Comparison of Physician vs. AutoContour Drawn LAD Contours: A Geometric and Dosimetric Analysis in Left Sided Breast Cancer Patients

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Introduction

The use of artificial intelligence and automation tools are becoming an integrated part of the radiation oncology field. For dosimetrists, autocontouring tools, such as AutoContour (AC) from RadFormation (RF), are being readily used in clinics across the country. In addition, the field of radiation oncology is looking into more specific, often intricate, organs at risk (OARs) testing the limits of these tools. In left sided breast cancer patients, the Left Anterior Descending Artery (LAD) is one of these intricate OARs that can be delineated by autocontouring tools. With the growing use and convenience of these autocontouring tools, coupled with a movement to investigate dose to the LAD, a closer look into the accuracy and reliability of these tools is warranted.

Methodology

20 left sided breast cancer patients treated to 4256cGy in 16 fractions were randomly selected from the last year (Mar. 2024 – Mar. 2025) allowing the latest version of RF's AutoContour (Version 2.5.6) to be investigated. Each patient had the LAD contoured by a board-certified physician, as well as, by RF's AutoContour. These contours were geometrically analyzed using R and R studio across several metrics including a total volume (cc) comparison, 3D overlay, and dice similarity coefficient (DSC).
Next, the pair of contours were analyzed dosimetrically, comparing both the max and mean doses received to each LAD contour pair.

Results

On average, the physician drawn volumes were 1.43 cc's (~35%) larger than AC's LAD volumes. The most common discrepancies occurred in the proximal portion of the LAD as it initially branches off the left main coronary artery, as well as the distal portion of the LAD as it extends into the apex of the heart. The mean dice coefficient between the contour pairs was 0.535, indicating just over half of each autocontoured LAD overlapped with the physician drawn LAD.

	PhysicianVolumes	AutoContourVolumes	OverlapVolumes	Dice_Coefficient
1	5.3	4.8	4.30	0.8514851
2	5.9	5.5	4.90	0.8596491
3	6.0	4.7	4.40	0.8224299
4	6.0	4.1	1.00	0.1980198
5	4.7	3.7	3.50	0.8333333
6	3.2	2.9	2.70	0.8852459
7	6.4	2.2	1.30	0.3023256
8	4.3	4.0	3.60	0.8674699
9	6.2	4.9	4.60	0.8288288
10	3.5	3.9	1.40	0.3783784
11	4.1	3.5	0.50	0.1315789
12	5.7	3.9	2.20	0.4583333
13	7.4	3.0	1.75	0.3365385
14	6.3	4.6	2.80	0.5137615
15	6.1	4.8	1.80	0.3302752
16	4.9	4.4	1.70	0.3655914
17	6.2	3.8	2.10	0.4200000
18	5.3	2.6	1.40	0.3544304
19	6.8	4.8	2.80	0.4827586
20	5.2	4.8	2.40	0.4800000

Table 1: The volume of the physician drawn LAD, AutoContour drawn LAD, their overlap volumes, and corresponding dice similarity coefficient.

