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Case Report
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Robotic Pancreatectomy for Insulinoma

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Abstract

Objective: To investigate the feasibility and safety of robotic resection of insulinoma.

Methods: A successful case of robotic insulinoma resection in our department was analyzed and compared with relevant domestic and foreign literature reports.

Results: The operation was successful, the tumor was completely resected, the blood glucose index was recovered, and there were no postoperative complications such as pancreatic leakage, bleeding and infection.

Conclusion: Robotic insulinoma resection has the advantages of minimally invasive, safe, fast postoperative recovery and less complication.

Keywords: Robot; Pancreatic head resection; Insulinoma; Pancreatic neuroendocrine tumor

Introduction

Insulinoma is a common clinical functional neuroendocrine tumor with a low incidence of about 0.01% to 0.03% annually [1]. Most of the tumors are single, small in size, less than 2 cm in diameter. Most of them are benign. At present, the etiology and pathogenesis of pancreatic tail, body and head insulinoma are not clear. The main clinical manifestations are episodic hypoglycemia, which is mostly caused by excessive insulin release from tumor tissues, and the most common cause of hypoglycemia in non-diabetic patients [2]. A patient with insulinoma admitted to our hospital in 2021.05 underwent robotic insulinoma resection after the diagnosis was confirmed. The report is as follows.

Case Presentation

Clinical data

A 71-year old female patient was admitted to our department with recurrent hypoglycemia for more than 10 years". The patent reported a history of more than 10 years of sudden onset dizziness, palpitations, fatigue and other symptoms. After relevant examinations in the local hospital, hypoglycemia was suggested, which was relieved by fluid replenishment and improvement of glycemic state. Later, the symptoms recurred. On 2021-04-22 extended OGTT test (mmol/L): Fasting 3.19, half an hour 6.65, 1 h 8.55, 2 h 7.63, 3 h 4.76, 4 h 2.37; C-peptide (ng/ml): Fasting 2.47, half an hour 3.58, 1 h 5.73, 2 h 6.21, 180 min 4.33, 240 min 4.31; Luminescence test report (uU/mL): Insulin fasting 15.92, 30 min 30.29, 60 min 41.37, 120 min 39.26, 180 min 17.77, 240 min 10.89; Cortisol 190.80 nmol/L; Cortisol 186.60 nmol/L at 8 am; Outer courtyard: IGF-1109.00 ng/ml; Luminescence test report: Cortisol 223.50 nmol/L; 04-26 Starvation test: Glucose 2.45 mmol/L, insulin 25.08 uU/ML, C-peptide 2.70 ng/ ML; 04-22CT: 1. Pancreatic tumor with rich blood supply, neuroendocrine tumor was considered 2. Bilateral renal cysts; MR: Abnormal signal in pituitary gland, cyst? Insulinoma was considered and transferred to our hospital for further treatment. After admission, blood glucose was 1.81 mmo1/L, Cortisol, adrenocorticotropic hormone, thyroid function, fasting C-peptide, fasting insulin, glycosylated hemoglobin were generally normal. Abdominal CT showed a round isodense/slightly dense image about 16 mm × 12 mm in size at the junction between the head and neck of the pancreas, with a clear boundary and obvious enhancement of the lesions on enhanced scan (Figure 1a). Abdominal MRI plain scan and enhancement: there was a circular T1WI and T2WI with a size of about 15 mm × 12 mm and slightly low signal in the cranial and cervical junction area of the pancreas, with clear boundary, and the enhancement degree was close to the pancreatic parenchyma after enhancement (Figure 1b). Insulinoma was considered and surgical treatment was proposed.

