Left Anterior Descending Coronary Artery (LAD) Doses from Breast Radiotherapy: is Prone Treatment Beneficial?

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Introduction: Breast radiotherapy increases risks of late cardiovascular mortality/morbidity. LAD irradiation is implicated in pathogenesis, but the effects of prone positioning on its dosimetry are unknown. We compared LAD and heart doses from whole (WBI) and partial (PBI) breast radiotherapy planned prone and supine.

Methods: Thirty-nine (14 left-breast-affected) patients had titanium clips placed in excision cavity walls at breast-conservation surgery. Each underwent standard supine CT scanning before repositioning and re-imaging prone on an in-house platform with an aperture through which index breast falls. Partial-breast (PB) CTV was defined as tumour bed (clips/architectural distortion) plus 15 mm margin. WBClinical target volume (CTV) was defined using radio-opaque wire marking clinically palpable breast tissue. Heart and LAD were outlined. Conventional tangential-field PBI and WBI plans and dose volume histograms were produced for each position (total: 156 plans). Mean heart/LAD, and maximum LAD doses were compared.

Results: In left-breast-affected patients, mean (SD) LADmean doses were 11.5 (8.4) Gy (supineWB), 12.1 (7.4) Gy (proneWB), 1.7 (1.6) Gy (supinePB), and 3.2 (3.0) Gy (pronePB). Mean (SD) LADmax doses were 47.5 (5.7) Gy (supineWB), 47.4 (3.7) Gy (proneWB), 22.8 (19.3) Gy (supinePB) and 32.1 (17.1) Gy (pronePB). Prone positioning improved heart and LAD doses in 6/14 WBI (mean improvement in LADmean ¼ 12.0 Gy) and 3/14 PBI cases (mean improvement in LADmax ¼ 25.3 Gy), but worsened doses in 7/14 WBI (mean increase in LADmean¼ 9.8 Gy) and 8/14 PBI (mean increase in LADmax¼ 24.7 Gy) cases. Breast volume O1000 cm³ correlated with a benefit of prone treatment (P ¼ 0.02). Heart and LAD parameters agreed on the best plan in 24/28 instances. PBI reduced heart and LAD doses in 100% of patients compared to WBI.

Conclusions: LAD doses from WBI are significant. Prone positioning is likely to improve heart and LAD dosimetry in women with breast volumes O1000 cm³ (RE cup), but to increase heart/LAD doses in women with breast volumes .1000 cm³. PBI universally improves cardiac dosimetry compared to WBI and all eligible women should be offered participation in PBI trials where available.