

# Impact of Margin Accentuation with Intraoperative Irreversible Electroporation on Local Recurrence in Resectable Pancreatic Cancer



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## Introduction

- Pancreatic cancer is one of the most aggressive cancers and is the seventh leading cause of cancer-related deaths in the world.
- Surgical resection remains as the optimal treatment for patients with pancreatic cancer.
- One of the main limitations of surgical resection is the high frequency of margin positive resections and subsequent tumor recurrence.
- Local recurrence is generally the most common type of recurrence, and it occurs in approximately 33% of patients undergoing pancreatic resection.
- The pancreas has extensive vascular involvement which limits the available treatments that are safe for local tumor control near the surgical margins.
- A limitation of many established local tumor ablation technologies is that they cannot be safely or effectively used near blood vessels.
- Irreversible Electroporation (IRE) is a novel ablation technology that has the unique quality of being able to be used safely near major blood vessels.
- IRE can be used intraoperatively during pancreatic resection to sterilize the surgical margins in a technique called margin accentuation (MA).
- MA is performed in an effort to achieve higher rates of microscopically cancer-free margins in resections which may play a role in the incidence of local recurrence.

## Purpose

The purpose of this study was to evaluate the rates of local recurrence and positive surgical margins in patients with locally advanced and borderline resectable pancreatic cancer after IRE MA.

## Methods

Prospective data from an institutional review board-approved database consisting of multiple institutions was evaluated for 75 patients who underwent IRE MA from March 2010 to November 2020 and 71 patients who underwent pancreatic resection alone from May 2014 to July 2021.