Surgical procedure

(1) After satisfactory anesthesia, the patient was placed in supine position and routine

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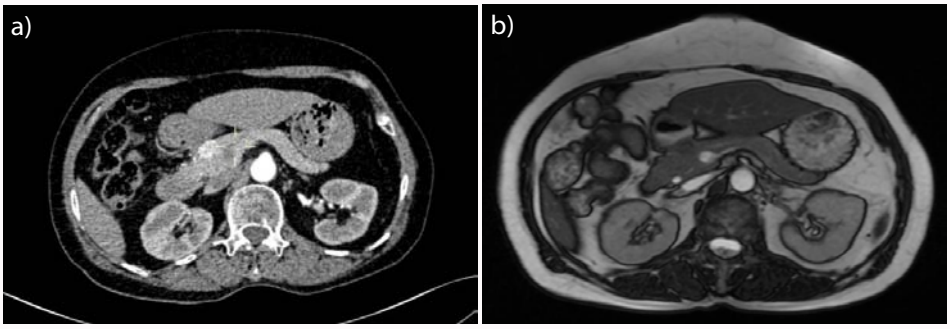

Figure 1: Preoperative abdominal contrast-enhanced CT and MRI showing tumor at pancreas head (a: CT, b: MRI).

disinfection was performed. An incision of about 1 cm in length at the lower umbilical margin was made, and 10 mm Trocar was inserted to establish CO_2 pneumoperitoneum, and the pressure was maintained at about 12 mmHg. A camera was placed into the abdominal cavity. No metastasis was found on surfaces of omentum, liver, stomach, small intestine, colon and other organs. Laparoscopy was performed to make 1.2 cm, 1 cm, 0.5 cm, 0.5 cm incisions in left and right axillary front 2 cm below costal margin and lateral margin of rectus muscle flat umbilicus, respectively. Corresponding Trocar was inserted (Figure 2), and the robotic arm was connected. Exploration: a small amount of clear ascites in the abdominal cavity. Gallbladder, liver and pelvis showed no obvious abnormality. Pancreatic texture was hard, with a little exudation around the head of the pancreas, and peripheral adhesion. Hepatoduodenal ligament, superior margin of pancreas and adjacent common hepatic artery were not palpated with enlarged lymph nodes. Resection of pancreatic head mass was performed according to intraoperative findings.

(2) Kocher incision was performed to dissociate the descending part of duodenum and hepatic curvature of colon. The inferior vena cava and the right wall of the abdominal aorta were exposed without excessive dissociation. The left hand was extended to the posterior part of the head of the pancreas for exploration and to guide the depth of resection and to protect the retroperitoneal structure from injury during the removal of the head of the pancreas mass. The uncinate process of pancreas was dissociated from the right, exposing the superior mesenteric vein. The small branches of uncinate process were ligated separately. The upper edge of pancreas was dissected to expose the portal vein, and the large curved forceps was applied behind the pancreatic neck to explore the end of the common hepatic artery from under the uncinate process of pancreas, which could pass through the back of the pancreatic neck smoothly. The large curved forceps were inserted into the back of the uncinate process of the pancreas to guide the suture and ligate the precut tissue of the pancreatic head and the upper and lower blood vessels of the pancreatic neck. A large amount of clear pancreatic fluid gushed out after the anastomat transected the head of the pancreas (Figure 3). From duodenal pancreatic head around the 0.5 cm to 1.0 cm, a silk thread with a row of suture ligation Was made to stop bleeding, and to protect pancreatoduodenal artery front arch from damage, the stitching inside curved incision was made in the pancreas, in the case of bleeding hemostasis suture is gradually placed, gradually taken out except for pancreatic head tumor, only in the inside of the duodenal pancreatic tissue, leaving a layer of 0.5 cm to 1.0 cm. A layer of tissue behind the pancreas was preserved to protect the pancreatic mesangium and inferior vena cava. The lower common bile duct was intact with good blood flow and duodenal blood flow and peristalsis. Suture reduces the pancreatic wound.

Figure 2: The Trocar schematic diagram.

