

# Reduced Survival in Pancreatic Cancer Patients with Low Muscle Attenuation Index

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## Background

- Pancreatic cancer related mortality is highly associated with cachexia, a syndrome of severe weight loss and sarcopenia (muscle wasting).
- In other types of cancer, sarcopenia has been associated with low survival and poor surgical outcome.
- Standard abdominal CT-scan imaging can be used for accurate body composition measurements.
- Analysis of the so-called Muscle Attenuation Index (MAI) using CT-scans is a promising tool for measuring muscle quality and -loss.

## Objective

To investigate the association between CT-scan derived body composition measurements and post-surgical outcomes in pancreatic cancer patients.

## Methods

- CT-images of 192 patients from a prospective cohort (2008-2013) were analysed at the L3 level for area of muscle, visceral adipose tissue, subcutaneous adipose tissue, and intermuscular adipose tissue (Figure 1). Muscle area and visceral adipose tissue were corrected for stature to calculate the L3-index.
- The Muscle Attenuation Index was measured as average Hounsfield units (HU) of the total muscle area at the L3 level.
- Sex-specific cut-offs were chosen at the median and at tertiles to assess the effect of the different measurements on post-surgical outcomes.

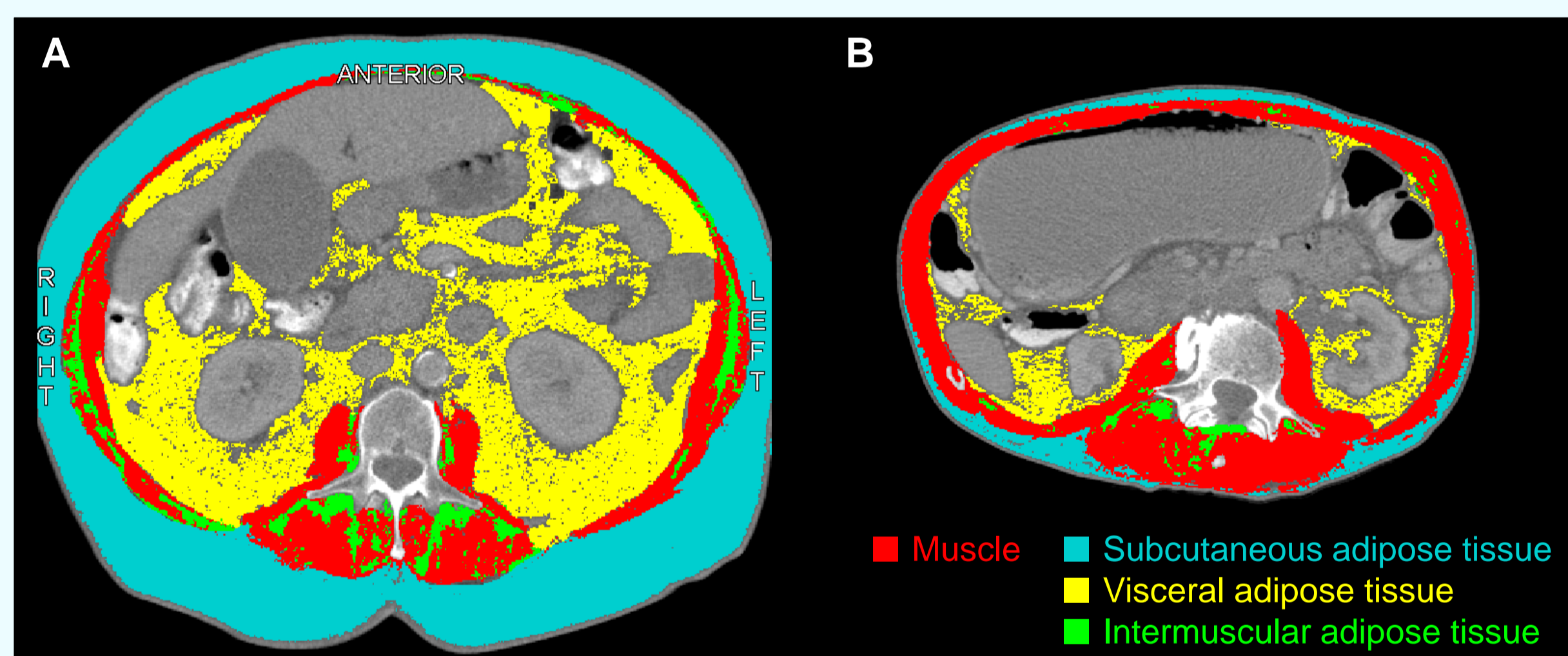


Figure 1: CT analysis at L3 level of an overweight (A) and a lean (B) patient.

