

# Plan Quality of Patients Receiving Pancreatic SBRT with Volumetric Modulated Arc Therapy

Rojymon Jacob, MD  
Department of Radiation Oncology  
University of Alabama at Birmingham, AL, USA

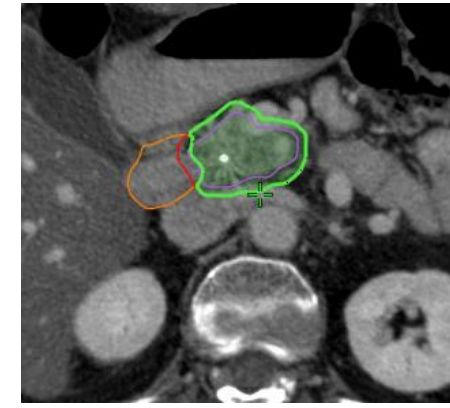
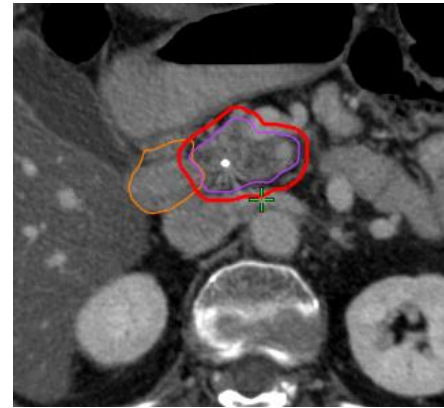
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# Background

- Dose escalation via. conventional IMRT or SBRT is increasingly utilized in locally advanced pancreatic cancer
- SBRT is used following FOLFIRINOX or Gem-NabPaclitaxel chemotherapy
- Emerging data show
  - Improved R0 resection rates in locally advanced tumors
  - Reduced local failure rates in both operable and inoperable tumors
  - Promising results with pre-op treatment (studies under way)
- There is significant variability among institutions utilizing pancreatic SBRT
  - Treatment planning, prescription, and normalization of RT dose.
  - Consistent reporting of prescription practices & meaningful correlation with outcomes is therefore not possible

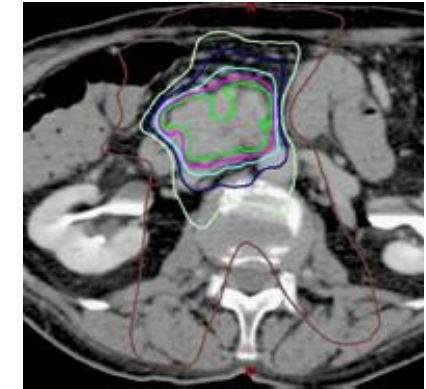
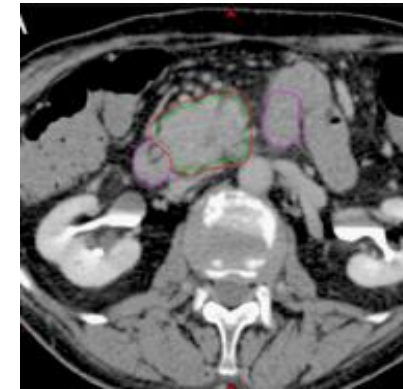
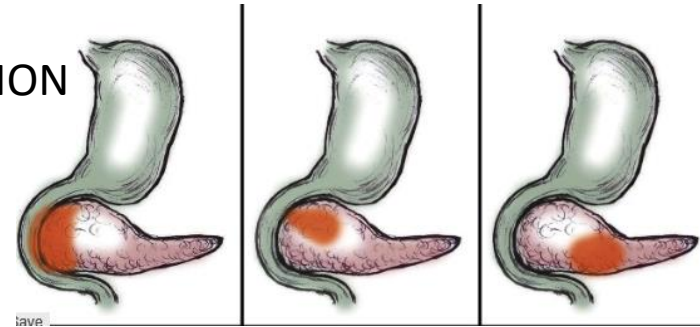
# Strategies to avoid GI toxicities

