



Detection of Pancreatic Tumor by The Radiological Measure of Curved Planar Reconstruction (CPR)

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Abstract

The case involves a 74-year-old female with type 2 diabetes (T2D). HbA1c remained stable at 6% until summer 2019, but suddenly worsened to 8.4% in autumn 2019 without a certain reason. An abdominal CT scan detected a probable pancreatic tumor, which required further evaluation. Contrast-enhanced images of the arterial, portal vein, and equilibrium phase showed no staining, slight staining, and strong staining, respectively. The application of Curved Planar Reconstruction (CPR) has revealed an apparent pancreatic tumor image with three different stainings, associated with a dilated main pancreatic duct (MPD) in the pancreas body and tail and a normal MPD in the pancreas head. Consequently, CPR would be useful for diagnosis.

Keywords

Curved Planar Reconstruction (CPR), Main Pancreatic Duct (MPD), CT Scan, Contrast-Enhanced Images, Japan LCD Promotion Association (JLCDPA)

Abbreviations

CPR: Curved Planar Reconstruction; MPD: Main Pancreatic Duct; JLCDPA: Japan LCD Promotion Association

Introduction

In developed countries, recent medical and social problems include diabetes mellitus. Authors and collaborators have continued clinical research concerning type 2 diabetes (T2D) for a long time [1]. Among them, we have reported various patients and related radiological achievements [2]. Our radiological medical team has presented some cases using reconstruction measures for CT scans [3]. Recent new methods for PET/CT imaging were developed for detailed investigation of pancreatic diseases [4]. They use contrast-enhanced exams for abdominal CT

images. Especially, the novel technique of curved planar reconstruction (CPR) can be applied when detecting pancreatic atrophy, pancreatic tumors, and also a dilated main pancreatic duct (MPD). We have applied CPR methods for patients with MPD problems. It shows the development of a 3D (three-dimensional) neural network [5]. Such a new computerized technique can be beneficial for detecting various lesions in the pancreas.

During our medical practice, research, and radiological performance, we have experienced a

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meaningful patient. The case is an elderly female with T2D and a recent history of acute exacerbation of HbA1c value without any particular reasons. For necessary diagnostic procedures, the reconstruction technique was evaluated to be useful using the CPR method. The general clinical progress and some related perspectives will be reported in this article.

Medical History

The case involves a 74-year-old female with T2D. She had a medical history of urinary stones and angina pectoris in her early 60s and had been taking medication for diabetes, hypertension, and dyslipidemia since her late 60s. From spring to summer 2019, her HbA1c remained stable at 6%, and abdominal CT showed no significant changes. However, since autumn 2019, her HbA1c value suddenly worsened to 8.4% without a certain reason. Therefore, she was transferred to our hospital for thorough investigation. At that time, her medication included the following: empagliflozin, linagliptin, voglibose, atorvastatin, diltiazem, prasugrel hydrochloride, candesartan, and rebamipide.

Several Examinations

Her physical examination in July 2022 revealed the

following: Consciousness and vitals were within normal limits. She showed unremarkable findings in the head, neck, heart, lungs, and abdomen, associated with intact neurological exams. Her physique measured 148cm in height, 40kg in weight, and 18.3 kg/m² in body mass index (BMI).

The results of her biochemical tests were as follows: TP 7.9 g/dL, AST 18 U/L, ALT 14 U/L, γ GT 28 U/L, LDH 172 U/L (124-222), Cr 0.65 mg/dL, BUN 29 mg/dL, uric acid 5.2 mg/dL, LDL 92 mg/dL, HDL 41 mg/dL, CRP 3.03 mg/dL, CEA 0.6 ng/mL, CA 19-9 17 U/mL (-37), HbA1c 8.4%.

