

Supplementary material

Supplementary Table 1 Characteristics of patients in the submucosal injection group and the non-injection group

Characteristics	submucosal injection group (n= 65)	non-submucosal injection group (n=11)	<i>P</i>
Gender,n,%			1.000
Male	38(58.5%)	6(54.5%)	
Female	27(41.5%)	5(45.5%)	
Age,mean±SD,yesrs	61.3±10.0	60.8±8.8	0.891
BMI,mean±SD,kg/ m2	23.9±3.4	25.7±3.5	0.094
Clinical symptoms,n,%			0.506
Asymptomatic	37(56.9%)	5(45.5%)	
Fever	3(4.6%)	0(0%)	
Abdominal pain	18(27.7%)	4(36.4%)	
Abdominal distension	6(9.2%)	1(9.1%)	
Heartburn	1(1.5%)	1(9.1%)	
Comorbidities,n,%			
Hypertension	26(40.0%)	4(36.4%)	1.000
Diabetes	11(16.9%)	3(27.3%)	0.690
Cardiovascular disease	10(15.4%)	1(9.1%)	0.932
Malignancy	5(7.7%)	1(9.1%)	1.000
Oral anticoagulans,n,%	7(10.8%)	1(9.1%)	1.000
Smoking history,n,%	19(29.2%)	5(45.5%)	0.472
Alcohol intake,n,%	21(32.3%)	6(54.5%)	0.278

Supplementary Table 2 Preoperative characteristics of the submucosal injection group and the non-injection group

Characteristics	submucosal injection group (n= 65)	non-submucosal injection group (n=11)	<i>P</i>
Tumor marker			
CEA,median(IQR),ng/mL	1.9(0.7,2.8)	1.7(1.3,2.6)	0.971
CA199,median(IQR),U/mL	7.5(3.3,18.2)	5.5(1.7,3.3)	0.250
Blood routine test			
WBC,median(IQR),10 ⁹ /L	5.8(4.8,6.7)	5.7(4.9,6.8)	0.827
NEU,mean±SD,%	60.4±10.7	60.5±8.0	0.965
HGB,mean±SD,g/L	140.0±13.3	135.6±16.7	0.341
PLT,median(IQR),10 ⁹ /L	222.0(194.5,261.5)	202.5(162.5,236.3)	0.135
Liver function test			
TBIL,median(IQR),umol/L	12.7(9.6,20.6)	11.6(8.9,16.3)	0.600
DBIL,median(IQR),umol/L	3.4(2.5,6.1)	3.2(2.0,4.2)	0.497
ALT,median(IQR),U/L	19.8(13.7,28.9)	24.4(19.0,30.8)	0.127
AST,median(IQR),U/L	18.3(15.5,26.3)	21.3(20.3,25.3)	0.165
AKP,median(IQR),U/L	77.85(62.4,97.5)	89.0(76.1,94.9)	0.334
GGT,median(IQR),U/L	27.0(17.0,45.6)	66.9(22.6,115.1)	0.146
ALB,mean±SD,g/L	41.8±4.0	39.8±3.8	0.142
Serum ions			
K ⁺ ,median(IQR),mmol/L	4.0(3.7,4.2)	3.9(3.8,4.0)	0.550
Na ⁺ ,mean±SD,mmol/L	141.5±13.3	140.6±2.1	0.176
Coagulation function			
PT,mean±SD,s	12.1±1.0	12.7±1.2	0.082
INR,mean±SD	1.0±0.1	1.0±0.1	0.810
APTT,median(IQR),s	28.8(26.4,35.0)	32.1(27.6,38.0)	0.249
FIB,median(IQR),g/L	3.13(2.6,3.5)	3.13(2.9,3.5)	0.674

TT,mean±SD,s	17.2±1.0	17.4±0.7	0.670
EUS assessment,n,%			0.257
Hypoechoic	42(64.%)	8(72.7%)	
Isoechoic	22(33.8%)	2(18.2%)	
Hyperechoic	1(1.5%)	1(9.1%)	
Bile duct diameter, median(IQR),mm	8.0(6.0,10.4)	7.0(5.8,13.3)	0.796
Pancreatic duct diameter, median(IQR),mm	2.2(2.0,3.1)	2.5(2.0,3.0)	0.832
Tumor size, median(IQR),mm	15.0(15.0,25.0)	15.0(15.0,20.0)	0.281

Supplementary Table 3 Intraoperative and pathological information for the submucosal injection group and the non-injection group