A MODIFY PTV to EXCLUDE duodenum or stomach



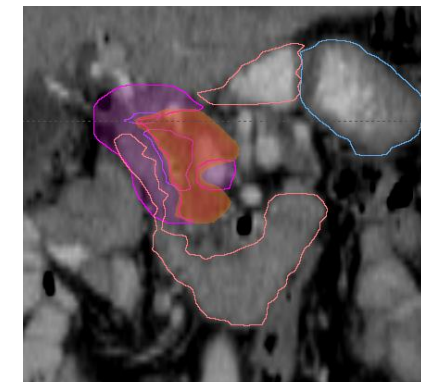
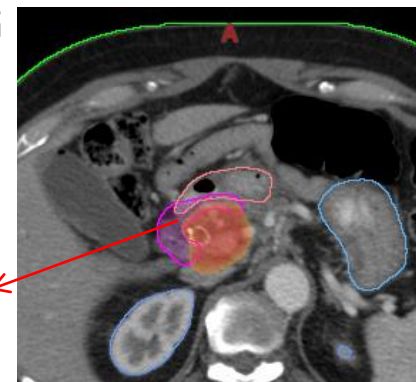
B SELECT PRESCRIPTION ISODOSE LINE to meet GI dose constraints

C VARIABLE DOSE PRESCRIPTION



D Create DOSE-AVOIDANCE structure and perform DOSE-PAINTING

Dose painted PTV



## Purpose

Report treatment planning and delivery characteristics of pancreatic SBRT at our institution.

Prescription doses, GTV and PTV coverage

GTV and PTV mean doses, Conformality Index

Use of dose-painted technique and OAR exposure

Neoadjuvant chemotherapy

No mets

→ **SBRT**

No mets

→ **Surgical evaluation**

## Results

- 29 patients (19 unresectable; 10 borderline) [13 treated on protocol]
- Dose Prescription: 33 -40 Gy in 5 fractions (no violation of OAR tolerance)
- Delivered using 2-arc VMAT on VarianTrueBeam STx or Edge

Dose-painted IMRT (with dpPTV) was used in 28/29 patients.

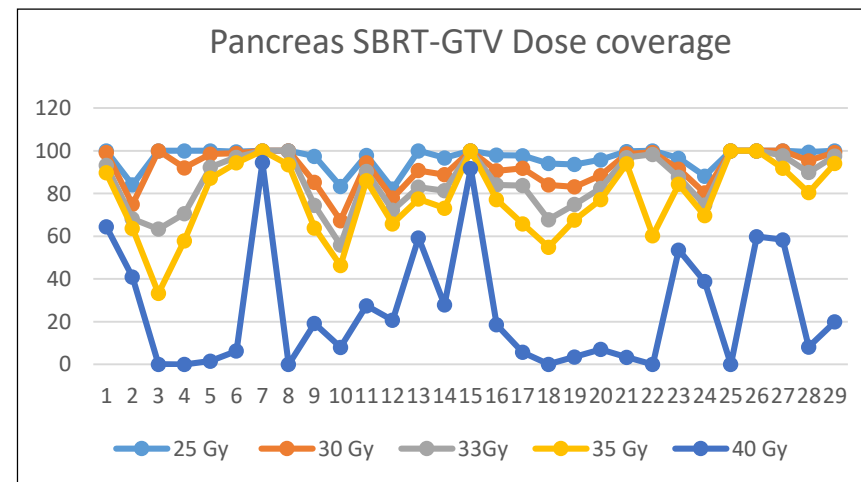
Average treatment fraction time was 19m:14s (15:04 -24:38)

Average total treatment time was 1:33:24.

## GTV Coverage

Mean coverage was 82.9% of prescription (63.8 – 100%) for protocol and 88.6% (67.8 – 100%) for off protocol pts ( $p = 0.122$ ).