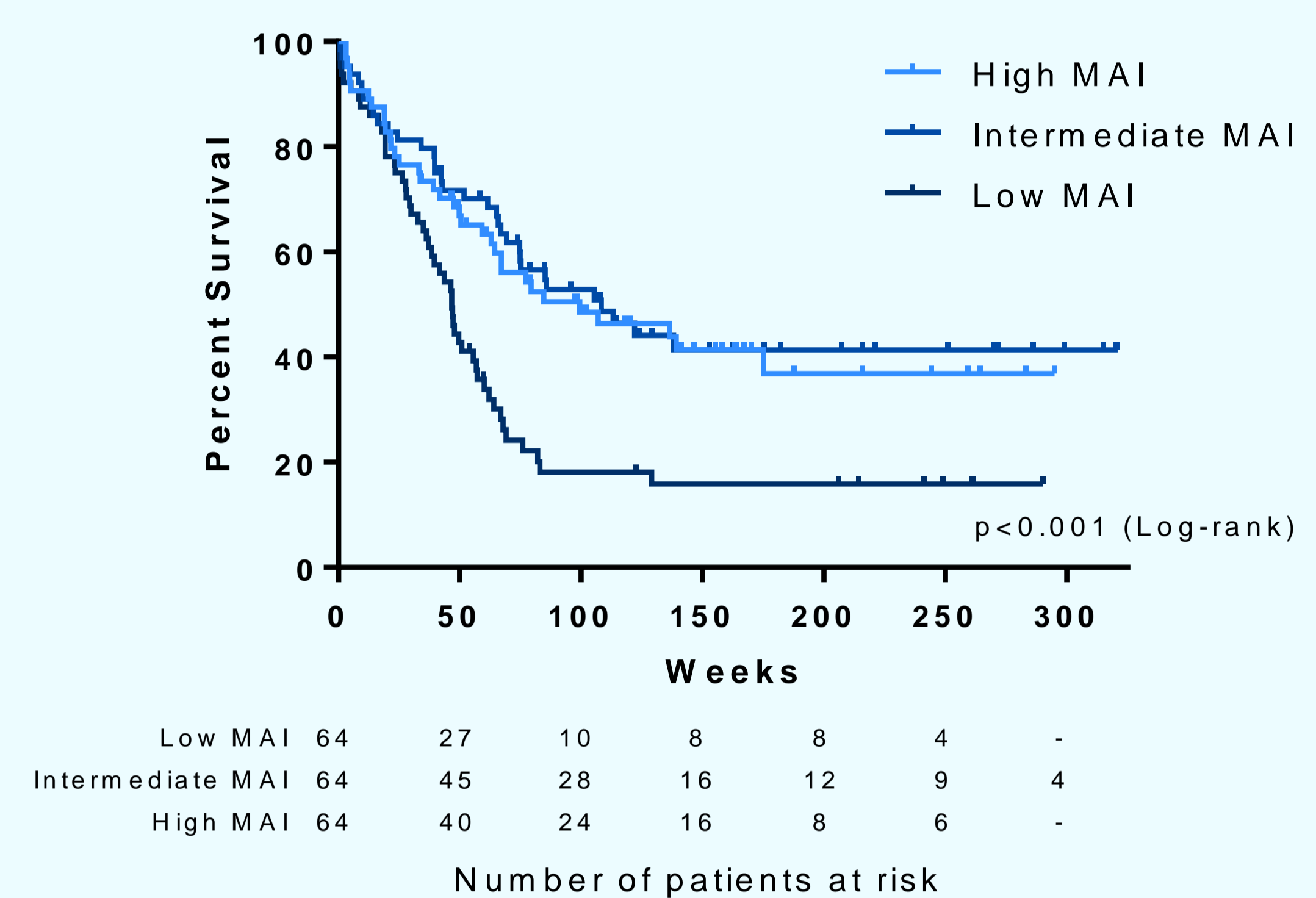
## Results

Patient Characteristics		
	Male (54.7%)	Female (45.3%)
Age (yrs)	66.0 ± 9.5	67.3 ± 9.6
Body mass index (kg/m <sup>2</sup> )	25.3 ± 4.4	25.2 ± 4.8
Type of surgery (n, %)		
Whipple/PPPD*	67 (63.8%)	64 (73.5%)
Double bypass	32 (30.4%)	16 (18.4%)
Total pancreatectomy	1 (1.0%)	0 (0%)
Other	5 (4.8%)	7 (8.1%)
Pathology (n, %)		
Pancreatic carcinoma	38 (36.2%)	45 (51.7%)
Ampullary carcinoma	15 (14.3%)	11 (12.6%)
Cholangiocarcinoma	3 (2.9%)	8 (9.2%)
Duodenal carcinoma	8 (7.6%)	1 (1.1%)
Other	15 (14.3%)	8 (9.2%)
Unknown	26 (24.8%)	14 (16.1%)
L3-muscle index (cm <sup>2</sup> /m <sup>2</sup> )	49.4 ± 7.3	40.0 ± 6.7
L3-visceral adipose tissue index (cm <sup>2</sup> /m <sup>2</sup> )	53.5 ± 30.4	34.7 ± 24.1
Subcutaneous adipose tissue (cm <sup>2</sup> )	143.7 ± 79.2	195.6 ± 95.2
Intermuscular adipose tissue (cm <sup>2</sup> )	14.5 ± 12.7	15.0 ± 11.0
Muscle Attenuation Index (HU)	36.8 ± 7.3	33.9 ± 9.8