Characteristics	submucosal group(n= 65)	injection non-submucosal injection group(n=11)	<i>P</i>
En bloc resection,n,%	58(89.2%)	11(100%)	0.563
Diverticulum,n,%	12(18.5%)	2(18.2%)	1.000
Hemostasis,n,%			0.523
Electrocautery hemostasis	39(60.0%)	5(45.5%)	
Epinephrine spray	10(15.4%)	1(9.1%)	
None	17(26.2%)	5(45.5%)	
Stent implantation,n,%			0.030
Biliary stent	1(1.5%)	3(27.3%)	
Pancreatic stent	5(7.7%)	1(9.1%)	
Double stent	58(89.2%)	6(54.5%)	
Non stent	1(1.5%)	1(9.1%)	
Metal clips,n,%	59(86.2%)	8(72.7%)	0.227
Drainage tube,n,%	4(6.2%)	0(0)	1.000
Procedure time,median(IQR),min	28.0(18.0,33.0)	30.0(16.0,50.0)	0.488
Pathological,n,%			<0.001
Adenoma with LIGN	26(40.0%)	7(63.6%)	
Adenoma with HIGN	25(38.5%)	2(18.2%)	
Focal carcinoma	6(9.2%)	0(0)	
Carcinoma	5(7.7%)	1(9.1%)	
Others	3(4.6%)	1(9.1%)	
Complete	63(96.9%)	10(90.9%)	0.379

resection,n,%

Supplementary Table 4 Characteristics of patients in the double stents group and control group

Characteristics	Double stents group (n=64)	Control group (n=12)	<i>P</i>
Gender,n,%			0.546
Male	38(59.3%)	6(50.0%)	
Female	26(40.6%)	6(50.0%)	
Age,mean±SD,yesrs	60.9±9.6	62.8±11.1	0.532
BMI,mean±SD,kg/ m2	24.4±3.2	23.0±4.4	0.189
Clinical symptoms,n,%			0.444
Asymptomatic	34(53.1%)	8(66.7%)	
Fever	3(4.7%)	0(0%)	
Abdominal pain	20(31.3%)	2(16.7%)	
Abdominal distension	6(9.4%)	1(8.3%)	
Heartburn	1(1.6%)	1(8.3%)	
Comorbidities,n,%			
Hypertension	24(37.5%)	6(50.0%)	0.623
Diabetes	12(18.7%)	3(25.0%)	0.917
Cardiovascular disease	10(15.6%)	1(8.3%)	0.832
Malignancy	6(9.3%)	0(0%)	0.370
Oral anticoagulans,n,%	7(10.9%)	1(8.3%)	1.000
Smoking history,n,%	23(35.9%)	1(8.3%)	0.121
Alcohol intake,n,%	22(34.3%)	5(41.6%)	0.876

Supplementary Table 5 Preoperative characteristics of the double stents group and control group

Characteristics	Double stents group (n=64)	Control group (n=12)	<i>P</i>
Tumor marker			
CEA,median(IQR),ng/mL	1.8(0.7,2.6)	2.0(1.6,3.1)	0.218
CA199,median(IQR),U/mL	6.4(2.5,14.3)	10.9(2.2,24.8)	0.555
Blood routine test			
WBC,median(IQR),10 ⁹ /L	5.7(4.8,6.6)	5.9(5.2,7.5)	0.534
NEU,mean±SD,%	59.5±10.2	63.4±10.2	0.070
HGB,mean±SD,g/L	140.6±14.0	133.5±10.8	0.100
PLT,mean±SD,10 ⁹ /L	228.3±57.3	212.8±52.3	0.387
Liver function test			
TBIL,median(IQR),umol/L	12.5(9.2,18.8)	15.5(10.0,25.9)	0.260
DBIL,median(IQR),umol/L	3.4(2.5,4.9)	3.1(2.1,8.1)	0.759
ALT,median(IQR),U/L	19.8(14.3,28.2)	24.5(14.0,81.9)	0.254
AST,median(IQR),U/L	18.8(15.7,25.9)	21.9(17.9,71.1)	0.263
AKP,median(IQR),U/L	79.5(62.1,96.0)	82.5(65.0,106.4)	0.417
GGT,median(IQR),U/L	27.6(18.5,48.7)	34.9(14.4,103.1)	0.765
ALB,mean±SD,g/L	41.7±1.0	40.0±3.4	0.195
Serum ions			
K ⁺ ,mean±SD,mmol/L	4.0±0.3	3.9±0.4	0.472
Na ⁺ ,mean±SD,mmol/L	141.6±2.0	140.0±2.3	0.015
Coagulation function			
PT,mean±SD,s	12.1±1.0	12.6±1.2	0.141
INR,mean±SD	1.0±0.1	1.0±1.0	0.988
APTT,mean±SD,s	30.5±5.2	33.1±7.4	0.150
FIB,median(IQR),g/L	3.1(2.7,3.4)	3.1(2.8,3.8)	0.608
TT,mean±SD,s	17.3±1.0	16.9±1.0	0.210

