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Delayed gastric emptying after distal pancreatectomy

Retraso del vaciamiento gástrico tras pancreatectomía distal

Delayed gastric emptying (DGE) is a set of symptoms (sensation of fullness, epigastric pain, nausea and vomiting) that appears in the absence of mechanical obstruction[1–5] and can occur after surgeries in the supramesocolic region[6]. It is usually resolved with prokinetics and aspiration, although it may occasionally require surgical or interventional treatment, which prolongs hospital stay and increases healthcare costs[5,6].

In pancreatic surgery, DGE after pancreatoduodenectomy (PD) has been widely studied, observing high percentages (11%–60%)[1–3,6] and a general association with postoperative pancreatic fistula (POPF)[1,3,6]. In 2007, the International Study Group for Pancreatic Surgery (ISGPS) published a classification for DGE after pancreatic surgery, divided into 3 categories according to severity, which was quickly accepted internationally.

However, few studies have been published about the incidence of DGE after distal pancreatectomy (DP), which ranges from 5%–24%[5,6]. The predisposing factors are also not clearly defined. This paper analyzes the incidence of DGE in a multicenter DP series and identifies the associated factors.

This is a retrospective observational study of DP conducted by 8 medium-high volume hepatobiliary and pancreatic surgery units (mean volume 10–40 pancreatectomies/year, high volume >40 pancreatectomies/year)[7] between January 1, 2008 and December 31, 2018. The study included all DP performed for any diagnosis, except for patients who underwent urgent surgery, DP associated with resection of the celiac trunk, and minor patients under the age of 18. DGE was defined according to the ISGPS[1] classification. We studied epidemiological, clinical, serum, diagnostic, surgical, histological variables and postoperative complications. Quantitative data were expressed as median and interquartile range (IQR) and qualitative data as frequencies or percentages. In the case of quantitative variables, differences between groups were analyzed using the non-parametric Mann-Whitney *U* test and the Pearson chi-square test was applied for differences between percentages.

We have reviewed 450 DP. In 41.8% of cases, the approach was laparoscopic, mostly for neuroendocrine tumors and pancreatic cystic tumors. This percentage was 24.2% from 2008 to 2013, which increased to 63.3% from 2013 to 2018. The conversion rate was 8.5%. ERAS protocols existed in 3 of the 8 hospitals at the beginning of the study period, and these were gradually implemented in the remaining study centers. Drain tubes were systematically placed in 7 of the 8 hospitals, with early removal (<72 h) if amylase levels were less than 3 times the reference serum amylase levels at each medical center. Table 1 reports the pre-, intra-, and post-operative data. Thirteen patients presented DGE (2.9%): 7 (53.8%) grade A, 5 (38.5%) grade B, and 1 (7.7%) grade C. The median age was 71 years, and 53.8% were men. These patients had a longer hospital stay (6 vs 24 days). Likewise, they presented statistically significant differences for: smoking habit, splenic vascular involvement, resection of adjacent organs, drain tube placement, presence of POPF, intra-abdominal collections, and larger size of the resected pancreas (Table 1). In these patients, there was a lower percentage of laparoscopic approach and a higher rate of transfusion and major complications (Clavien-Dindo >II). Five patients presented intra-abdominal collections. One patient was treated with percutaneous drainage, 2 with transgastric drainage, and 2 with antibiotic therapy. One patient required surgery for gastric perforation. All cases were treated with prokinetics, nasogastric tube (median 12 days [6–22]), and parenteral nutrition. In one case, gastrojejunostomy was performed to resolve the DGE.

DGE-DP occurred in 2.9% of the patients in the series, a rate that is lower than previously published series[5–10]. In all

Table 1 – Comparison between patients with/without delayed gastric emptying.

