumors, overall survival remains generally unsatisfactory even after PD, although some long-term survivors have been described [1,2]. It is known that some long-term surviving patients develop exocrine pancreatic in sufficiency (EPI) [3-5]. One of the consequences of EPI is fatty liver disease (FLD), which has been reported to occur in 7.8% - 40.0% of patients after PD [6-14].

Possible risk factors for the development of FLD include pancreatic fistula [9], lack of insulin use [11], postoperative loss of body mass index(BMI) [11], volume of surgical blood loss [12], low remnant volume of the pancreas [7,14], postoperative diarrhea [7], infection [14], female gender [8], cancer of pancreatic head [7.10], and postoperative EPI [13], but none of these factors has been found to be fully responsible for the occurrence of FLD. In addition, no methods have been developed for the prevention and treatment of FLD after PD.

Tomimaruet. al. reported that reduced remnant pancreatic volume after PD influences the development of FLD [15].

SomestudiessuggestthatmalnutritionormalabsorptionofessentialnutrientscausedbyEPI leads to FLD [16-21]. Changes in metabolism resulting in hepatic steatosis could lead to sensitivity for hepatocyte damage, inflammation, and fibrosis [20,22]. Pancreatic enzyme administration as treatment of EPI has beneficial impact on FLD after PD, indicating that EPI could be the main cause of new onset FLD in these patients [16,21]. Other evidence for malnutrition in patients with EPI or after PD is the report of increase oftaurine serum levels and decreaseofmethionine, tyrosine, albumin, cholinesterase, zinc, andtotalcholesterolserumlevels [16,17,18,20,22-25]. Therefore, other nutrients or mechanism that not yet have been identified couldcausethehepaticsteatosis.BesideslittleevidenceindicatingthatFLDcouldbetreatedwith pancreatic enzyme administration, adequate treatment is not yet recognized.

The pancreas plays a central role in the absorption of essential nutrients. Its dysfunction causes various abnormalities in the body, notably in metabolic cascades in the liver. It has been previously documented that severe hepatic steatosis sometimes occurs in pancreatectomized patients [26,27]. However, the clinicopathological characteristics of this type of FLD have not been fully investigated.

FLD **is characterized by two steps of liver injury: intrahepatic lipid accumulation (hepatic steatosis) and** inflammatoryprogressionto FLD (i.e., the two-hit theory). [28]. The first hit is fat accumulationinhepatocytesinthesettingofobesity,typeIIdiabetes,andhyperlipidemia,leading to development of hepatic steatosis. A second hit, including oxidative stress, inflammatory cytokines, and endotoxins, isconsidered to activate inflammatorycells, leading to progressionof simplehepaticsteatosistoFLD.ThistheoriswellknownaspathogenesisofFLDassociatedwith obesity and metabolic syndrome.

The gold standard for diagnosis of hepatic steatosis is a liver biopsy [29,30]. Biopsies are performedonlyhowever, iftheoutcome significantlyinfluencesthetherapeuticoptionsand non- invasive alternativeshave not yielded sufficient information. Studieshave investigatedthe useof imaging modalities (US, CT and MRI) as non-invasive means to assess hepatic steatosis. Ultrasound is simple to employ but has limitations in both sensitivityand accuracy [29]. CT and MRI provide higher sensitivity and thus are better alternatives [29,30].

Regarding development of FLD after major pancreatectomy, there have been few papers worldwide. The previous study by Nomura et al. [31] reported in 2007 that 14 (33%) of the 42 patients who underwent PD developed hepatic steatosis (liver-to-spleenCT attenuationratio less than 0.9), which is currently known as FLD. Kato et al. reported in 2010 [32], that 54 patients underwentPDinourdepartment,and20(37%)ofthemdevelopedFLD(hepaticCTvalue\40HU) after surgery. The most recent studyby Tanaka et al. [33] reported in 2011 that the incidence of FLDafter PD(liver-to-spleenCT attenuationratio lessthan0.9) was23% (14of60 patients) andliver biopsy of 8 patients showed FLD. However, FLD is a still little-known complication after PD, and the mechanism of development of FLD after PD remains unclear.