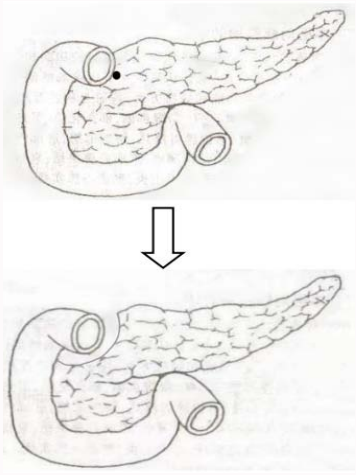

Figure 3: Schematic representation of the pancreatic head mass resection.

(3) After the surgical field was cleaned, an abdominal drainage tube was placed to lead out the pancreatic head area. Count the number of gauze instruments and check no active bleeding. There is no distortion, no tension and no stricture at each anastomosis. Close the abdomen layer by layer. Intraoperative freezing pathology: Neuroendocrine tumor. (Surgical field of view: Figure 4).

Results

The operation was smooth, the intraoperative bleeding was about 100 ml, postoperative monitoring of blood glucose fluctuated

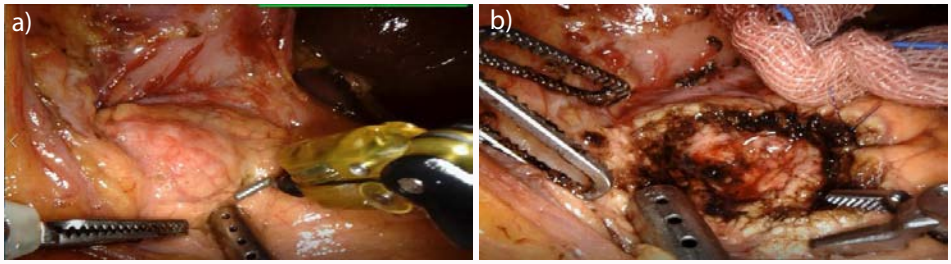

Figure 4: Surgical field of view (a: The tumor is located at the head of the pancreas. b: The tumor of the head of pancreas was completely resected).

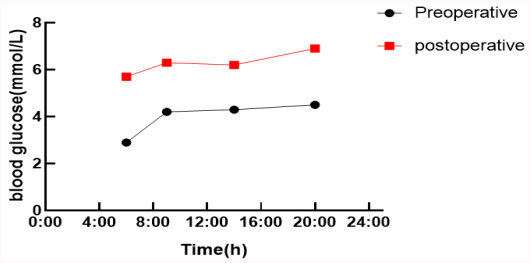

Figure 5: Preoperative and postoperative blood glucose.

between 4.9 mmol/L to 11.2 mmol/L (preoperative blood glucose and postoperative blood glucose contrast as shown in Figure 5), blood biochemistry and amylase were normal, no pancreatic leakage occurred, and the patient was discharged 11 days after surgery. Pathological examination: Microscopically, the tumor cells showed trabecular and papillary arrangement, mild atypia, abundant interstitial sinusoids, and no tumor involvement was observed in dorsal membrane of pancreas and resection margin. Combined with the morphology of HE section, the pathological diagnosis was: Pancreatic neuroendocrine tumor, with a diameter of about 1.5 cm, located in pancreatic parenchyma, without capsule, showing invasive growth, without vascular or nerve invasion. The patient was followed up 3 months after discharge. No hypoglycemic symptoms occurred, and blood glucose was in the normal range.

Discussion

Pancreatic Neuroendocrine Tumors (pNET Neuroendocrine Tumors of pancreas) minimally invasive treatment of indications and timing is the same as the traditional open surgery. For functional PNETS, surgery is required regardless of tumor size. Insulinoma is the most common functional pNET, most of which are single and benign, and most suitable for minimally invasive surgery. Laparoscopic or robotic pancreatic tumor enucleation is appropriate [3,4], so as to preserve organ function to the maximum extent. If enucleation is not suitable, pancreaticoduodenectomy or spleen-sparing pancreatic body and tail resection can be performed according to tumor location. The second most common is gastrinoma. Presenting as refractory peptic ulcer with potentially malignant manifestations, lymph node metastasis is common. Anatomic resection and dissection of regional lymph nodes are generally performed. Other rare functional pNETs, such as glucagon tumor and vasoactive enteropeptidoma, also have significantly higher malignant potential than insulinoma, and pancreatic dissection and lymph node dissection should be performed according to the circumstances [5].