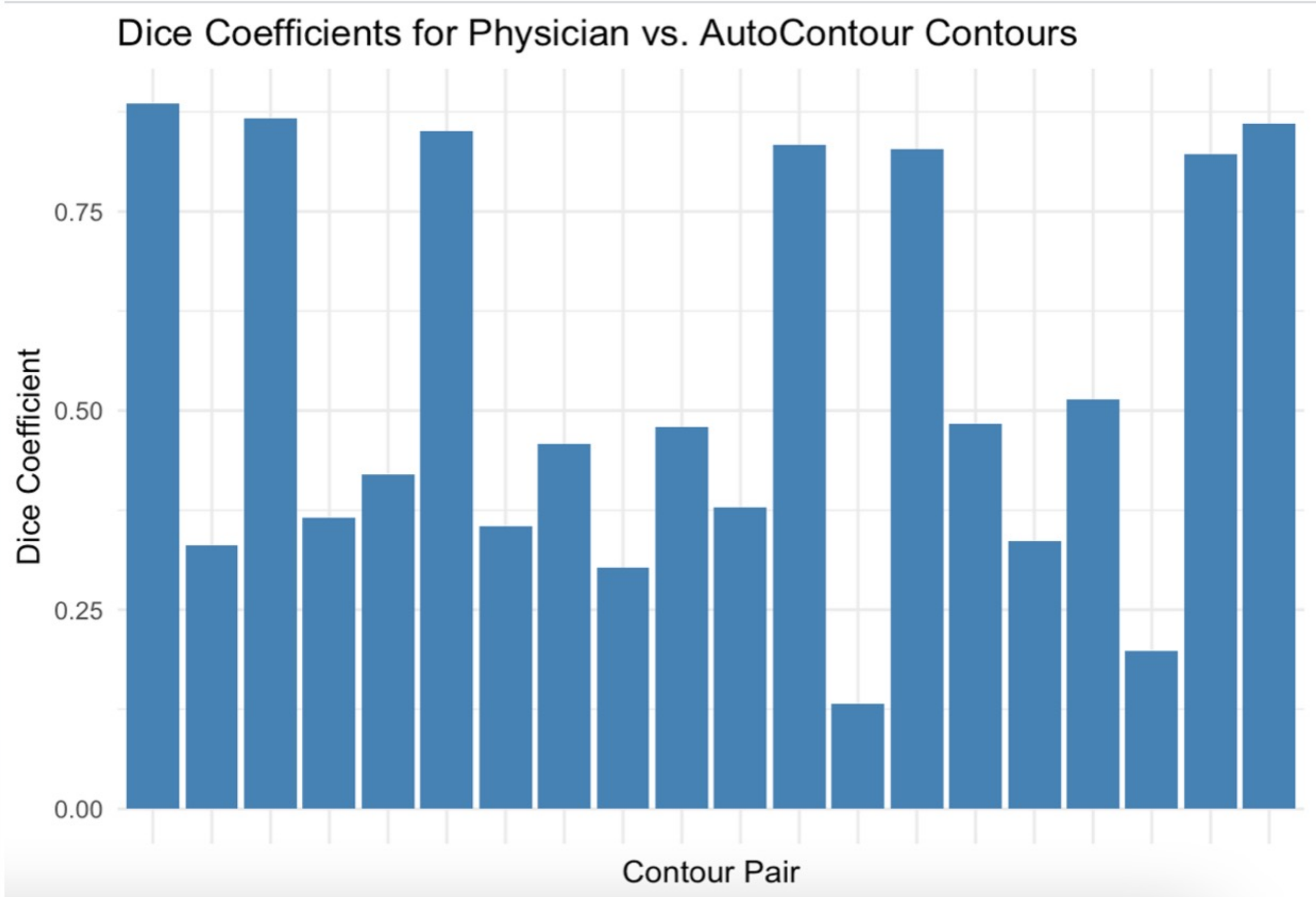

Figure 1: Dice coefficents for the physician drawn and AutoContour drawn LAD volumes for each of the 20 cases. The Dice coefficients for the LAD contour volumes ranged from 0.132 to 0.885, with 7 out of 20 cases showing good agreement (DSC ≥ 0.7), but 12 out of 20 cases showing poor agreement (DSC < 0.5).