Here we describe 2 cases ofrapidly progressive and fatal fatty liver disease that developed shortly after PD and total pancreatectomy without concomitant liver disease.

Clinical presentation

Case 1. Patient I., 67 years old, was admitted to our clinic as planned "National Scientific Center of Surgery named after A.N. Syzganov", Department of hepatopancreatobiliary surgery and liver transplantation with a diagnosis ofatumorofthe pancreatic head. It is known fromthe medical history of the disease that the patient has been ill since July 2022, when she began to complainofpain inthe epigastrium and right hypochondrium, generalweakness,

drymouth, and nausea. After 1 week, the patient's general condition worsened, pain in the epigastric region increased, complaints of jaundice of the skin and sclera, and acholic stools joined.

Shewasurgentlyadmittedtoaclinicforobstructivejaundiceinoneoftheclinicsin Almaty. At that time, the total bilirubin level in the analyzes was 269 mmol/l. The patient underwent surgical treatment in the following volume: percutaneous transhepatic biliary drainageby ultrasoundcontrol.Thedynamicsoftotalbilirubindecreasedto135mmol/l.Afterthat,thepatient was sent to our clinic for examination and radical surgical treatment. Upon admission, the condition was stable. During the examination, a contrast-enhanced CT scan revealed a tumor emanating from the head of the pancreas.

After preparation, laparotomy and standard PD were performed under general anesthesia. Pancreatojejunostomy was performed using a modified Blumgart method using the duct-to- mucosa method. The histopathological diagnosis is a morphological picture of a moderately differentiated ductal adenocarcinoma ofthe pancreatic head with negative resection margins. On the 2nd day, water intake was started, and 4 days after the operation, a fat-restricted diet was started. Pancreatic fistula was not observed. Large losses of ascites fluid were noted through drainage tubes from the abdominal cavity, and albumin therapy was performed. After the operation, the biochemicalparameters ofliver functionreturned to normal. However, onthe18th day after the operation, biochemical parameters of liver function, white blood cells in the blood beganto increase, and coagulopathywasobserved. The patient'sgeneralconditionworsened, she was prone to hypotension (arterial pressure - 60/40 mmHg), and hemodynamics was unstable. Afterthat,the patient wastransferred and received treatment inthe department ofanesthesiology and intensive care.

Table1.Data on laboratory testsaftersurgery

	Day 18	Day 19	Day 20
Totalbilirubin(normallevel4.0-20,5 mmol/l)	28.2	58.7	128.4
Direct bilirubin(normallevel0.0-5.1 mmol/l)	24.8	39.4	85.6
Prothrombinindex(normallevel 180.0- 110.0 %)	42.9	50.9	50.0
INR(normallevel0.8-1.4)	1.6	1.5	1.5
Whitebloodcells(normallevel4.0-9.0 10^9/l)	7.8	14.8	30.2

On the 19th day after surgery, the patient underwent contrast-enhanced computed tomography, where there was a diffuse decrease in liver parenchyma density, the presence of ascites and signs of FLD. The patient's general condition gradually worsened. The subsequent clinicalcourse of liver dysfunction worsened, and the patient developed severe liver failure with increasing hyperbilirubinemia. She died on the 22nd day after surgery by FLD. Histological examinationrevealedpronouncedfattytissuewithmicrodropsandlargedroplets;signsoffibrosis, balloon degeneration of hepatocytes, fatty deposits indicating hepatitis or FLD.

A B

Figure 1.Contrast-enhanced computed tomography of clinicalcaseNo.1.

A-B Postoperative computed tomographyshowed signs ofpronounced fatty liver disease, where there was a diffuse decreaseinliverparenchymadensity+22+34HUunits,andthepresenceofascites.19thdayafter surgery.