EUS assessment,n,%			0.058
Hypoechoic	40(62.5%)	10(83.3%)	
Isoechoic	23(35.9%)	1(8.3%)	
Hyperechoic	1(1.5%)	1(8.3%)	
Bile duct diameter	8.0(6.0,10.9)	6.0(5.8,11.8)	0.571
Pancreatic duct diameter	2.2(2.0,3.0)	2.5(2.0,3.5)	0.860
Tumor size, median(IQR),mm	15.0(15.0,25.0)	15.0(14.3,23.8)	0.824

Supplementary Table 6 Intraoperative and pathological information for the double stents group and control group

Characteristics	Double stents group (n=64)	Control group (n=12)	<i>P</i>
En bloc resection,n,%	58(90.6%)	11(91.6%)	1.000
Submucosal injection,n,%	58(90.6%)	11(91.6%)	1.000
Diverticulum,n,%	10(15.6%)	4(33.3%)	0.295
Hemostasis,n,%			0.243
Electrocautery hemostasis	37(57.8%)	7(58.3%)	
Epinephrine spray	11(17.1%)	0(0%)	
None	16(25%)	5(41.6%)	
Metal clips,n,%	58(90.6%)	9(75%)	0.294
Drainage tube,n,%	3(4.6%)	1(8.3%)	0.505
Procedure time,median(IQR),min	28.0(17.0,33.5)	30.0(24.0,36.0)	0.327
Pathological,n,%			0.050
Adenoma with LIGN	28(43.7%)	5(41.6%)	
Adenoma with HIGN	23(35.9%)	4(33.3%)	
Focal carcinoma	6(9.3%)	0(0%)	
Carcinoma	6(9.3%)	0(0%)	
Others	1(1.5%)	3(25.0%)	
Complete resection,n,%	61(95.3%)	12(100%)	1.000

Supplementary Table 7 Characteristics of patients in the clips closure group and non-clips closure group

Characteristics	Metal clips group (n=67)	Non-metal group(n=9)	clips	<i>P</i>
Gender,n,%				0.835
Male	38(56.7%)	6(66.6%)		
Female	29(43.2%)	3(33.3%)		
Age,mean±SD,yesrs	61.2±9.8	60.9±10.1		0.921
BMI,mean±SD,kg/ m2	24.3±3.5	23.3±3.2		0.444
Clinical symptoms,n,%				0.663
Asymptomatic	37(55.2%)	5(55.5%)		
Fever	3(4.4%)	0(0%)		
Abdominal pain	20(29.8%)	2(22.2%)		
Abdominal distension	5(7.4%)	2(22.2%)		
Heartburn	2(2.9%)	0(0%)		
Comorbidities,n,%				
Hypertension	29(43.2%)	1(11.1%)		0.136
Diabetes	14(20.8%)	1(11.1%)		0.805
Cardiovascular disease	11(16.4%)	0(0%)		0.418
Malignancy	5(7.4%)	1(11.1%)		0.544
Oral anticoagulans,n,%	8(11.9%)	0(0%)		0.585
Smoking history,n,%	19(28.4%)	5(55.5%)		0.205
Alcohol intake,n,%	23(34.4%)	4(44.4%)		0.822

Supplementary Table 8 Preoperative characteristics of the clips closure group and non-clips closure group