Variable	Total	Delayed gastric emptying		
		No	Yes	P value
Preoperative data				
Patients, n (%)	450	437 (97.1)	13 (2.9)	
Age, years, median (IQR)	64 (52–72)	63 (52–72)	71 (64–71)	0.136
Sex, n (%)				
Males	217 (48.2)	210 (48.1)	7 (53.8)	0.680
Females	233 (51.8)	227 (51.9)	6 (46.2)	
ASA, %				
I	6.7	6.9	0.0	0.328
II	50.4	50.3	53.8	
III-IV	37.6	37.3	46.2	
Smoker, n (%)	129 (29.3)	122 (28.5)	7 (53.8)	0.048
Surgical history	318 (70.7)	308 (70.5)	10 (76.9)	0.615
Analytical data (mg/dL)				
Preoperative hemoglobin	13.4 (12.2–14.5)	13.3 (12.2–14.5)	13.8 (13.2–14.2)	0.246
Hemoglobin at discharge	10.9 (9.9–11.9)	10.9 (10.0–11.9)	10.9 (9.5–11.5)	0.499
Leukocytes at discharge	11.9 (9.5–15.6)	11.9 (9.5–10.0)	13.6 (10.4–162.)	0.546
Other affected organs, n (%)	36 (8.0)	34 (7.8)	2 (15.4)	0.279
Vascular involvement, n (%)	65 (14.4)	62 (14.2)	3 (23.1)	0.042
Preoperative FNA, n (%)	206 (45.8)	203 (46.5)	3 (23.1)	0.221
Intraoperative data, n (%)				
Laparoscopic approach	188 (41.8)	185 (42.3)	3 (23.1)	0.372
Resection of other organs	159 (35.3)	151 (34.6)	8 (61.5)	0.045
Drain tube placement	251 (55.8)	240 (54.9)	11 (84.6)	0.029
Intraoperative transfusion	49 (10.9)	46 (10.5)	3 (23.1)	0.391
Spleen preservation	69 (15.3)	68 (15.6)	1 (7.7)	0.024
	64 Kimura	63 Kimura	Kimura	
	5 Warsaw	5 Warsaw		
Postoperative data, n (%)				
Clavien complications > II	101 (22.4)	96 (22.0)	5 (38.5)	0.143
Pancreatic fistula (BQ, B or C)	94 (20.9)	88 (20.1)	6 (46.2)	0.035
Intra-abdominal collections	49 (10.9)	44 (10.1)	5 (38.5)	0.019
90-day readmittance	74 (16.4)	71 (16.2)	3 (23.1)	0.363
Mortality	11 (2.4)	11 (2.5)	0.0	0.722
Hospitalization, days, median (IQR)	7 (4–10)	6 (4–10)	24 (13–28)	< 0.001
Diagnosis PA, n, %				0.248
Adenocarcinoma	112(25.3)	106 (24.7)	6 (46.2)	
Cystic mucinous neoplasm	48 (10.8)	46 (10.7)	2 (14.4)	
Serous cystadenoma	49 (11.1)	46 (10.7)	3 (23.1)	
Metastasis	12 (2.7)	12 (2.8)	0	
IPMN	38 (8.6)	38 (8.8)	0	
Pancreatitis, pseudocysts	19 (4.3)	19 (4.4)	0	
Neuroendocrine tumor	125 (28.2)	124 (28.8)	1 (7.7)	
Pseudopapillary tumor	8 (1.8)	8 (1.8)	0	
Other	32 (7.2)	31 (7.2)	1 (7.7)	
Tumor size, cm median (IQR)	3 (1.9–5.0)	3 (1.8–5.0)	3.5(3.0–4.3)	0.535
Resected pancreas size, cm, median (IQR)	7 (4.4–10.0)	7 (4.0–10.0)	10 (10.0–11.0)	0.001
Specimen weight (g)	212.5 (70.2–657.1)	168.9 (67.5–422.3)	234.1 (80.3–622.3)	0.623
Tumor location				0.534
Body	82 (18.2)	80 (18.3)	2 (15.4)	
Body-tail	245 (54.5)	239 (54.7)	6 (46.2)	
Tail	123 (27.3)	118 (27.0)	5 (38.5)	

IQR: interquartile range; ASA: American Society of Anesthesiologists classification; AP: anatomic pathology; FNA: Fine needle aspiration; BQ: biochemical fistula; PA: pathological anatomy; IPMN: intraductal papillary mucinous neoplasm.

published DGE-DP studies, increased hospital stay is observed[5–8], as is the case of this study.

The etiological factors of DGE after PD have been studied extensively. The following have been suggested: hormonal alterations after duodenal resection, gastric ischemia and denervation, POPF, and mechanical alterations[6]. Of these, only ischemic gastropathy when there is gastric ischemia in DP associated with celiac trunk resection[6,8,9] and POPF are applicable to DP.

The etiological factors of DGE-DP have not been determined, although it has been related to: age >75 years[6,9], diagnosis of malignancy[7], laparotomic approach[5,7], clinically relevant

POPF[5,6] (B/C), resection of the celiac trunk[8,10], and major complications (Clavien-Dindo >II), highlighting the presence of intra-abdominal collections[6,9]. There are no evident etiopathogenic mechanisms except for POPF, post-resection ischemic gastropathy of the celiac trunk and abdominal collections, which explains why the mentioned factors increase DGE. In this paper, only POPF and intra-abdominal collections were also confirmed as factors associated with DGE, while the other parameters were not. However, we have also observed other factors that have not been previously studied, such as splenic vascular involvement or the length of the resected pancreas.

The limitations of this study are its retrospective nature and, as it is multicenter, the lack of common protocols for intraoperative use and subsequent removal of the nasogastric tube and initiation of oral tolerance. In the same way, the small number of cases with DGE prevents having sufficient statistical power to be able to affirm which factors influence the appearance of DGE. The strength of the study is that it is a series that includes a large number of patients. In conclusion, DGE can occur after DP, and we must keep this in mind when a patient who has undergone DP presents symptoms compatible with DGE.

Conflict of interest

The authors have no conflicts of interest to declare.

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