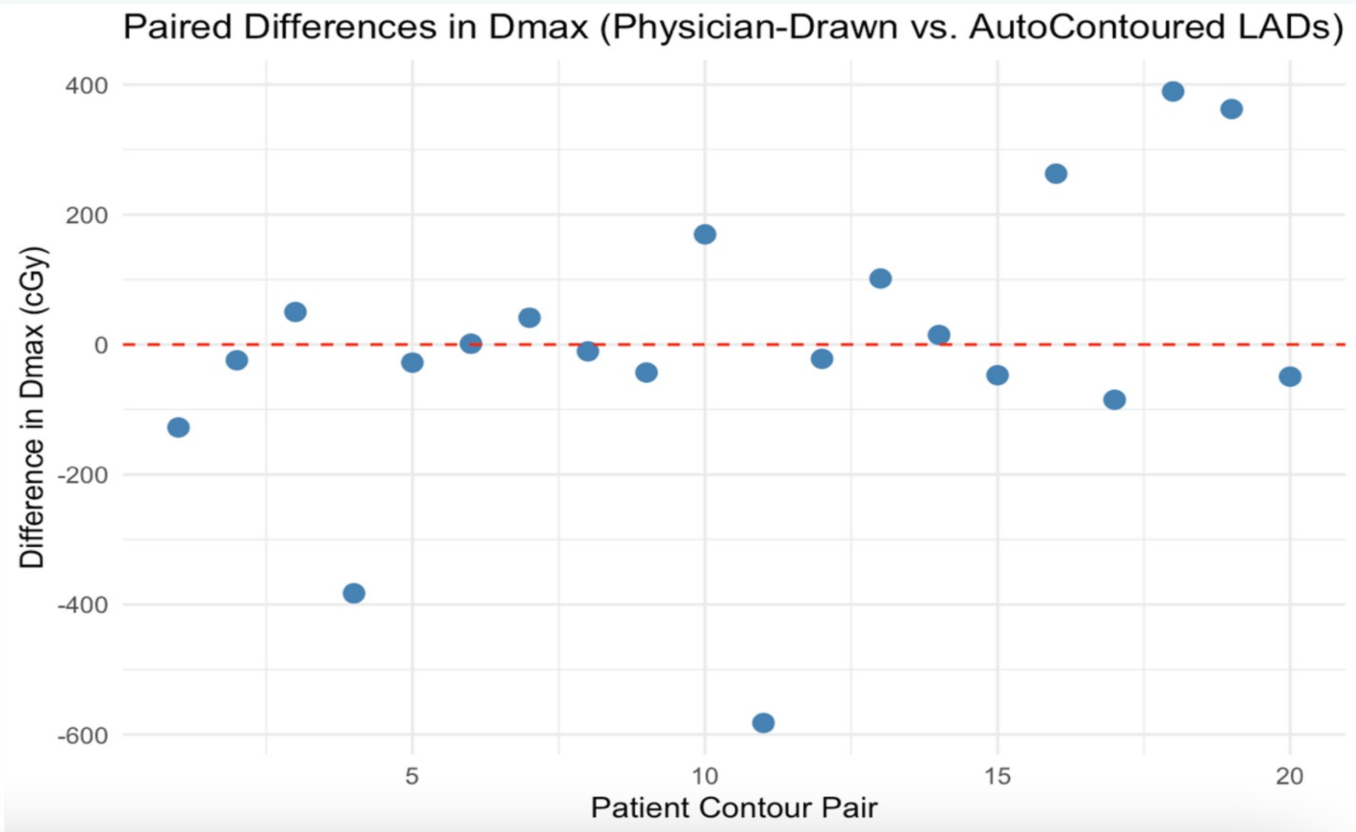

Figure 2: Differences in max dose between each physician and AutoContour drawn pair of LAD volumes.