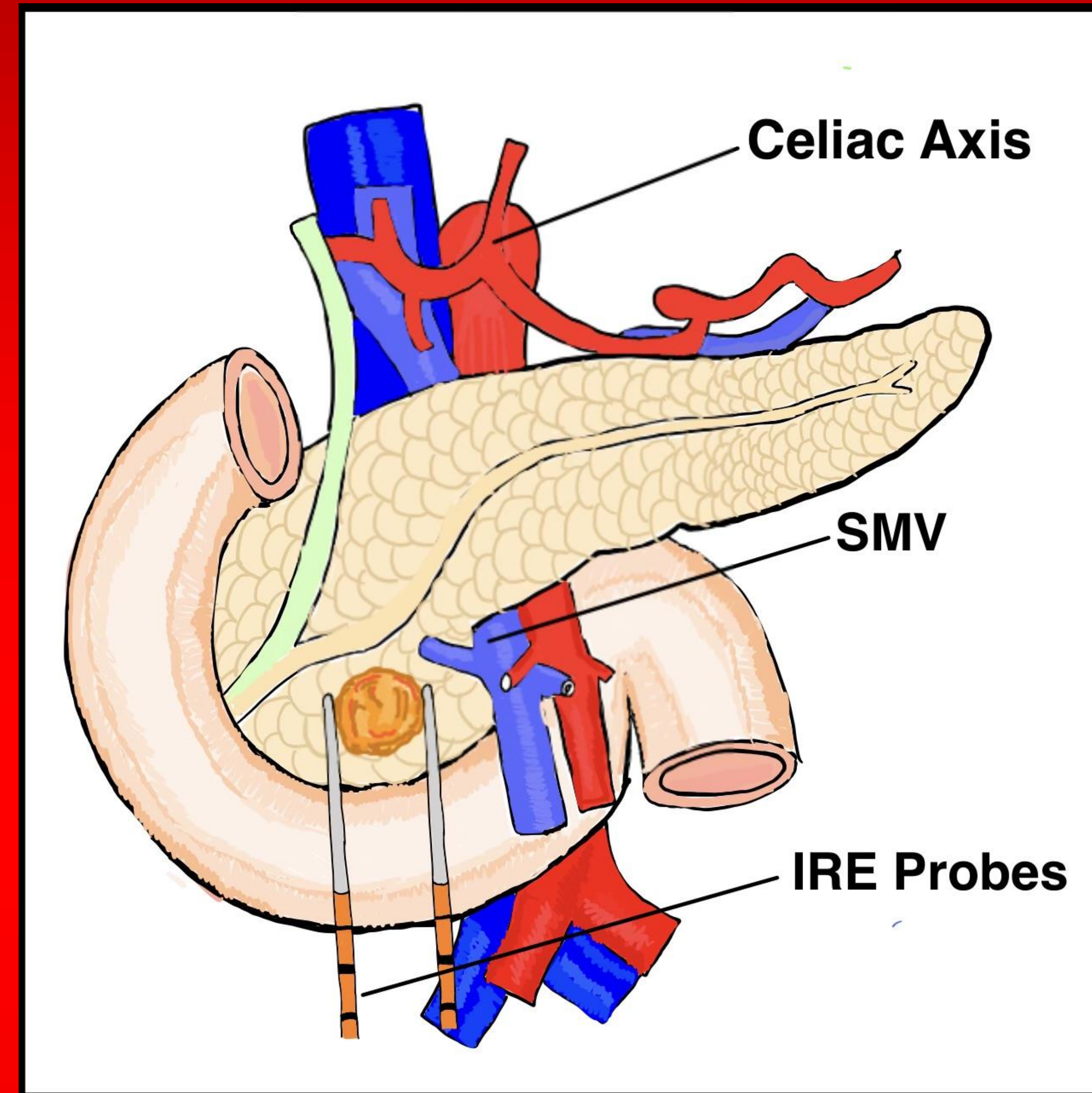


Figure 1. Schematic of the pancreas and the surrounding structures. Two IRE probes are shown around a pancreatic tumor.

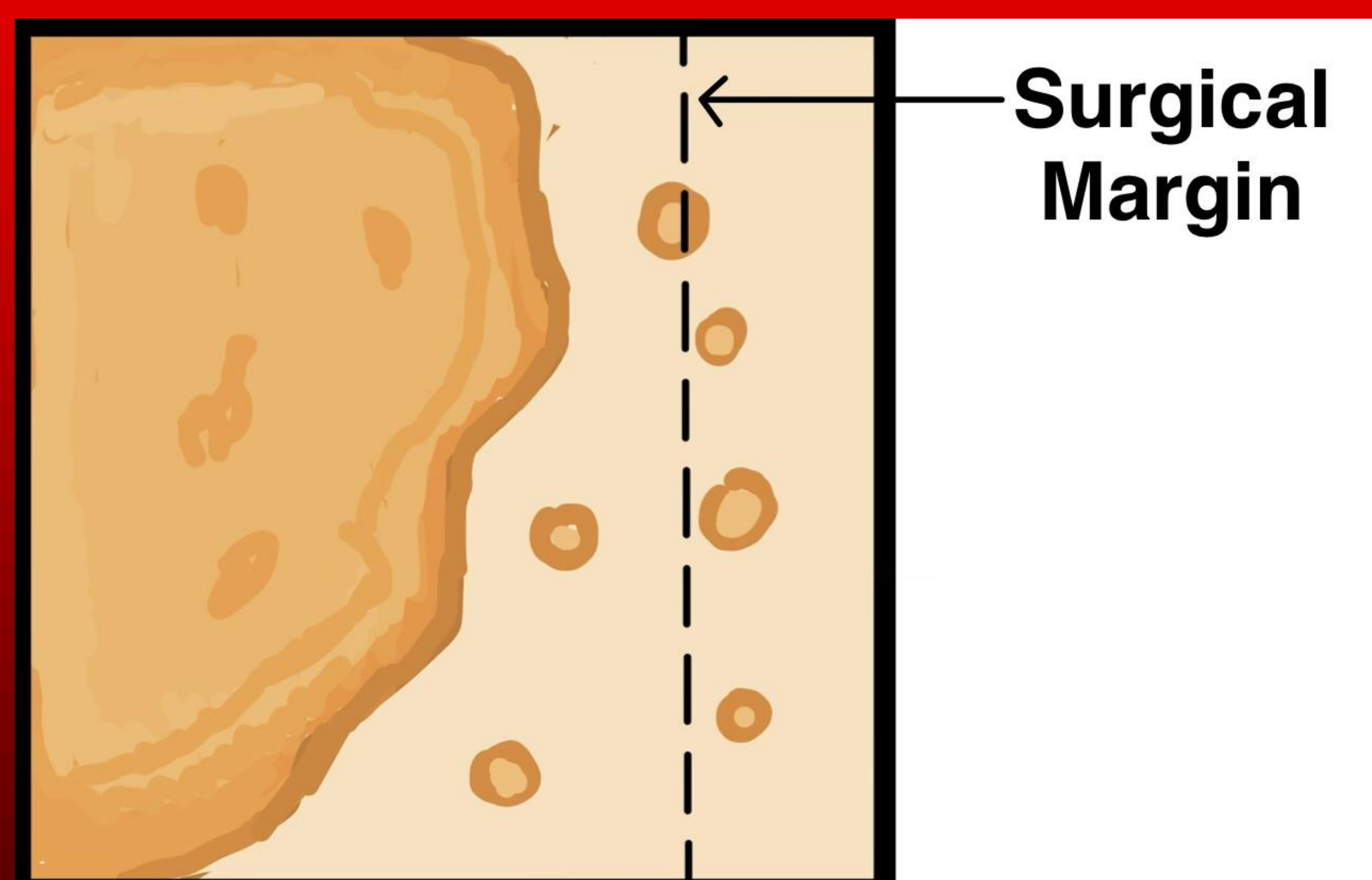


Figure 2. Magnified schematic of a tumor with surrounding microscopic cancer cells.