Figure 2. Histological examination of the liver. A - The portal ractsare expanded due to diffuse focal lymphoplasmocytic infiltration. Hepatocytes with signs of balloon dystrophy. There are sharply dilated bile ducts filled with bile. Hepatocytes of the periportal zone are in a state of micro- and macrovesicular steatosis, the total percentage of steatosis is about 70%. (Staining with hematoxylin and eosin. Magnification ×100). B - The architecture of the liver is impaired due to edema, focal necrosis of hepatocytes, macro- microdroplastic steatosis. Sinusoids contain single erythrocytes, lymphocytes, and plasmocytes. The central veins are anemic. (Staining with hematoxylin and eosin.Magnification×200).C- Groups of hepatocytes are visible, filled with fatty vacuoles stained red by ahistochemical reaction. (Coloring of Sudan III. Magnification ×200).

Case2

PatientN.,62yearsold,washospitalizedattheSyzganovNationalScientificCenterofSurgery in the Department of General Surgery for the diagnosis of IPMN of main duct of pancreas. The patient also has type 2 diabetes mellitus. The disease began in September 2021, when pain appeared in the epigastrium and right hypochondrium, general weakness and it ching of the skin. Since October 2021, symptoms of jaundiceanda15kg decrease in body weight have appeared. In October 2021, the patient was treated in a hospital, where the total bilirubin level was 223 mmol/l, and the level of the cancer marker CA 19-9 was 199 U/ml. She underwent percutaneous transhepatic biliary drainage by ultrasound control, after which the bilirubin level decreased to 78 mmol/l.Accordingtotheresultsofcontrast-enhancedcomputedtomography,thediagnosisofIPMN ofthemainductofthepancreaswasestablished,withanincreaseinthesizeofthetumorcompared to the previous examination. After preparation, the patient underwent laparotomy and total pancreatoduodenectomy. Histological examination revealed invasive intraductal mucinous papillary carcinoma of the pancreas. After the operation, the patient recovered without complications and was discharged after 14 days with an improvement in her condition.

In March 2022, the patient developed symptoms: abdominal enlargement, swelling on her legs, weakness, vomiting and diarrhea. The patient was re-admitted tothe clinic witha diagnosis ofmalabsorptionsyndrome and protein-energydeficiency, aswellas signsofascites. Bloodtests revealed hypoalbuminemia and marked electrolyte abnormalities. The patient underwent paracentesis and was prescribed albumin therapy.

Table1.Dataoflaboratory testsaftersurgery

	Day 52	Day 59	Day 64	Day 68	Day 69
Totalbilirubin(normallevel 4,00 - 20,50 mmol/l)	40.90	101.40	153.10	184.00	192.40
Direct bilirubin (normal level0.00-5.10mmol/l)	22.00	58.50	39.40	143.20	154.50
Prothrombinindex(normal level 80.00 - 110.00 %)	46.2	38.4	34.7	31.3	27.50
INR(normallevel0.85- 1.40)	1.62	1.78	1.97	2.28	2.57
Whitebloodcells(normal level 4.0-9.0 10^9/l)	11.39	16.70	17.30	13.00	6.20

On the 48th day after surgery, the tests showed signs of severe coagulopathy and the level of total and direct bilirubin in the blood began to rise. The patient's general condition worsened. Afterthat,the patient wastransferred and received treatment inthe department ofanesthesiology and intensive care.

Contrast-enhanced computed tomography of the abdominal cavity revealed liver atrophy, accompaniedbymarkedfataccumulationandmassiveascites(Figure 3).Subsequently,thepatient's clinical condition continued to worsened, and severe liver

failure with progressive hyperbilirubinemia developed. She died on the 69th day after surgery by FLD.

Figure 3 Data of liver study. A - Preoperative computed tomography of the abdominal cavity with signs of IPMN of the main duct of the pancreas. B - Magnetic resonance imaging of the liver shows signs of IPMN of the main duct of the pancreas. C - Postoperative computed tomography showed signs of pronounced fatty liver disease with atrophy, signs of liver failure, a decrease in liver parenchyma densityof+5+11 HU units and the presence of ascites. 59th day after surgery.