Results

The current case received an abdominal CT scan, which included simple and contrasted images. Our radiological department has continued clinical practice and research using computerized reconstruction. In this case, we applied the technical measure of Curved Planar Reconstruction (CPR). Contrast images in the arterial phase by transverse and coronal views are shown in **Fig-1**. In the transverse view, the shape of the pancreatic tumor is not clear (**Fig-1A**). The main pancreatic duct (MPD) in the tail body and portion is dilated, and two cross-sectional images are observed,

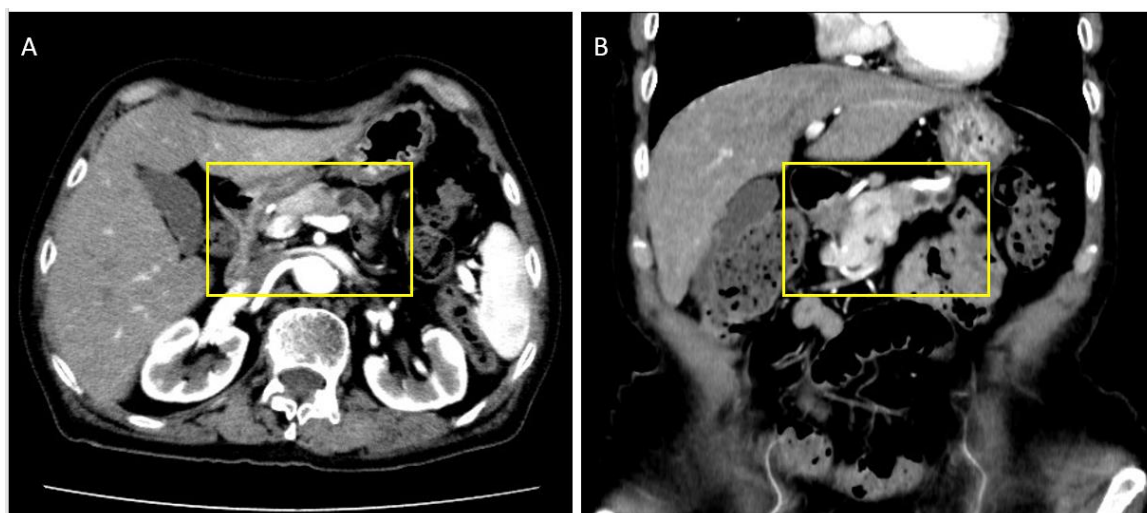


Fig-1: Abdominal CT Findings

Contrasted images in arterial phase by transvers and coronal views.

A) Transvers view: The shape of the pancreas tumor is not clear. The pancreatic duct at tail portion is dilated, and two cross-sectional images are observed. This indicates the meandering of dilated pancreatic duct. Just adjacent to this, a tumor lesion is found, in which the shape is not so apparent.

B) Coronal view: The shape of the pancreas tumor is not apparent. Dilated pancreas duct can be found in the middle to tail portion of the pancreas, in which the lesion seems to be not stained. Just next to this for right direction, pancreas tumor with generalized slightly stain is characteristic. Ordinary pancreatic duct is seen in the head portion of the pancreas.

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indicating the meandering of the dilated MPD. Adjacent to this, a tumor lesion is found, although the shape is not so apparent. In the coronal view, the shape of the pancreatic tumor is also not apparent (**Fig-1B**). Dilated APC can be found in the middle to tail portion of the pancreas, where the lesion seems to be unstained. Just next to this in the right direction, a pancreatic tumor with a generalized slightly stained appearance is characteristic. The ordinary breadth of the MPD is seen in the head portion of the pancreas.

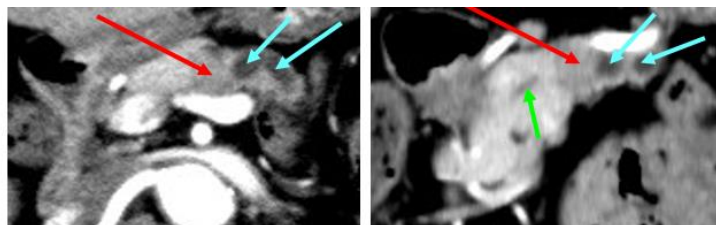
From the obtained data of Fig-1A, Fig-1B, the indicated square area was observed in detail as shown in **Fig-2**. The successive contrasted images were shown in the following phases: a) arterial phase, b) portal venous phase, and c) equilibrium phase (**Fig-2**). The results showed that the tumor image exhibited a dull borderline (phase a), slightly stained (phase b), and delayed stained (phase c) (**Fig-2A**, **Fig-2B** and **Fig-2c**). The image of the pancreatic tumor was found using the radiological technical measure of CPR (**Fig-3**). The organ of the pancreas is not flat but curved. Therefore, ordinary CT scans cannot provide a useful image of a straight tomogram. By the application of