Characteristics	Metal clips group (n=67)	Non-metal clips group (n=9)	<i>P</i>
Tumor marker			
CEA,median(IQR),ng/mL	1.9(0.9,2.8)	1.4(0.6,3.8)	0.625
CA199,median(IQR),U/mL	7.1(2.5,14.3)	8.8(1.8,18.4)	0.960
Blood routine test			
WBC,median(IQR),10 ⁹ /L	5.8(4.8,6.2)	5.8(5.3,7.1)	0.546
NEU,mean±SD,%	60.7±10.6	58.6±8.9	0.578
HGB,mean±SD,g/L	139.5±14.0	139.6±12.6	0.986
PLT,mean±SD,10 ⁹ /L	229.6±57.5	197.8±40.4	0.113
Liver function test			
TBIL,median(IQR),umol/L	12.5(9.1,19.2)	14.5(11.3,21.7)	0.377
DBIL,median(IQR),umol/L	3.4(2.4,5.9)	3.2(2.4,6.0)	0.930
ALT,median(IQR),U/L	20.0(14.0,29.1)	20.6(16.2,27.0)	0.816
AST,median(IQR),U/L	19.2(15.7,26.1)	20.8(17.5,29.6)	0.505
AKP,median(IQR),U/L	80.1(63.8,96.3)	76.1(49.1,138.1)	0.547
GGT,median(IQR),U/L	28.5(17.2,53.2)	23.7(19.6,52.4)	0.791
ALB,mean±SD,g/L	41.5±4.0	41.2±4.2	0.858
Serum ions			
K ⁺ ,mean±SD,mmol/L	3.9±0.3	4.0±0.2	0.219
Na ⁺ ,mean±SD,mmol/L	141.3±2.1	141.8±1.5	0.483
Coagulation function			
PT,mean±SD,s	12.1±1.0	12.7±1.0	0.105
INR,mean±SD	1.0±0.1	1.0±0.1	0.604
APTT,mean±SD,s	30.4±5.2	35.1±6.7	0.016
FIB,median(IQR),g/L	3.1(2.7,3.5)	3.1(2.7,3.6)	0.853

TT,mean±SD,s	17.3±1.0	17.0±0.9	0.376
EUS assessment,n,%			0.202
Hypoechoic	45(67.1%)	5(55.5%)	
Isoechoic	21(31.3%)	3(33.3%)	
Hyperechoic	1(1.4%)	1(11.1%)	
Bile duct diameter, median(IQR),mm	7.0(6.0,11.0)	8.5(5.3,10.0)	0.898
Pancreatic duct diameter, median(IQR),mm	2.2(2.0,3.0)	2.5(2.0,5.0)	0.776
Tumor size, median(IQR),mm	15.0(15.0,25.0)	15.0(12.5,22.5)	0.880

Supplementary Table 9 Intraoperative and pathological information for the clips closure group and non-clips closure group

Characteristics	Metal clips group(n=67)	Non-metal clips group(n=9)	<i>P</i>
En bloc resection,n,%	61(91.0%)	8(88.8%)	1.000
Submucosal injection,n,%	59(88.0%)	6(66.6%)	0.227
Diverticulum,n,%	12(17.9%)	2(22.2%)	1.000
Hemostasis,n,%			0.109
Electrocautery hemostasis	40(59.7%)	4(44.4%)	
Epinephrine spray	11(16.4%)	0(0%)	
None	16(23.8%)	5(55.5%)	
Stent implantation,n,%			0.119
Biliary stent	3(4.4%)	1(11.1%)	
Pancreatic stent	5(7.4%)	1(11.1%)	
Double stent	58(86.5%)	6(66.6%)	
Non stent	1(1.4%)	1(11.1%)	
Drainage tube,n,%	3(4.4%)	1(11.1%)	0.403
Procedure time,median(IQR),min	29.0(17.3,34.5)	23.0(19.5,31.5)	0.641
Pathological,n,%			0.014
Adenoma with LIGN	24(35.8%)	9(100%)	
Adenoma with HIGN	27(40.2%)	0(0%)	
Focal carcinoma	6(8.9%)	0(0%)	
Carcinoma	6(8.9%)	0(0%)	
Others	4(5.9%)	0(0%)	
Complete	64(95.5%)	9(100%)	1.000

resection,n,%

Supplementary Table 10 Risk factors for post-EP pancreatitis

	Pancreatitis group (n=17)	Non-pancreat itis group(n=59)	<i>P</i>	Exp (B)	95%CI
Age,mean±SD,yesrs	61.7±9.9	61.1±9.8	0.807	1.007	0.952-1.065
Gender,n,%			0.639	1.296	0.438-3.836
Male	9(52.9%)	35(59.3%)			
Female	8(47.1%)	24(40.7%)			
BMI,mean±SD, kg/m ²	23.3±3.9	24.4±3.3	0.273	0.913	0.776-1.074
CEA,median(IQR), ng/mL	1.9(0.9,2.8)	1.9(0.8,2.8)	0.620	0.847	0.440-1.631
CA199,median(IQR), U/mL	14.3(11.6,23.6)	5.9(2.4,13.1)	0.580	1.011	0.972-1.053
TBIL,median(IQR), umol/L	13.0(9.3,20.9)	12.5(9.3,17.7)	0.560	0.989	0.951-1.028
DBIL,median(IQR), umol/L	3.0(2.2,7.2)	3.4(2.5,4.9)	0.551	0.982	0.926-1.042
ALT,median(IQR), U/L	20.4(12.0,42.2)	20.0(14.5,27.8)	0.677	1.001	0.995-1.007
AST,median(IQR), U/L	18.2(15.8,25.5)	20.8(16.0,26.1)	0.785	1.001	0.992-1.011
AKP,median(IQR), U/L	70.5(63.1,102.7)	81.6(62.4,96.3)	0.779	1.000	0.997-1.003
GGT,median(IQR), U/L	28.7(16.9,64.8)	27.0(18.4,45.9)	0.465	1.000	0.999-1.002
ALB,mean±SD,g/L	40.7±3.9	41.7±4.0	0.376	0.938	0.815-1.080
K ⁺ ,mean±SD, mmol/L	3.7±0.4	4.0±0.3	0.011	0.103	0.018-0.596

