Purpose: compare two optimization methods using brachyvision and compare the dosimetry between multimen-lumen and single-lumen catheters used for partial breast brachytherapy.

Methods: Single-lumen catheter is the Mammosite device. Two multi-lumen devices are used: contura 5-lumen and Hologic 4-lumen devices. The planning system is Brachyvision. PTV is constructed by expanding the balloon by 1cm, and shaping the volume to exclude the pectoralis muscle and leave a 0.5cm margin from the skin. PTV_EVAL is defined as PTV subtracts the balloon. We also define two critical-organ ROIs: skin region and chest region, where skin region is the skin side to PTV excluding PTV and the chest region is the chest side to PTV excluding PTV. One optimization method is to achieve uniform 3.4 Gy/fx on the PTV surface, and the other method is an inverse optimization method to achieve at least 95% of PTV receive dose higher than 3.4 Gy/fx and less than 10% of PTV receive more than 5Gy/fx with upper bound to skin region and chest region. Patients are grouped into 4 categories: (a) Skin and chest wall are within 1cm from the balloon; (b) only skin (c) only chest wall is within 1cm from the balloon and (d) both skin and chest wall are within 1cm from the balloon.

Results: For category (a) patients, both optimization methods give similar satisfactory results: 98% and 99% of PTV_EVAL receive 3.4 Gy/fx for single-lumen and multi-lumen catheters, respectively; while the skin dose are less than 3.4Gy/fx. For patients in categories (b) and (d), the inverse optimization method and multi-lumen catheter gives significant lower skin dose.

Conclusions: single-lumen, multi-lumen device provide similarly satisfactory result for patients with skin and chest at least 1cm from the balloon; for other patients, the inverse optimization method and multi-lumen catheter device give significantly less skin dose.