Tumor size is an important prognostic factor for pNET. For non-functional pNET with a maximum diameter of >2 cm, radical resection should be performed according to the location of the tumor (expanding the surgical resection scope if necessary), and regional lymph node dissection should be performed at the same time. For nonfunctional

pNET with a maximum diameter of <2 cm, functional pancreatic surgery is feasible, such as tumor enucleation, pancreatectomy, splenopancreatic body tail resection [6]. For patients with complicated pancreatic surgery, high complication rate, small tumor size, non-function and slow growth, it is estimated that they can be observed first and not operated for the time being [7].

In addition, robotic pancreatic tumor enucleation is feasible for benign or low-grade pancreatic tumors with small tumor diameter and a certain distance from the main pancreatic duct. This is the most widely used robotic partial pancreatectomy. The advantage of robotic enucleation lies in the maximum preservation of pancreatic parenchyma, the reduction of the risk of pancreatic endocrine or exocrine insufficiency, and the need for digestive tract reconstruction. Impotence is still the main complication after enucleation. Compared with open pancreatic enucleation, robotic enucleation can reduce intraoperative bleeding and shorten operative time. Tian et al. [8] compared 60 cases of pNET with less than 2 cm in diameter treated by robot and open pancreatic enenosis with propensity ratio score (PSM), and the results showed that the incidence of pancreatic impotence was similar between the two groups (10% *vs.* 17%, P=0.283). The incidence of Dindo-Clavien III-V complications and length of postoperative hospital stay were not significantly different, while the robotic group had less intraoperative bleeding and shorter operative time. DiBenedetto et al. [9] reported 12 cases of robotic pancreatic enucleation for pNET, and the incidence of postoperative pancreatic impotence was 8.3% (1/12). The occurrence and severity of postoperative pancreatic impotence are closely related to whether the main pancreatic duct is damaged during operation. Preoperative MRI can show the adjacent relationship between the main pancreatic duct and tumor more clearly than CT, which is more helpful for surgical decision making. The current international consensus of robotic surgery [10] suggests that robotic pancreatic entrainment is generally suitable for benign, borderline and low-grade malignant tumors with a diameter of less than 2 cm and a distance of at least 2 mm from the main pancreatic duct, which can be used as a reference for surgical indications of this operation.

The Da Vinci robotic surgical system has brought great technological changes to minimally invasive surgery. The 3D HIGH-DEFINITION imaging system can provide surgeons with 10 to 15 time's high-resolution 3D images, giving a true sense of depth to the surgical field and facilitating accurate anatomical level identification during surgery [11]. The flexible and stable arm used to complete intraoperative operations exceeds the limits of human beings,

facilitating separation, suturing, knotting and other fine operations, significantly improving the accuracy and safety of surgery, especially in reconstructive surgery has obvious advantages. The surgeon can control the lens according to the operation process, and the lens holding arm can provide a stable surgical field, so as to avoid visual discomfort caused by the lens shaking and too close to the object in conventional laparoscopic surgery [12]. The technical advantages of robotic surgery above overcome the limitations of traditional laparoscopic technology, maximize the minimally invasive advantages, and use limited operating space to achieve the purpose of fine anatomical operation, effective control of bleeding, and reduce surgical injury. Therefore, there is a great space for the pancreatic surgery.

Compared with traditional laparoscopy, the robot has the advantages of three-dimensional vision and flexible operation, which can increase the probability of successful surgery. In this case, a robotic pancreatectomy was performed to preserve the integrity of the digestive tract, reduce damage, and maintain pancreatic secretory function. Less intraoperative bleeding less postoperative complications, patients recover quickly. The successful experience of this case shows that the treatment of insulinoma by robotic pancreatic head resection is feasible and safe, and can be used as a reference for robotic insulinoma resection.

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