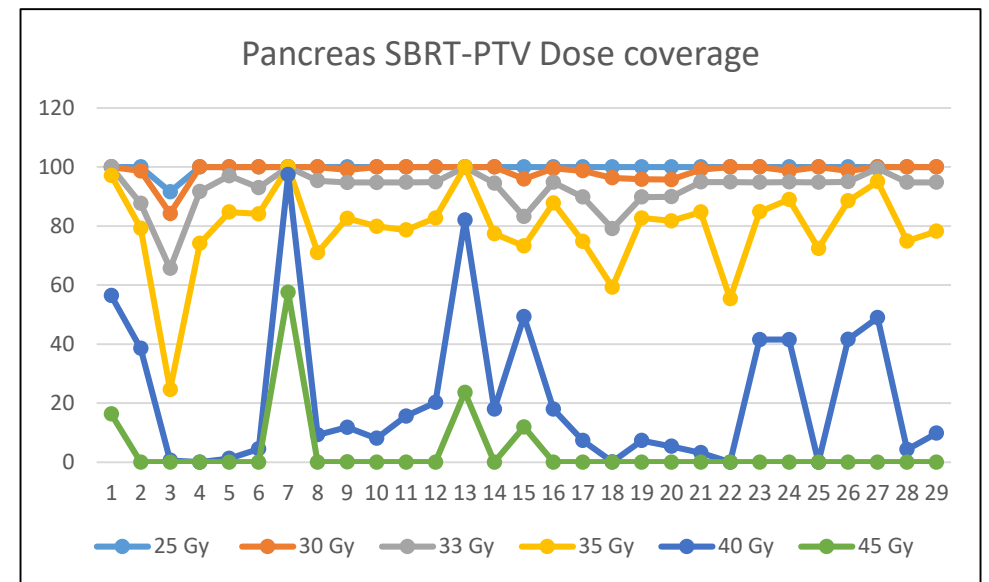
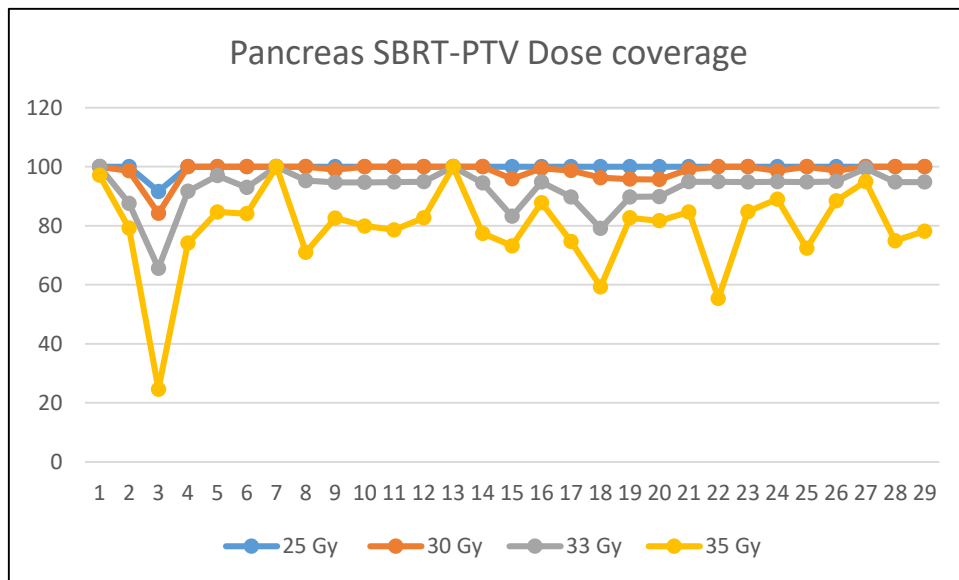
100% coverage of GTV by prescription isodose was achieved only in 6 patients (3 each on and off protocol).



## PTV Coverage

Mean PTV coverage 92.6% of prescription (65.6 – 100%) [off-protocol]  
92.9% (79.1 – 99.5%) [on-protocol (p = 0.465)].

Paddick CI for PTV was 0.84 and 0.85 off and on protocol (p = 0.338).



## Conclusions

- No significant differences in measured Plan quality and delivery parameters among pancreas SBRT patients treated on-protocol vs. off-protocol.
- There were considerable variations in dose coverage of GTV and PTV by prescription isodose due to use of dpPTV for sparing critical OAR.
- Highlights the need for
  - Uniform isodose coverage requirements to optimize individual treatment plans and for inter-institutional comparisons of outcomes.
  - Reporting of plan quality and prescription coverage will become increasingly important in dose-escalated pancreatic SBRT.