CPR, the dilated pancreatic duct and probable pancreatic tumor can be observed in a plane for three different stainings in the arterial phase, portal venous phase, and equilibrium phase.

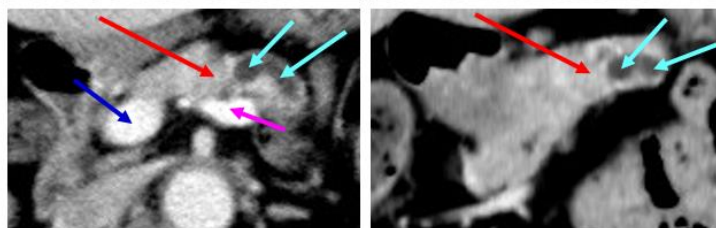
Ethical Considerations

This patient complied with the ethical guidelines of the Declaration of Helsinki [6]. Furthermore, certain comments were found regarding information regulation. Ethical principles exist in the rules governing research and practice. Several clinical problems concerning humans have been studied. Valuable guidelines from the Japanese government, originating from the Ministry of Health, Labor, and Welfare, as well as the Ministry of Education, Culture, Sports, Science, and Technology, were followed. The authors, et al., established our ethical committee for the current case at Kanaiso Hospital, Komatsushima, Tokushima, Japan. The committee comprises several hospital personnel, including the hospital president, doctors, registered nurse, pharmacist, nutritionist, and legal professional. The members fully discussed the protocol, and informed consent was obtained from the case through written documentation.

A: Arterial Phase



B: Portal Venous Phase



C: Equilibrium Phase

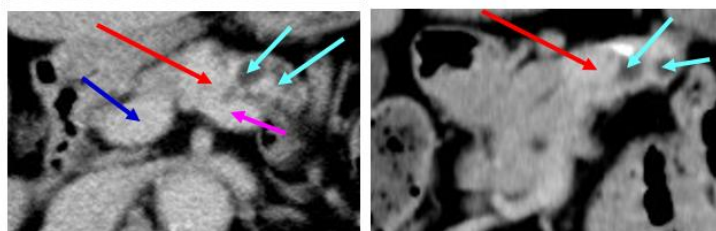


Fig-2: Abdominal CT Scan (Transvers and Coronal Views)

A: Tumor image with dull borderline (red), dilated pancreatic duct (cyan), and normal pancreatic duct (green).

B: Tumor image with slight stained (red), dilated pancreatic duct (cyan), portal vein (blue), and splenic artery (pink).

C: tumor image with highly and delayed stained (red) which is characteristic for pancreas tumor, dilated pancreatic duct (cyan), portal vein (blue), and splenic artery (pink).