Discussion

These clinical cases represent a significant problem in the treatment of patients who have undergone pancreatic surgery, in particular, associated with the development of life-threatening FLD,whichcandevelopinjustashorttimeaftersurgery.Oneofthecharacteristicfeaturesofthis case was a significant loss of body weight due to malnutrition caused by surgery.

The most commonpatientswithFLD havea number ofrisk factors, suchasobesity, type 2 diabetesmellitus,dyslipidemia,andhypertension,whichmakesFLDamanifestationofmetabolic syndrome [34-36]. However, in recent years, it has been noted that pancreatic surgery may also playarole inthedevelopment ofFLD[37-42].Accordingtothe latest data,theprevalenceofthis type of liver disease ranges from 23 to 37% among such patients [37,39,40]. Tanaka and his colleagues reported that the mainrisk factor for developing FLD in suchpatients is cancer ofthe pancreatic head[40].Atthesametime, Kato et.al.identified fiverisk factorsthatmaycontribute to the development of FLD after pancreatic surgery: pancreatic adenocarcinoma, cancer in the resection area, pancreatic consistency, postoperative diarrhea, and eating disorders [39].

The exact mechanisms leading tothe development ofFLD after PDhave not yet been fully studied. Unlike the classical form of the disease, this version is not accompanied by obesity, hyperlipidemiaorinsulinresistance[40].EPIcausedbyitsreductioninsizeaftersurgery, aswell as dietarydisorders leading to impaired absorption of essential amino acids, fats, and fat-soluble vitamins (for example, choline), play a key role in the pathogenesis. This is due to impaired synthesis of low-density lipoproteins in the liver and deficiency of methionine and choline [38,40,43].TheuseofhighdosesofpancreaticenzymereplacementtherapyinpatientswithFLD after PD has shown a positive effect, which supports the proposed hypothesis about the pathogenesis of the disease [39-41].

One possible mechanism is that a lack of nutrition caused by a decrease in the exocrine function of the pancreas may contribute to the conversion of carbohydrates into fats in the liver. Thekeyfactorsareneurogenicdiarrheaassociated withdissectionofthe nerveplexusaround thesuperior mesenteric artery, impaired fat absorption and steatorrhea caused by a decrease in the exocrine activity ofthe pancreas. It is believed that this impaired fat absorption contributes to an increase in the conversion of carbohydrates into fats in the liver [44].

Another possible mechanism suggests that endotoxins may cause liver damage. Adecrease in the intestinal exocrine function can lead to the movement of bacteria due to atrophy of the intestinal mucosa. This, in turn, can promote the entry of endotoxins into the liver through the portal vein, which activates Kupffer cells and causes fatty deposits in the liver [45]. It has also been hypothesized that this mechanism may be related to zincdeficiency. In cases after extensive resection of the pancreas, there is a significant decrease in the level of zinc in the blood and its content in the pancreatic tissues. Zinc is absorbed mainly in the duodenum and proximal jejunum with the help of zinc-binding proteins contained in pancreatic juice, and plays an important rolein the regeneration and maintenance of the epithelial structure of the intestinal mucosa. In addition to restoring part ofthe gastrointestinal tract after PD, the amount ofzinc ingested from food also decreases due to a decrease in overall exocrine function. In addition, the hypofunction of insulin after PD increases the excretion of zinc in the urine, which leads to a deficiency of this trace element. It is believed that this reduces the protective role of zinc on the intestinal mucosa, which increases intestinal permeability and promotes the penetration ofendotoxins through the mucous membrane [46].

In these clinical cases, we did not measure the serum zinc levels in these patients, as they began receiving parenteral nutrition immediately after surgery, which contained zinc and magnesium. Fatty liver hepatosis, which has developed against the background of protein and energy deficiency with severe liver failure, can in some cases lead to death.

Future recommendations should focus on the study of specific methods of perioperative nutrition, includingcaloriccalculationandtheuseofdietarysupplements,taking into account the dynamics of weight changes and progress or improvement in liver steatosis. Our clinical cases indicatethat followingdietaryrecommendationsinthepostoperativeperiod,togetherwithinsulin therapy, can play an important role in preventing a decrease in BMI in patients undergoing pancreatectomy.