\*Pylorus-Preserving Pancreaticoduodenectomy

## Survival

### Survival related to Muscle Attenuation Index (MAI)



## Post-Operative Outcomes

### Major Postoperative Complication\*

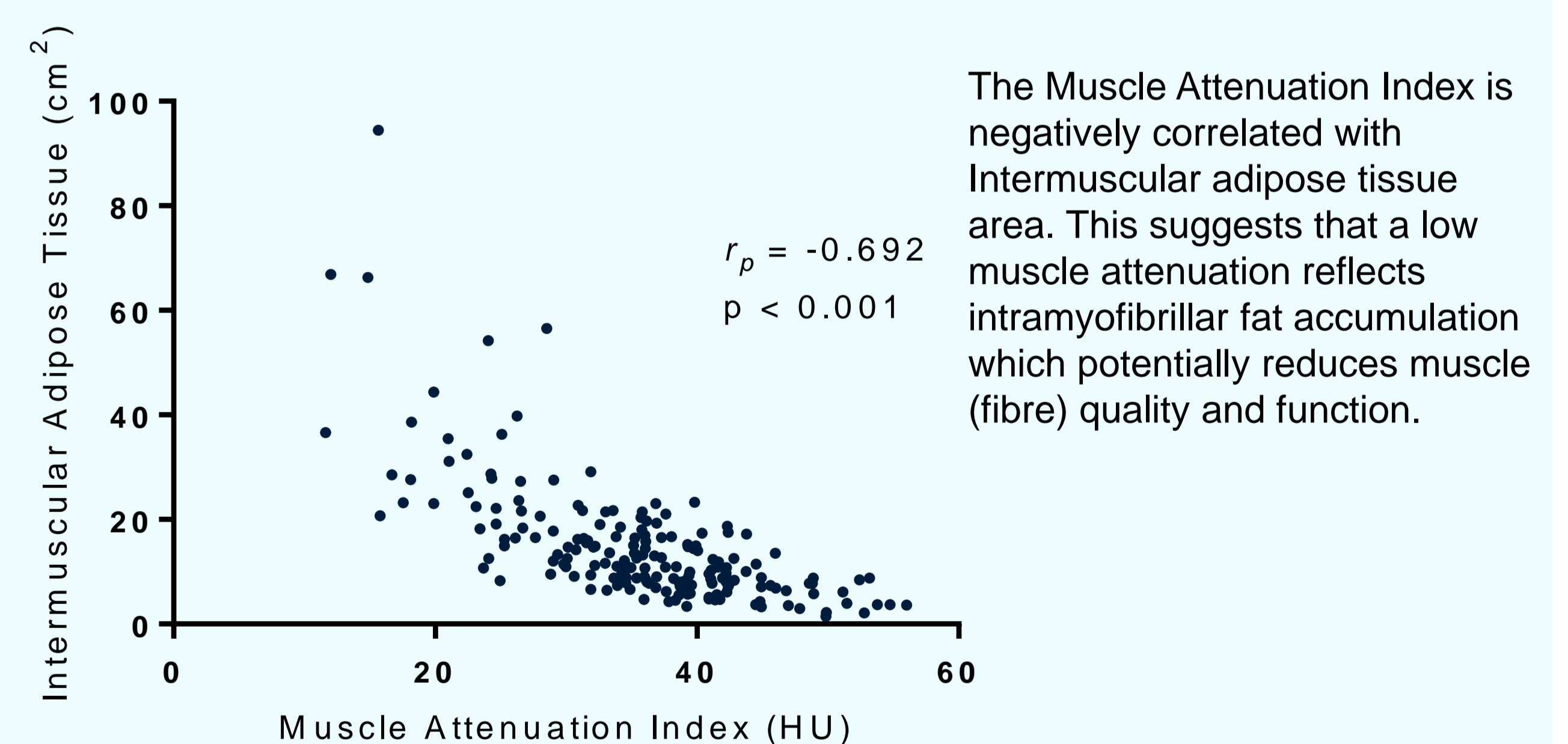
	Odds ratio <sup>†</sup>	95% CI	p-value
Muscle Attenuation Index (continuous)	0.95	0.91-0.99	0.017
Muscle Attenuation Index (lower half)	2.83	1.44-5.58	0.003
Muscle Attenuation Index (lower tertile)	2.33	1.13-4.78	0.021

### Pancreatic Fistula

	Odds ratio <sup>†</sup>	95% CI	p-value
Visceral adipose tissue index (continuous)	1.02	1.01-1.04	0.008
Visceral adipose tissue index (higher half)	3.02	1.22-7.47	0.017
Visceral adipose tissue index (higher tertile)	2.68	1.12-6.44	0.028

\*Intra-abdominal abscess, sepsis, gastrojejunostomy leakage, post-pancreaticoduodenectomy hemorrhage, bile leakage, pancreatic fistula, delayed gastric emptying, and operative mortality.  
<sup>†</sup>Multiple logistic regression corrected for sex, age, type of surgery, and tumour type. Only significant results are shown.

## Intramyofibrillar Fat Accumulation?



## Conclusion

- A low Muscle Attenuation Index is associated with poor survival and increased postoperative complications in pancreatic cancer patients undergoing surgery.
- Elevated visceral adipose tissue is associated with an increased risk of developing a postoperative pancreatic fistula.
- Reduction in Muscle Attenuation Index might reflect intramyofibrillar fat accumulation.
- Preoperative CT-scans contain valuable information on patient body composition that can greatly improve preoperative risk assessment.