## Results

Variable	Pancreatic Resection Alone (n=71)	Pancreatic Resection with IRE Margin (n=75)	P value
Age, mean (years)	66	61	
Male gender, n (%)	38 (54)	24 (49)	
BMI, mean	26	25	
Stage, n (%):			
<i>I</i> b	35 (49)	13 (17)	<0.01
<i>III</i>	36 (51)	62 (83)	
Tumor location, n (%):			
<i>Head</i>	51 (72)	48 (64)	
<i>Body/Neck</i>	18 (25)	23 (31)	
<i>Tail</i>	7 (10)	2 (3)	
Tumor size (cm), n (%):			
≤ 2	23 (32)	13 (18)	
2.1-2.9	13 (18)	24 (33)	
≥ 3	35 (49)	36 (49)	
Recurrence type, n (%):			
<i>Local only</i>	30 (42)	49 (65)	<0.01
<i>Regional only</i>	3 (10)	13 (27)	0.06
<i>Distant only</i>	0 (0)	6 (12)	0.05
<i>Local + regional</i>	24 (80)	26 (53)	0.2
<i>Local + distant</i>	0 (0)	1 (2)	0.4
<i>Local + distant</i>	3 (10)	3 (6)	0.5
Location of distant progression, n (%):			
<i>Liver</i>	34	29	
<i>Peritoneum</i>	16 (47)	14 (48)	
<i>Lymph node</i>	10 (29)	7 (24)	
<i>Lung</i>	4 (12)	1 (3)	
<i>Bone</i>	4 (12)	6 (21)	
<i>Bone</i>	0 (0)	1 (3)	
Margin status, n (%)	71 (100)	55 (73)	
<i>Positive</i>	14 (20)	15 (27)	0.32
<i>Negative</i>	57 (80)	40 (73)	
Time to local recurrence from diagnosis (mo.), mean	16.5	15.8	0.83
Time to local recurrence from procedure (mo.), mean	10.5	9.4	0.73
Time to any recurrence from diagnosis (mo.), mean	24.9	27.3	0.6
Time to any recurrence from procedure (mo.), mean	17.3	17.4	1
Overall Survival from diagnosis (mo.), mean	27.9	34.2	0.1
Overall Survival from procedure (mo.), mean	20.3	24.4	0.17

Table 1. Patient demographics, tumor characteristics, and outcome measures.

## Results

- Stage III pancreatic cancer was classified in 62 (83%) and 36 (51%) patients in the margin accentuation and resection alone groups, respectively.
- A total of 49 (65%) patients in the margin accentuation group experienced any type of recurrence whereas 30 (42%) patients had recurrence in the resection only group.
- Of the total recurrences, 13 (27%) and 3 (10%) were local-only recurrences in the margin accentuation and resection only groups, respectively.
- Additionally, 26 (53%) and 24 (80%) of the total recurrences were distant-only recurrences in the margin accentuation and resection only groups, respectively.
- There were 15 (27%) and 14 (20%) positive surgical margins in the margin accentuation and resection only groups, respectively.
- The mean time to local recurrence from diagnosis was 15.8 months in the margin accentuation group and 16.5 months in the resection only group.
- The mean time to any recurrence from diagnosis was 27.3 months in the margin accentuation group and 24.9 months in the resection only group.
- The mean overall survival from diagnosis was 34.2 and 27.9 months in the margin accentuation and resection only groups, respectively.

## Conclusions

- Margin accentuation did not show any benefit in the rates of local recurrence, total recurrence, and negative surgical margins in this study. However, there was a lower rate of distant recurrence for the margin accentuation group.
- Despite the discouraging results from the margin status and local recurrence, the margin accentuation group had an overall survival from diagnosis that was 6.3 months (22.6%) longer than the resection only group.
- In addition, the margin accentuation group had significantly more patients with the more advanced stage of pancreatic cancer ( $p < 0.01$ ) than the resection only group.
- The increased overall survival of the margin accentuation group even with a higher percentage of more advanced stage of cancer is a promising finding that will need to be further validated in future studies.

## Acknowledgements

Research was supported by the University of Louisville Cancer Education Program and the R25-CA 134283 grant.