Use of Glutaraldehyde-Preserved Bovine Pericardium Patch in Vascular Repair of Portal Vein in a Patient with Pancreatic Cancer

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Abstract Advanced-stage gastrointestinal tumors are aggressive and frequently invade blood vessels. Advances in endovascular surgery can repair blood vessels that may be infiltrated by a tumor. Currently there are many materials to do this, as the use of prostheses or implants and patches. In Mexico, the bovine pericardium preserved with glutaraldehyde has been used to treat incisional, inguinal, and diaphragmatic hernias and repair vascular defects with good results, low cost, and no allergic reaction from the patient. We report the case of a 47-year-old man, with a history of smoking and alcoholism, diagnosed with pancreatic adenocarcinoma. The tumor, with the use of endoscopic ultrasound, showed direct contact with the portal vein without invading the confluence of the mesenteric vein. During exploratory laparotomy, a tumor attached to the head of the pancreas of 4 cm×4 cm was found, with tumor invasion of 1 cm×2 cm on the outer sidewall of the portal vein. We performed pylorus-preserving pancreatoduodenectomy and tumor resection of the portal vein wall with placement of glutaraldehyde-preserved bovine pericardium patch to repair it. The intraoperative and immediate postoperative period arose without complications. The patient was discharged with good result and is currently under surveillance. We report this case to show a successful result using glutaraldehyde-preserved bovine pericardium to close vascular defects after resection of the tumor secondary to vascular invasion.

Keywords Glutaraldehyde-preserved bovine pericardium patch · Pancreatic cancer · Portal vein injury

Background

Vascular invasion of gastrointestinal tumors is aggressive and a sign of advanced illness. In many cases, patients are not candidates for surgical treatment, as this would lead to multiple organ and vascular resection, increasing the morbidity and mortality and would decrease the survival of the patient [1]. Vascular repair takes relevance in oncologic surgery when tumors infiltrate the part of blood vessels, and even in those cases the resection of the tumor can benefit the patient's survival. An Italian multicenter study concluded that the vascular resections can be safely performed in both of the different conditions: localized tumors locally invading the vessels and neoplasms with massive invasion of the peripancreatic structures [2].

Case Report

A 47-year-old man presented with a history of moderate smoking and social drinking. He had no surgical history. His current condition started 3 months ago, with jaundice, dark urine, and progressive acholia, with weight loss of 10 kg in 3 months. Physical examination revealed jaundice in the skin and mucous membranes, tendency to cachexia, with no palpable lymphadenopathy in the neck or chest, the abdomen without palpable solid masses or lymphadenopathy, and no other data relevant to the case. The ultrasound report showed the dilated gallbladder with lithogenic bile, dilated intra and extrahepatic bile ducts, and choledocolation (20 mm) due to the presence of obstruction in the intrapancreatic portion, probably due to the pancreatic head

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Fig. 1 **a** The resected (~2 cm) outer sidewall of the portal vein, **b** the repaired portal vein with bovine pericardium patch, and **c** 5-0 polypropylene simple stitch used for suturing the patch into the portal vein

tumor. Tumor marker CA 19-9 raised to 477. Computed tomography (CT) scan confirmed the dilation of intra- and extrahepatic bile ducts, the dilated common bile duct and obstructed by the dependant tumor of the pancreatic head, retropancreatic lymphadenopathy, and intracavaortic lymph nodes. Endoscopic ultrasound showed a hypoechoic tumor of 1.4 cm × 1.1 cm at the head of the pancreas, infiltrating the choledoco bile duct above the ampulla, conditioning dilation in 15 mm of it, the tumor in direct contact without invading the confluence of the superior mesenteric vein 50 % around the circumference. Biopsy was performed which reported pancreatic adenocarcinoma. The patient was assessed by radiation service and medical oncology, which confirmed resectable disease. Exploratory laparotomy, pylorus-preserving pancreatoduodenectomy, and resection (~2 cm) of the outer sidewall of the portal vein with placement of bovine pericardium patch to repair veins were performed (Fig. 1). A 5-0 polypropylene simple stitch was used for suturing the patch into the portal vein, which was clamped for 25 min, without intraoperative complications (Fig. 2). The findings were a tumor attached to the head of the pancreas of 4 cm × 4 cm, firmly adhered to the outer wall of the portal vein in an area of extension of 1 cm × 2 cm, lymph nodes in hepatoduodenal ligament, and the rest of the abdominal cavity without tumor activity. The patient was discharged after 10 days.

Discussion

Fukuda and colleagues reported that pancreaticoduodenectomy with portal vein resection can be the only potential cure for patients with pancreatic duct adenocarcinoma who present with portal vein involvement [1]. In our case, the portal vein was repaired using a glutaraldehyde-preserved bovine pericardium patch.

Specifically, the glutaraldehyde-preserved bovine pericardium patch was used for the first time by Ionescu to treat

valvular abnormalities, with an adequate tolerance in 212 patients during the late sixties [3]. The use of glutaraldehyde-preserved bovine pericardium is widely used in cardiovascular surgery with good results and is one of the most used biological patches. However, its use is controversial, specially in the European continent, because of the presence of mad cow disease. Hence, their use was limited in the last decade. However, the decellularization and sterilization processes have been improved, and therefore currently bioprotheses are available and are used mostly in ventral hernia repairs. In Mexico, the glutaraldehyde-preserved bovine pericardium has been used in the surgical treatment of incisional, inguinal, diaphragmatic hernia, and in repair of thoracoabdominal wall defects, without complications [4]. In Brazil, Boin et al also used glutaraldehyde-preserved bovine pericardium to repair a diaphragmatic defect with adequate functional results [5]. Currently cadaveric pericardium implants are used (Tutoplast®). Hellstrom and Reddy [6] reported their experience to correct penile curvature in 11 patients with

Fig. 2 **a** Image after applying the patch of bovine pericardium in the portal vein; **b** the scalpel blade marks the outer sidewall of the portal vein resected with the surgical specimen

Peyronie's disease having adequate results. However, it is well known that glutaraldehyde-preserved bovine pericardium is subjected to degenerative processes involving rigidity, calcium depositions, and structural changes after implantation in humans with the subsequent bioprosthesis failure. Currently the use of lyophilized glutaraldehyde-preserved bovine pericardium has been tried to decrease the cytotoxicity and enhancing resistance to calcification [7]. Currently in the literature there are no reports in which glutaraldehyde-preserved bovine pericardium has been used for the repair of a portal vein in a patient with cancer. In the case that we present the patient had good results after surgery and in oncology, and we believe that glutaraldehyde-preserved bovine pericardium can be a useful tool in selected patients to repair blood vessels that require a partial resection from tumor infiltration.

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