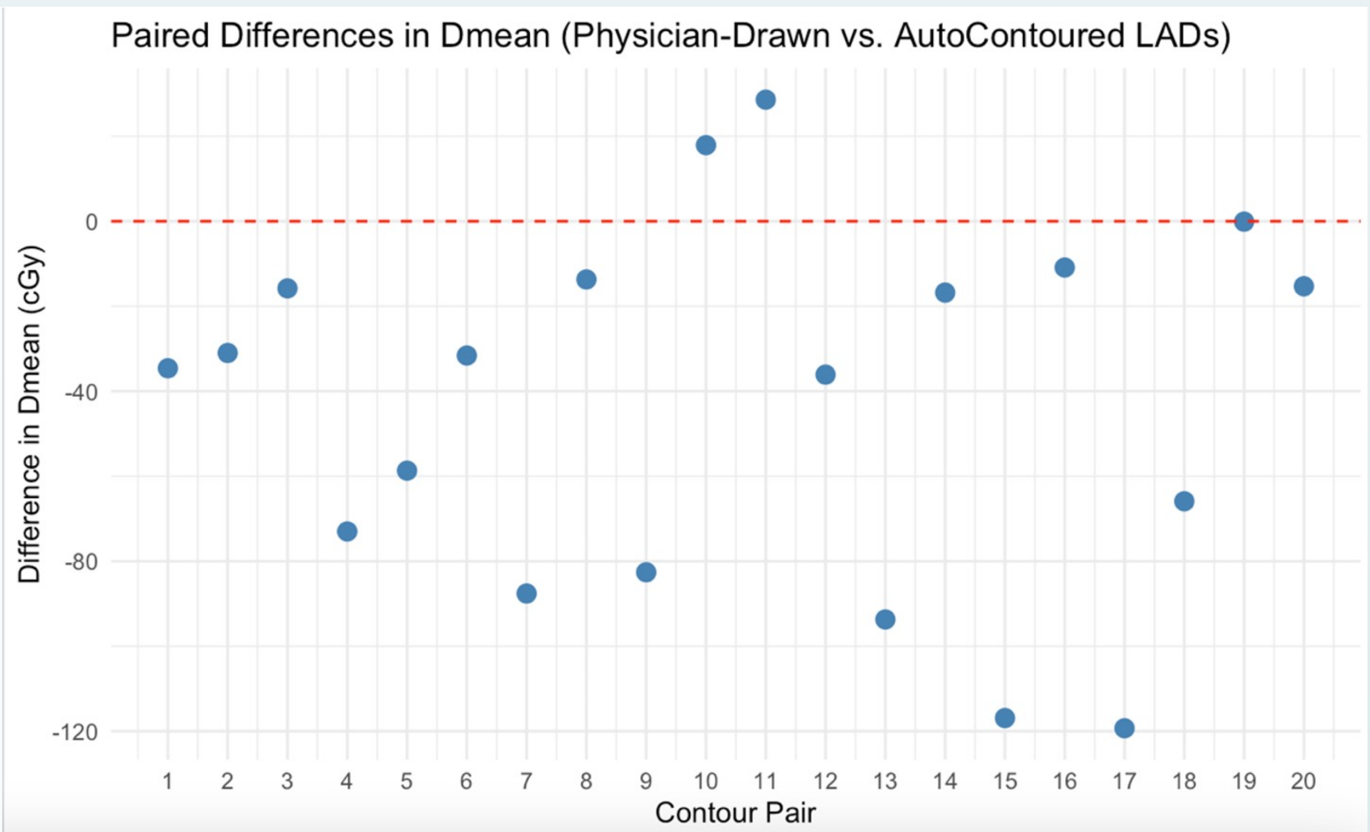

Figure 3: Differences in mean dose between each physician and AutoContour drawn pair of LAD volumes.

No statistical difference was found between contour pairs (p value > 0.05) regarding max dose, however, individual cases varied. For example, 5 out of 20 cases had a difference > 250cGy, with the largest being 582.3cGy. There was a statistically significant (p value < 0.05) difference of 42.855cGy when comparing mean doses between the LADs.

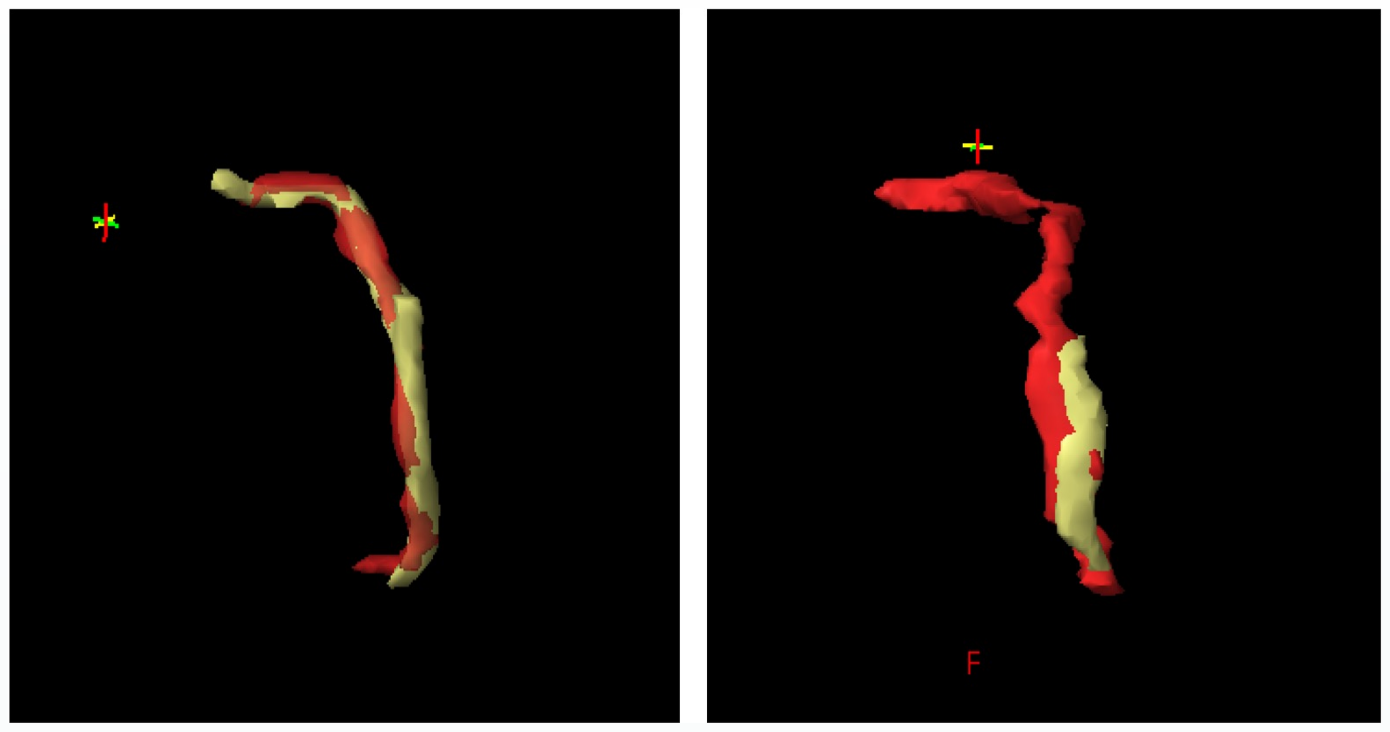

Image 1: Side by side images of two different 3D visual overlays. The image on the left shows good congruency between the physician (red) and AutoContour (yellow) drawn LAD volume, while the image on the right shows a poor congruency.