Limitation Intheseclinicalcases, we did notmeasure the serumzinc levels inthesepatients,astheybeganreceivingparenteralnutritionimmediatelyaftersurgery,whichcontainedzincandmagnesium.Futurerecommendationsshouldfocus onthestudy of specificmethods of perioperativenutrition,includingcaloriccalculationand the use of dietarysupplements,taking into account the dynamics of weightchangesandprogressorimprovementinliversteatosis.

What's known? Theseclinicalcasesrepresentasignificantproblemin the treatment of patients who have undergonepancreaticsurgery,inparticular,associatedwith the developmentoflife-threateningFLD,whichcandevelop in justashorttimeaftersurgery.Oneof the characteristicfeatures of thiscasewas a significantloss of bodyweightdue to malnutritioncaused by surgery.

What's new? There is a hypothesisthatthismechanismmayberelatedtozincdeficiency.Incasesafterextensiveresection of the pancreas, there is a significantdecrease in the level of zincin the bloodanditscontentin the pancreatictissues.AfterPD, the amount of zincingestedfromfoodalsodecreasesdue to adecrease in overallexocrinefunction. It is believedthatthisreduces the protectiverole of zincon the intestinalmucosa,whichincreasesintestinalpermeabilityandpromotes the penetration of endotoxinsthrough the mucousmembrane.

Conclusion

This clinical case demonstrates that after PD and total pancreatectomy, a life-threatening FLD withsevere fibrosis canoccur. Whentreating patients who have undergone pancreatic head resectionortotalpancreatectomy,doctorsshouldconsiderthe likelihood ofdevelopingfattyliver,as well as the importance of assessing nutritional status. It is necessary to use preventive drugswith pancreatic enzymes and supplements.

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Author's contributionsStudy concept B.B., M.D., S.T., A.D. Study design: M.D., S.T., A.D., Zh.O. Data analysis: S.T., M.D., Sh.K., E.E., M.T. Drafting of manuscript: S.T. **Writing the text of the article: B.B., M.D.,** S.T., Zh.O., Sh.K., E.E. and M. T. Critical **revision of the manuscript: B. B. All authors approved the final version of the manuscript.**

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References

1. Strobel O, Neoptolemos J, Jager D, Buchler MW. Optimizing the outcomes of pancreatic cancer surgery. Nat Rev ClinOncol. 2019;16(1):11-26.

