



Laparoscopic distal pancreatectomy for elderly patients

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As life expectancy has increased worldwide, number of elderly patients who need surgery is growing. Surgeons increasingly encounter decision on whether to perform surgical treatment for elderly patients. Although many surgeons consider that age alone should not be contraindication for the surgical treatment, elderly patients are generally considered to be associated with high risk of postoperative complication because of their compromised physiological conditions and existence of multiple comorbidities. Thus, many studies addressed on the issue have been reported in various type of surgery (1-6). In pancreatic surgery, significant increase of morbidity and mortality have been reported in elderly patients after surgical treatment (7,8), whereas others reported no difference when comparing to younger patients (9). One of the most reasons of the controversy, these studies included various types of pancreatic resections or focused predominantly on pancreaticoduodenectomy. With the recent advances in minimally invasive surgery, laparoscopic distal pancreatectomy (LDP) is the most widely performed because of its technical feasibility and safety without requirement of complex reconstruction. However, there are few studies that address on the role of LDP in elderly patients. It is important to evaluate surgical outcome after LDP in elderly patients compared with that in non-elderly patients whether LDP increase morbidity and mortality. At the same time, it is expected that LDP reduce morbidity and mortality while maintaining quality of life due to its minimally invasiveness comparing to open distal pancreatectomy (ODP).

LDP in elderly versus non-elderly patients

Recently, Chen *et al.* reported an interesting study titled “Surgical outcome of laparoscopic distal pancreatectomy in elderly and octogenarian patients: a single-center, comparative study” (10). The single-center retrospective study showed that although comorbidity was more common in elderly patients (≥ 70 years, $n=70$) than in non-elderly patients (40–69 years, $n=264$) undergoing LDP (57.1% *vs.* 38.3%, $P<0.01$), intraoperative factors (operative time, blood loss, transfusion rate, spleen-preserving, and conversion rate), postoperative complication rate, and lengths of postoperative hospital stay were no differences. Sahakyan *et al.* (11) conducted a similar retrospective study compared elderly patients (≥ 70 years, $n=118$) with non-elderly patients (<70 years, $n=284$) from single center. The summary of the two studies is shown in *Table 1*. In accordance with the findings of Chen *et al.* (10), Sahakyan *et al.* (11) reported that the elderly group showed significant higher rates of comorbidities and ASA score. Additionally, patients with pancreatic ductal adenocarcinoma (PDAC) were more common in the elderly group than in non-elderly group in the both studies. However, contrary to the results of Chen *et al.* (10), Sahakyan *et al.* (11) found that elderly patients had significant lower overall postoperative complication (28.8% *vs.* 40.1%, $P=0.032$), postoperative pancreatic fistula (POPF) (18.6% *vs.* 36.6%, $P=0.001$), clinically relevant POPF (9.3% *vs.* 20.1%, $P=0.009$), and readmission rates (2.5% *vs.* 8.8%, $P=0.025$) compared with non-elderly patients. However, the major complication rate defined by Clavien-Dindo classification $\geq III$ did not

Table 1 Perioperative outcomes of elderly versus non-elderly patients undergoing LDP

Variables	Chen <i>et al.</i> (10)			Sahakyan <i>et al.</i> (11)		
	Elderly, N=70	Non-elderly, N=264	P	Elderly, N=118	Non-elderly, N=284	P
Age (years)	75.3±4.4	50.0±7.6	<0.01	74.6±3.8	53.4±12.9	<0.01
Sex (male, %)	40 (57.1%)	98 (37.1%)	<0.01	57 (48.3%)	140 (49.3%)	0.86
BMI (kg/m ²)	22.8±2.6	22.3±3.0	0.18	25.1±4.4	25.6±4.7	0.37
Comorbidity (yes, %)	40 (57.1%)	101 (38.3%)	<0.01	87 (73.7%)	132 (46.5%)	<0.01
ASA score (I/II/III/IV)	4/53/13/0	156/106/2/0	<0.01	4/60/54/0	27/186/69/2	<0.01
Pathology (PDAC, %)	27 (38.6%)	56 (21.2%)	<0.01	29 (24.5%)	47 (16.5%)	0.06
Tumor size (mm)	37±21	42±21	0.07	NA	NA	
Operative time (min)	185.5±53.9	175.1±52.6	0.14	162 [29–374]	156 [45–520]	0.95
Intraoperative blood loss (ml)	191.0±113.2	193.8±107.8	0.85	100 [0–3,000]	60 [0–6,250]	0.20
Transfusion required (yes, %)	4 (5.7%)	6 (2.3%)	0.14	13 (11.0%)	33 (11.6%)	0.86
Spleen-preserving (yes, %)	18 (25.7%)	99 (37.5%)	0.07	27 (14.4%)	62 (21.8%)	<0.01
Major complication (Clavien-Dindo ≥III)	7 (10.0%)	21 (10.0%)	0.84	18 (15.3%)	59 (20.8%)	0.20
Pancreatic fistula (ISGPF grade B or C)	7 (10.0%)	17 (6.4%)	0.44	11 (9.3%)	57 (20.1%)	<0.01
Cardiopulmonary complication	3 (4.3%)	6 (2.3%)	0.69	NA	NA	
Length of postoperative stay (days)	11.4±5.8	10.1±5.9	0.12	5 [1–81]	6 [2–58]	0.57