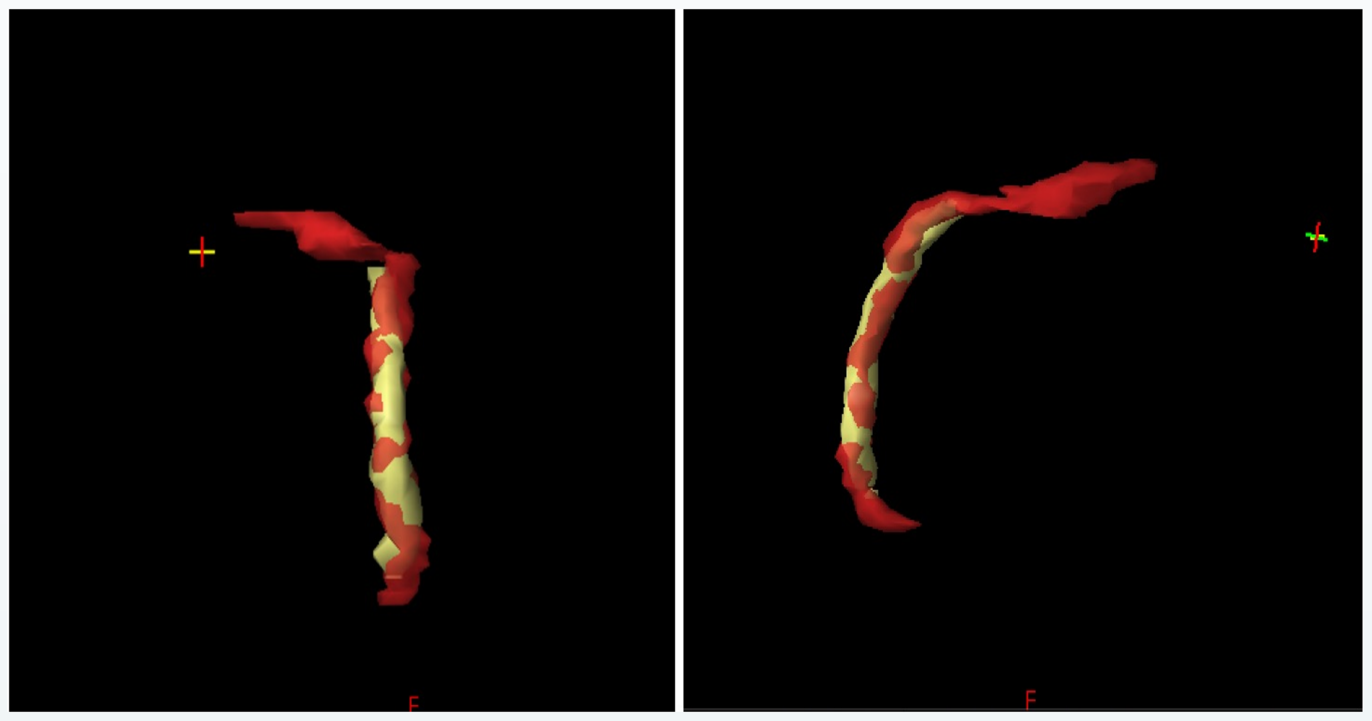

Image 2: A coronal and sagittal view of the LAD highlighting the proximal and distal ends of the LAD having the least overlap between physician and AutoContour drawn LADs.

Conclusion

Autocontouring tools, such as AutoContour by RadFormation, are valuable tools that can aid the field of dosimetry, however, in the context of the LAD, thorough physician/dosimetrist review is necessary. AutoContour underdraws' the LAD in the proximal and distal ends of the vessel and overall does not produce a comparable contour to that of a physician. Relying on autocontoured LAD volumes can lead to significant false max dose reports on an individual case level and routinely leads to an overestimation of the mean dose to the LAD. Continuing and individual review of the LAD contour is warranted given the variability in similarity between physician drawn and autocontoured LADs and the subsequent dosimetric differences.

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