doi:https://doi.org/10.1038/s41571-018-0112-1.
2. Serrano PE, Cleary SP, Dhani N et al: Improved long-term outcomes after resection of pancreatic adenocarcinoma: A comparison between two time periods. Ann SurgOncol2015;22:1160-1167.
3. Sato T, Matsuo Y, Shiga K, Morimoto M, Miyai H, Takeyama H. Factors that predict the occurrence of and recovery from non-alcoholic fatty liver disease after pancreatoduodenectomy. Surgery. 2016; 160:318-30.
4. Bartel MJ, Asbun H, Stauffer J, Raimondo M. Pancreatic exocrine insufficiency in pancreatic cancer. A review of the literature. Dig Liver Dis 2015;47:1013-20.
5. Lim PW, Dinh KH, Sullivan M, Wassef WY, Zivny J, Whalen GF, et al. Thirty-day outcomes underestimate endocrine and exocrine insufficiency after pancreatic resection. HPB (Oxford) 2016;18:360-6.
6. Sabater L, Ausania F, Bakker OJ, Boadas J, Domínguez-Muńoz JE, Falconi M, et al. Evidence-based guidelines for the management of exocrine pancreatic insufficiency after pancreatic surgery. Ann Surg 2016;264:949-58.
7. Kumar TK, Tewari M, Shukla SK, Mishra SP. Pancreatic exocrine insufficiency occurs in most patients following pancreaticoduodenectomy. Indian J Cancer 2021;58:511-7
8. Cools KS, Sanoff HK, Kim HJ, Yeh JJ, Stitzenberg KB. Impact of neoadjuvant therapy on postoperative outcomes after pancreaticoduodenectomy. J SurgOncol. 2018;118(3):455-62. doi:https://doi.org/10.1002/jso.25183.
9. Idilman IS, Ozdeniz I, Karcaaltincaba M. Hepatic Steatosis: Etiology, Patterns, and Quantification. Semin Ultrasound CT MR. 2016;37(6):501-10. doi:https://doi.org/10.1053/j.sult.2016.08.003.
10. Okabe H, Yamashita YI, Inoue R, Kinoshita S, Itoyama R, Yusa T et al. Postoperative nonalcoholic fatty liver disease is correlated with malnutrition leading to an unpreferable clinical course for pancreatic cancer patients undergoing pancreaticoduodenectomy. Surg Today. 2020;50(2):193-9. doi:https://doi.org/10.1007/s00595-019- 01866-x.
11. Roeyen, G.; Jansen, M.; Chapelle, T.; Bracke, B.; Hartman, V.; Ysebaert, D.; De Block, C. Diabetes mellitus and pre-diabetes are frequently undiagnosed and underreported in patients referred for pancreatic surgery. A prospective observational study. Pancreatology 2016.
12. Imaoka, H.; Mizuno, N.; Hara, K.; Hijioka, S.; Tajika, M.; Tanaka, T.; Ishihara, M.; Yogi, T.; Tsutsumi, H.; Fujiyoshi, T.; et al. Evaluation of Modified Glasgow Prognostic Score for Pancreatic Cancer: A Retrospective Cohort Study. Pancreas 2016, 45, 211-217.
13. Kato H, Asano Y, Ito M, Arakawa S, Shimura M, Koike D, Significant positive impact of duodenum-preserving pancreatic head resection on the prevention of postoperative nonalcoholic fatty liver disease and acute cholangitis. Ann Gastroenterol Surg. 2022;6:851-861. https://doi.org/10.1002/ags3.12593
14. Duarte N, Coelho IC, Patarrão RS, Almeida JI, Penha-Gonçalves C, Macedo MP. How inflammation impinges on NAFLD: a role for Kupffer cells. Biomed Res Int. 2015;2015:1-11.
15. Brown JA, Jung JP, Zenati MS, Simmons RL, al Abbas AI, Hogg ME, et al. Video review reveals technical factors predictive of biliary stricture and cholangitis after robotic pancreaticoduodenectomy. HPB. 2021;23(1):144-53.
16. Beger HG, Mayer B, Poch B. Resection of the duodenum causes long-term endocrine and exocrine dysfunction after Whipple procedure for benign tumors-results of a systematic review and metaanalysis. HPB. 2020;22(6):809-20.
17. Luu C, Thapa R, Rose T, Woo K, Jeong D, Thomas K, et al. Identification of nonalcoholic fatty liver disease following pancreatectomy for noninvasive intraductal papillary mucinous neoplasm. Int J Surg. 2018;58:46-9. https://doi.org/10.1016/j. ijsu.2018.09.002