Hypokalemia,n,%	7(41.1%)	3(5.0%)	<0.001	13.07	2.88-59.19
Na ⁺ ,mean±SD, mmol/L	142.1±2.1	141.1±2.0	0.096	1.292	0.956-1.748
PT,mean±SD,s	12.0±0.9	12.2±1.1	0.486	0.826	0.482-1.415
INR,mean±SD	1.0±0.1	1.0±0.1	0.838	0.324	0.000-1607 0.842
APTT,mean±SD,s	29.9±3.8	31.2±6.0	0.374	0.954	0.860-1.058
FIB,median(IQR),g/L	3.1(2.7,4.0)	3.1(2.7,3.4)	0.322	1.331	0.756-2.343
TT,mean±SD,s	17.3±1.0	17.2±1.0	0.777	1.088	0.609-1.944
Comorbidities,n,%					
Hypertension	9(52.9%)	21(35.6%)	0.220	0.505	0.169-1.504
Diabetes	4(23.5%)	11(18.6%)	0.560	0.677	0.182-2.513
Cardiovascular disease	2(11.8%)	9(15.3%)	0.701	1.378	0.268-7.085
Malignancy	2(11.8%)	4(6.8%)	0.520	0.556	0.093-3.331
Oral anticoagulans,n,%	0	8(13.6%)	0.999		
Smoking history,n,%	6(35.3%)	21(35.6%)	0.945	1.041	0.336-3.220
Alcohol intake,n,%	5(29.4%)	19(32.2%)	0.795	1.169	0.360-3.800
EUS assessment,n,%			0.702		
Hypoechoic	12(70.6%)	38(64.4%)			
Isoechoic	4(23.5%)	20(33.9%)			
Hyperechoic	1(5.9%)	1(1.7%)			
Tumor size, median(IQR),mm	20.0(15.0,22.5)	15.0(15.0,25.0)	0.510	1.025	0.952-1.104
Bile duct diameter, median(IQR),mm	8.3(7.1,11.0)	7.0(6.0,10.5)	0.349	1.064	0.935-1.210
Pancreatic duct diameter,	3.0(2.0,3.0)	2.0(2.0,3.0)	0.768	1.070	0.682-1.679

median(IQR),mm					
En bloc resection,n,%			0.595	0.552	0.062-4.931
Submucosal	16(94.1%)	49(83.1%)	0.277	0.306	0.036-2.581
injection,n,%					
Diverticulum,n,%	3(17.6%)	11(18.6%)	0.926	1.069	0.261-4.374
Hemostasis,n,%			0.423	0.781	0.415-1.472
Electrocautery	12(70.6%)	32(54.2%)			
hemostasis					
Epinephrine spray	1(5.9%)	10(16.9%)			
None	4(23.5%)	17(28.8%)			
Stent			0.991		
implantation,n,%					
Non stent	2(11.8%)	0(0%)			
Biliary stent	1(5.9%)	3(5.1%)			
Pancreatic stent	1(5.9%)	5(8.5%)			
Double stent	13(76.5%)	51(86.4%)			
Complete	16(94.1%)	53(89.8%)	0.595	0.552	0.062-4.931
resection,n,%					
Metal clips,n,%	15(88.2%)	52(88.1%)	0.991	0.990	0.186-5.278
Drainage tube,n,%	1(5.9%)	3(5.1%)	0.897	0.857	0.083-8.813
Procedure time,	30.0(19.5,34.5)	28.0(17.0,33.8)	0.940	1.002	0.958-1.047
median(IQR),min					
Pathological,n,%			0.587		
Adenoma with LIGN	6(35.3%)	27(45.8%)			
Adenoma with	7(41.2%)	20(33.9%)			
HIGN					
Focal carcinoma	3(17.6%)	3(5.1%)			
Carcinoma	1(5.9%)	5(8.5%)			
Others	0(0%)	4(6.8%)			