LDP, laparoscopic distal pancreatectomy; BMI, body mass index; ASA, American Society of Anesthesiologists; PDAC, pancreatic ductal adenocarcinoma; ISGPF, International Study Group of Pancreatic Fistula.

differ between the two groups (15.3% *vs.* 20.8%, $P=0.20$). They discussed that clinically relevant POPF might affect readmission rate, and fatty involvement in the pancreas and exocrine pancreatic insufficiency observed with aging might reduce the incidence of POPF (11). Overall, current studies suggest that perioperative outcomes in elderly patients were non-inferior to those in the non-elderly patients although elderly patients have more comorbidities and higher ASA score.

LDP versus ODP in elderly patients

Several meta-analyses and systematic reviews showed the superiority of LDP in terms of intraoperative blood loss, patient recovery, and hospital stay when comparing to ODP (12–17). In 2019, the Dutch Pancreatic Cancer Group reported the first multicenter patient-blinded randomized control study of minimally invasive distal pancreatectomy versus ODP (LEOPARD) (18). They showed that minimally invasive distal pancreatectomy significantly reduced the time to functional recovery compared with ODP.

To prove the reproducibility of the benefits of LDP in elderly patients, Chen *et al.* (10) also compared LDP ($n=70$) with ODP ($n=48$) groups in elderly patients. Elderly patients undergoing LDP had significantly shorter operative time (185.5 *vs.* 208.0 min, $P=0.02$), less blood loss (191.0 *vs.* 291.8 mL, $P<0.01$), lower transfusion rate, (5.7% *vs.* 22.9%, $P<0.01$) and shorter postoperative hospital stay (11.4 *vs.* 15.1 days, $P<0.01$) than elderly patients undergoing ODP. The overall morbidity rate tended to be lower in the LDP group than that in the ODP group, but the difference was not significant (20.0% *vs.* 33.3%, $P=0.07$). Major complication, and clinically relevant POPF rates did not differ between the two groups. However, cardiopulmonary complications in the LDP group are less than those in the ODP group (4.3% *vs.* 14.6%, $P=0.05$). A French multicenter retrospective study reported by Souche *et al.* (19) showed similar results. The summary of the two studies is shown in *Table 2*. They found that elderly patients undergoing LDP had significantly less blood loss (238 *vs.* 425 mL, $P=0.009$), and shorter postoperative hospital stay (14 *vs.* 16 days, $P=0.041$) than elderly patients undergoing

Table 2 Perioperative outcomes of elderly patients undergoing LDP versus ODP

Variables	Chen <i>et al.</i> (10)			Souche <i>et al.</i> (19)		
	LDP, N=70	ODP, N=48	P	LDP, N=44	ODP, N=56	P
Age (years)	75.3±4.4	74.5±3.5	0.32	75.4±4	75.4±4	0.89
Sex (Male, %)	40 (57.1%)	27 (56.3%)	0.92	23 (52.2%)	29 (51.7%)	0.97
BMI (kg/m ²)	22.8±2.6	22.1±2.4	0.13	24.8±3.8	24.6±3.3	0.77
Comorbidity (yes, %)	40 (57.1%)	25 (52.1%)	0.59	NA	NA	
ASA score (I/II/III/IV)	4/53/13/0	4/37/7/0	0.80	10/30/4/0	7/40/8/1	0.75
Pathology (PDAC, %)	27 (38.6%)	30 (62.5%)	0.01	15 (34.1%)	33 (58.9%)	0.02
Tumor size (mm)	37±21	39±22	0.68	29 [8–100]	42 [10–290]	<0.01
Operative time (min)	185.5±53.9	208.0±41.2	0.02	204±57	220±76	0.625
Intraoperative blood loss (ml)	191.0±113.2	291.8±172.1	<0.01	238±312	425±582	<0.01
Transfusion required (yes, %)	4 (5.7%)	11 (22.9%)	<0.01	1 (2.2%)	8 (14.3%)	0.07
Spleen-preserving (yes, %)	18 (25.7%)	0 (0%)	<0.01	27 (61.3%)	12 (21.4%)	<0.01
Major complication (Clavien-Dindo ≥III)	7 (10.0%)	7 (14.6%)	0.15	8 (18.2%)	7 (12.5%)	0.43
Pancreatic fistula (ISGPF grade B or C)	7 (10.0%)	5 (10.4%)	0.52	3 (13.6%)	12 (7.1%)	0.26
Cardiopulmonary complication	3 (4.3%)	7 (14.6%)	0.05	NA	NA	
Length of postoperative stay (days)	11.4±5.8	15.1±6.7	<0.01	14±11	16±11	0.04