18. Yasukawa K, Shimizu A, Yokoyama T, Kubota K, Notake T, Seki H, et al. Preventive effect of high-dose digestive enzyme management on development of nonalcoholic fatty liver disease after pancreaticoduodenectomy: a randomized controlled clinical trial. J Am Coll Surg. 2020;231(6):658-69.
19. Shima T, Seki K, Umemura A, Ogawa R, Horimoto R, Oya H, et al. Influence of lifestyle-related diseases and age on the development and progression of nonalcoholic fatty liver disease. Hepatol Res. 2015;45(5):548-59.
20. Kang CM, Lee JH. Pathophysiology after pancreaticoduodenectomy. World J Gastroenterol 2015;21:5794-5804.
21. Canfora EE, Meex RC, Venema K, Blaak EE. Gut microbial metabolites in obesity, NAFLD and T2DM. Nat Rev Endocrinol. 2019;15(5):261-73.
22. Kiriyama S, Kozaka K, Takada T, Strasberg SM, Pitt HA, Gabata T, et al. Tokyo guidelines 2018: diagnostic criteria and severity grading of acute cholangitis (with videos). J Hepatobiliary Pancreat Sci. 2018;25(1):17-30. https://doi.org/10.1002/jhbp.512
23. . Izumo W, Higuchi R, Yamamoto M. The evaluation of the early and late postoperative pancreatic function and nutritional status: central pancreatectomy versus distal pancreatectomy. Int J Surg Res Pract. 2017;4:057
24. Faria G, Gonçalves A, Cunha R, Guimarães JT, Calhau C, Preto J, et al. Beyond central adiposity: liver fat and visceral fat area are associated with metabolic syndrome in morbidly obese patients. Int J Surg. 2015;14:75-9
25. Ueda H, Ban D, Kudo A, Ochiai T, Tanaka S, Tanabe M. Refractory long-term cholangitis after pancreaticoduodenectomy: a retrospective study. World J Surg. 2017;41(7):1882-9.
26. Takada T, Takikawa H, Sawada N, Higuchi R, Nagamachi Y, Isaji S, et al. Cholangio-venous reflux of biliary contents through paracellular pathways between hepatocytes in patients with acute cholangitis. J Hepatobiliary Pancreat Sci. 2021;28:508-14.
27. Kobayashi N, Kumada T, Toyoda H, Tada T, Ito T, Kage M, et al. Ability of cytokeratin-18 fragments and FIB-4 index to diagnose overall and mild fibrosis nonalcoholic steatohepatitis in Japanese nonalcoholic fatty liver disease patients. Dig Dis. 2017;35(6):521-30. 12. Takada T, Takikawa H, Sawada N, Higuchi R, Nagamachi Y, Isaj
28. Sun W, Cui H, Li N, Wei Y, Lai S, Yang Y, et al. Comparison of FIB-4 index, NAFLD fibrosis score and BARD score for prediction of advanced fibrosis in adult patients with nonalcoholic fatty liver disease: a meta-analysis study. Hepatol Res. 2016;46(9):862-70.
29. . Satoi S, Sho M, Yanagimoto H, Yamamoto T, Akahori T, Kinoshita S, et al. Do pancrelipase delayed-release capsules have a protective role against nonalcoholic fatty liver disease after pancreatoduodenectomy in patients with pancreatic cancer? A randomized controlled trial. J Hepatobiliary Pancreat Sci. 2016;23(3):167-73. https://doi.org/10.1002/jhbp.318
30. Hong SS, Chong JU, Hwang HK, Lee WJ, Kang CM. Laparoscopic pancreaticoduodenectomy reduces incidence of clinically relevantpostoperative pancreatic fistula in soft pancreas with a smaller than 2 mm pancreatic duct. SurgEndosc. 2021;1-10:7094-103.
31. Cools KS, Sanoff HK, Kim HJ, Yeh JJ, Stitzenberg KB. Impact of neoadjuvant therapy on postoperative outcomes after pancreaticoduodenectomy. J SurgOncol. 2018;118(3):455-62. doi:https://doi.org/10.1002/jso.25183.
32. Okabe H, Yamashita YI, Inoue R, Kinoshita S, Itoyama R, Yusa T et al. Postoperative nonalcoholic fatty liver disease is correlated with malnutrition leading to an unpreferable clinical course for pancreatic cancer patients undergoing pancreaticoduodenectomy. Surg Today. 2020;50(2):193-9. doi:https://doi.org/10.1007/s00595-019- 01866-x.