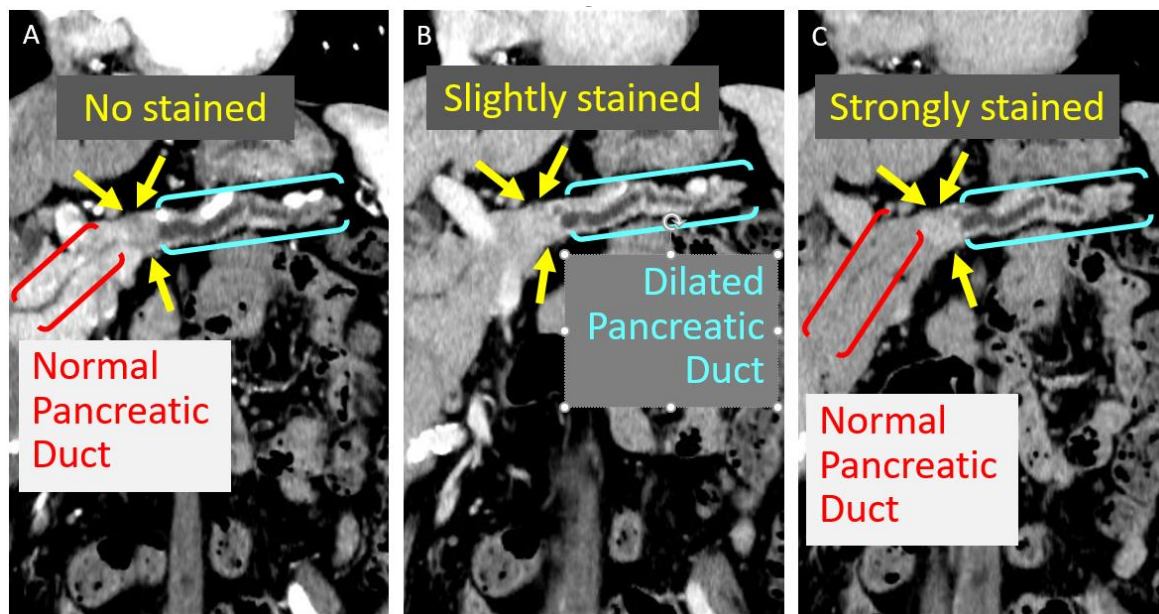


Fig-3: Images of The Pancreas by Curved Planar Reconstruction (CPR)

In contrast-enhanced CT scan examinations, images were examined.

A: Arterial phase

B: Portal venous phase

C: Equilibrium phase

Discussion

For years, research on type 2 diabetes has focused on its relationship with chronic pancreatitis and pancreatic tumors, with radiological studies of chronic pancreatitis conducted.

Diabetes has shown a relationship with chronic pancreatitis (CP). CP seems to develop from the gradual loss of pancreatic islet cells. From a radiographic aspect, pancreatic morphology was investigated in 76 cases of definite CP [7]. The protocol included a diabetes group (n=23) and a healthy group (age and sex matched, n=23). By comparison, pancreatic volume was significantly lower in diabetes (20mL vs 36mL). Additionally, atrophy of the pancreas was found in most cases of CP associated with diabetes. Diabetes possibly develops from CP, which may show elevated morbidity and mortality in the future. A cross-sectional investigation by the PROspective Evaluation of Chronic Pancreatitis for EpidEmiologic and Translational StuDies (PROCEED) cohort study included 645 CP cases [8], with diabetes included in 276 cases [9]. Statistical analyses utilized the area under the receiver operating characteristic curve (AUROC). The results showed independent correlations for CP-related factors, such as pancreatic

atrophy, previous history, pancreatic dysfunction, and calcification. Moreover, T2D risk factors were detected before and after the onset of pancreatitis. Consequently, multiple factors may be present in cases of CP and diabetes in CP.

Pancreatic tumors or cancer include types such as Intraductal Papillary Mucinous Neoplasm (IPMN). In diagnosing IPMN, detailed imaging using the CPR method would be useful [10]. A recent report found differences in the time effect and accuracy of CPR performance for two measures of automated analysis and the manual method. This research analyzed 100 related cases of dilated MPD with data from pancreatic CT scans [5]. The results showed a significant difference in MPD length: 110.5mm and 115.6mm in automated and manual methods, respectively. Additionally, the average creation time was 61.7sec and 174.6sec, respectively. Consequently, new software has been developed for the automated CPR method, which will be beneficial in achieving image accuracy.

Regarding this report, certain limitations may exist. This is only one case of T2D and pancreatic tumor for the application of CPR. The radiological technique of CPR seems to be useful for detailed diagnosis of the

pancreas. The current case will be followed up with careful attention. In summary, a 74-year-old female with T2D was found to have a pancreatic tumor through contrast-CT scan and CPR analysis. This radiological development contributes to better diagnosis and is expected to provide a useful reference for future diabetes research.

Conflict of Interest

The authors have read and approved the final version of the manuscript. The authors have no conflicts of interest to declare.

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