LDP, laparoscopic distal pancreatectomy; ODP, open distal pancreatectomy; BMI, body mass index; ASA, American Society of Anesthesiologists; PDAC, pancreatic ductal adenocarcinoma; ISGPF, International Study Group of Pancreatic Fistula.

ODP. The overall complication (45.4% *vs.* 51.7%, $P=0.534$), major complication (18.2% *vs.* 12.5%, $P=0.431$), and clinically relevant POPF (6.8% *vs.* 7.1%, $P=0.954$) rates did not differ between the two groups. It is noted that there are significantly more PDAC patients in the ODP group than in the LDP group in the both studies. There were significantly higher rates of spleen-preserving procedure in the LDP group in the both studies. Although both studies did not describe the precise indication of LDP for PDAC, distribution of PDAC in the LDP (38.6% and 34%) and the ODP (62.5% and 59%) groups were quite similar in the two studies. This may indicate that surgical indication of LDP for PDAC is similar among the specialized high volume centers. LDP seems to reduce intraoperative blood loss, and length of hospital stay in elderly patients.

LDP for PDAC in elderly patients

LDP for PDAC is technically more challenging than LDP for benign and low-grade malignant tumors of the pancreas, because it requires *en bloc* resection, R0 resection, and

lymph node dissection. Moreover, its oncological safety in terms of the long-term results compared with ODP has not been clarified, because no randomized study has been conducted. On the other hands, efficacy of pancreatic resection for elderly patients with PDAC was controversial. Lahat *et al.* (20) and Oliveira-Chunha *et al.* (9) reported that elderly patient who underwent surgery for PDAC showed significantly poor survival, whereas several studies demonstrated that survival rates in elderly and non-elderly patients were equivalent (7,21).

In the subgroup analysis of only for PDAC by Chen *et al.* (10), patient characteristics including age, sex, BMI, comorbidity, and ASA score were comparable between the LDP group (n=27) and the ODP group (n=30). Tumor size, number of retrieved lymph nodes, R0 resection rate did not differ between the two groups. However, they did not evaluate long-term outcome. Overall morbidity was less in LDP group (22.2% *vs.* 43.3%, $P=0.09$) and postoperative hospital stay was shorter in the LDP group (11.1 *vs.* 16.6 days, $P<0.01$) compared with the ODP group. Sahankyan *et al.* (11) reported oncologic outcome in elderly

(n=29) and non-elderly (n=47) patients with PDAC after LDP in their subgroup analysis. Tumor size, histological grade, R0 resection rate, number of retrieved and positive lymph nodes, and induction rate of adjuvant chemotherapy were not different between the both groups. Median survival in elderly patients was 20.2 months compared with 19 months in non-elderly patients with a median follow up period of 14 (1 to 154) months (P=0.94, log-rank). Three-year survival rates in elderly and non-elderly patients were 26.7% and 34.3%, respectively. Although the current evidence is very limited, these results suggest that LDP is recommended approach in elderly patients with PDAC.

Conclusion

In conclusion, although the available evidence on LDP for elderly patients is limited and definitive conclusions on the efficacy cannot be drawn, LDP seems to be safe and effective procedure for elderly patients. The short-term outcomes result in several benefits including less blood loss, shorter hospitalization, and potential lower morbidity in elderly patients undergoing LDP compared with ODP. Prospective randomized trials are warranted to prove clear benefits of LDP in elderly patients, especially with PDAC.

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Footnote

Conflicts of Interest: The authors have no conflicts of interest to declare.

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