33. Idilman IS, Ozdeniz I, Karcaaltincaba M. Hepatic Steatosis: Etiology, Patterns, and Quantification. Semin Ultrasound CT MR. 2016;37(6):501-10. doi:https://doi.org/10.1053/j.sult.2016.08.003.
34. Marchegiani G, Andrianello S, Nessi C, Sandini M, Maggino L, Malleo G et al. Neoadjuvant Therapy Versus Upfront Resection for Pancreatic Cancer: The Actual Spectrum and Clinical Burden of Postoperative Complications. Annals of Surgical Oncology. 2018;25(3):626-37. doi:https://doi.org/10.1245/s10434-017-6281- 9.
35. Verma V, Li J, Lin C. Neoadjuvant Therapy for Pancreatic Cancer: Systematic Review of Postoperative Morbidity, Mortality, and Complications. Am J ClinOncol. 2016;39(3):302-13. doi:https:// doi.org/10.1097/coc.0000000000000278.
36. Delpero JR, Jeune F, Bachellier P, Regenet N, Le Treut YP, Paye F, et al. Prognostic value of resection margin involvement after pancreaticoduodenectomy for ductal adenocarcinoma: updates from a French prospective multicenter study. Ann Surg. 2017;266:787-96.
37. Latchana N, Davis L, Coburn NG, Mahar A, Liu Y, Hammad A, et al. Population-based study of the impact of surgical and adjuvant therapy at the same or a diferent institution on survival of patients with pancreatic adenocarcinoma. BJS Open. 2019;3:85-94.
38. Nagakawa Y, Sahara Y, Hosokawa Y, Murakami Y, Yamaue H, Satoi S, et al. Clinical impact of neoadjuvant chemotherapy and chemoradiotherapy in borderline resectable pancreatic cancer: analysis of 884 patients at facilities specializing in pancreatic surgery. Ann SurgOncol. 2019;26:1629-36.
39. Javed AA, Wright MJ, Siddique A, Blair AB, Ding D, Burkhart RA, et al. Outcome of patients with borderline resectable pancreatic cancer in the contemporary era of neoadjuvant chemotherapy. J Gastrointest Surg. 2019;23:112-21.
40. Sato T, Matsuo Y, Shiga K, Morimoto M, Miyai H, Takeyama H. Factors that predict the occurrence of and recovery from nonalcoholic fatty liver disease after pancreatoduodenectomy. Surgery.2016;160:318-30.
41. Kishi Y, Shimada K, Nara S, Esaki M, Kosuge T. Administration of pancrelipase as efective treatment for hepatic steatosis after pancreatectomy. Pancreas. 2015;44:983-7.
42. Burkhart, R.A.; Gerber, S.M.; Tholey, R.M.; Lamb, K.M.; Somasundaram, A.; McIntyre, C.A.; Fradkin, E.C.; Ashok, A.P.; Felte, R.F.; Mehta, J.M.; et al. Incidence and Severity of Pancreatogenic Diabetes After Pancreatic Resection. J. Gastrointest. Surg. 2015, 19, 217-225.
43. Wu, J.M.; Ho, T.W.; Kuo, T.C.; Yang, C.Y.; Lai, H.S.; Chiang, P.Y.; Hsieh, S.H.; Lai, F.; Tien, Y.W. Glycemic Change After Pancreaticoduodenectomy: A Population-Based Study. Medicine 2015, 94, e1109.
44. Perinel, J.; Mariette, C.; Dousset, B.; Sielezneff, I.; Gainant, A.; Marbut, J.Y.; Bin-Dorel, S.; Bechwaty, M.E.; Delaunay, D.; Bernard, L.; et al. Early Enteral Versus Total Parenteral Nutrition in Patients Undergoing Pancreaticoduodenectomy: A Randomized Multicenter Controlled Trial (Nutri-DPC). Ann. Surg. 2016, 264, 731-737.
45. Lindkvist, B.; Phillips, M.E.; Domínguez-Muńoz, J.E. Clinical, anthropometric and laboratory nutritional markers of pancreatic exocrine insufficiency: Prevalence and diagnostic use. Pancreatology 2015, 15, 589-597.
46. Yamazaki S, Takayama T, Higaki T, Moriguchi M, Yoshida N, Miyazaki T, et al. Pancrelipase with branched-chain amino acids for preventing nonalcoholic fatty liver disease after pancreaticoduodenectomy. J Gastroenterol. 2016;51:55-62.