

Pancreas Regeneration After Resection: Does It Occur in Humans?

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Summary: Although pancreatic regeneration after partial resection or pancreatic injury (*restitutio ad integrum*) has been demonstrated in animal models, whether regeneration occurs in the human pancreas is unknown. Our aim was to determine whether the human pancreas regenerates after subtotal resection. We reviewed pre- and postoperative computerized tomograms (CTs) of 21 patients after proximal pancreatectomy (50–60% resection) for malignancy with no recurrent disease during follow-up of pancreatic parenchymal abnormalities. Three fixed anatomic measurements (pancreatic body width, tail width, and length) were compared with the same region 10 and

21 months after surgery. Data are expressed as mean \pm SEM. Pancreatic measurements before and 10 months after resection did not differ for body width (2.0 ± 0.1 cm vs. 1.8 ± 0.1 cm), tail width (2.2 ± 0.2 cm vs. 1.8 ± 0.2 cm) or length (8.2 ± 0.3 vs. 7.4 ± 0.4 cm) ($p \geq 0.1$ each). At 21 months after resection, measurements were less for body width and tail width (2.2 ± 0.2 cm vs. 1.5 ± 0.2 cm and 2.2 ± 0.1 cm vs. 1.5 ± 0.2 cm, respectively; $p = 0.01$) and unchanged for length (8.1 ± 0.4 cm vs. 8.1 ± 0.4 cm; $p = 0.9$). We conclude that the human pancreas does not regenerate after partial anatomic (50%) resection. **Key Words:** Pancreas—Regeneration.

Unlike the well-documented liver regeneration that occurs after partial hepatectomy, pancreatic regeneration is not known to occur. Although there have been animal studies proving regeneration of pancreatic islets with amelioration of diabetes mellitus (1) after 90% pancreatectomy, and functional recovery of pancreatic function after severe acute pancreatitis (referred to as "*restitutio ad integrum*") (2), true parenchymal volume increase of the pancreatic remnant after partial pancreatectomy has never been shown or well addressed in humans. Our aim was to determine reliably for the first time whether the normal human pancreas regenerates after subtotal resection, by assessing whether the remnant gland increases in size postoperatively.

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PATIENTS AND METHODS

We reviewed pre- and postoperative computerized tomograms (CTs) of patients undergoing curative proximal pancreatectomy (estimated 50–60% resection) for malignancy at our institution between 1993 and 1996 and selected those patients with no pre-morbid, global pancreatic parenchymal pathology and no recurrent disease during follow-up ($n = 21$). CTs were reviewed by a single radiologist (C.D.J.) blinded to patients' details. Patients with dilated pancreatic ducts and/or other benign parenchymal abnormalities on CTs, such as evidence of pancreatitis or obvious atrophy during follow-up, were excluded, as were patients requiring oral pancreatic enzyme supplements for exocrine insufficiency. Three CT measurements were made preoperatively and at two time points postoperatively (10 and 21 months) for each patient in fixed anatomic regions of the pancreas not resected: pancreatic body width, tail width, and length (Fig. 1). These measurements were compared statistically by using Student's *t* test. Numeric values are expressed as mean \pm SEM.