## Future directions

1) Report  $D_{100\%}$ ,  $D_{95\%}$ ,  $D_{50\%}$  for GTV and PTV

2) Need to individualize plans based on key questions:

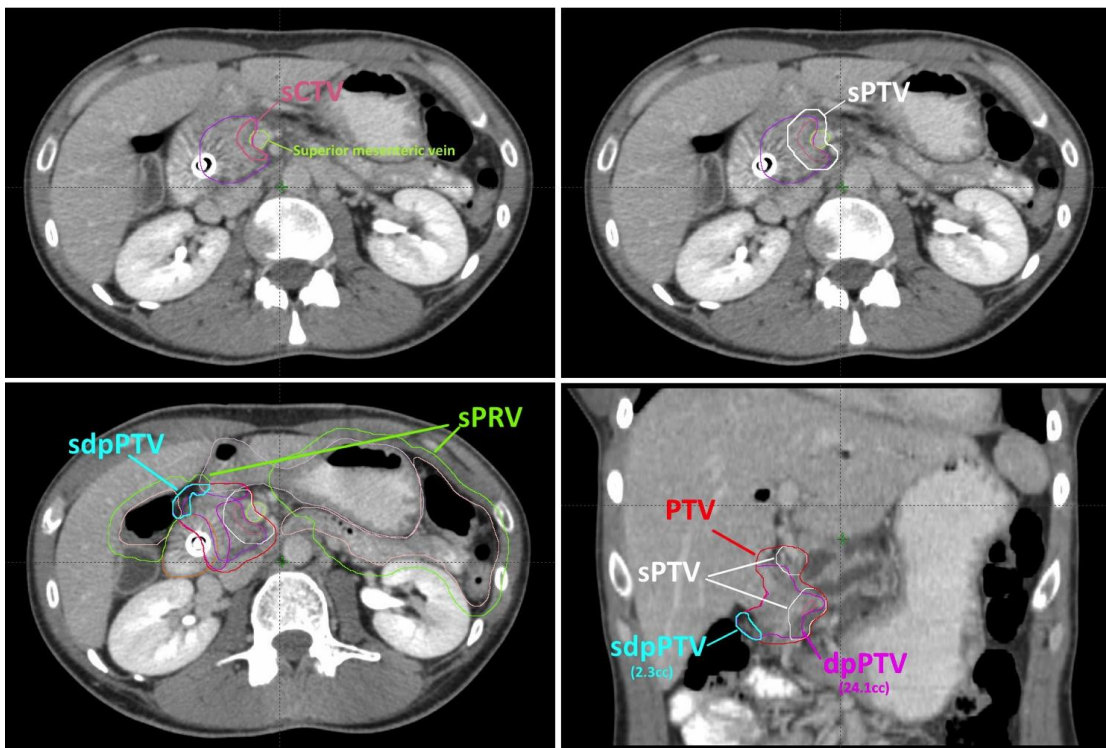
- GTV /PTV Coverage: Can parts of GTV/PTV not be treated to full dose?
- Dose escalation: Should portions of GTV/ PTV be dose-escalated?
- Should dose to all OAR dose constraints be met? / Can dose to certain OAR be safely exceeded?

i) Increase likelihood of R0 resection

ii) Increase confidence for surgeons to resect around blood vessels

iii) Increase local control in patients who do not undergo surgical resection

	OPERABLE	BORDERLINE	UNRESECTABLE
GTV	Aim to cover with prescription isodose-line	Aim to cover with prescription isodose-line	
PTV	Aim to cover with prescription isodose-line	Aim to cover with prescription isodose-line	
Tumor-vasculature interface	Not applicable	Dose escalate	Dose escalate
OAR-1 (resected) Eg: Duodenum	Cover with prescription isodose-line	Meet OAR constraint	Meet OAR constraint
OAR-2 (not resected) Eg: Stomach, small bowel	Meet OAR constraint	Meet OAR constraint	Meet OAR constraint



**GTV:** Gross tumor volume  
**sCTV:** surgical CTV  
**sPTV:** surgical PTV  
**PRV:** Planning OAR volume  
**dpPTV:** dose painted PTV  
**sPRV:** surgical planning OAR volume  
**sdPPTV:** surgical dpPTV

Use of sdPPTV instead of standard dpPTV reduces the dose de-escalated volume from 24.1cc to 2.3cc.

Clinical Plan

Clinical Plan w/ surgical planning volumes

Dose escalated plan w/ surgical planning volumes

33Gy

40Gy

50Gy

