Calculation of Breast Volumes from Mammogram: Comparison of Four Separate Equations Relative to Mastectomy Specimen Volumes

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Introduction

- Cosmetic outcomes and patient satisfaction after partial mastectomy are influenced, in part, by breast size and amount of breast tissue removed.2
- Assessing the patient’s breast volume relative to the volume of breast tissue to be removed could help objectively determine optimal candidates for breast conservation based on size criteria.

Purpose

- We hypothesize that breast volumes can be estimated reliably from standard preoperative imaging.

Methods

- Data was queried from an IRB approved, prospectively maintained database regarding patients who underwent mastectomy with or without a contralateral prophylactic mastectomy for breast cancer from 2005 to 2015 and whose preoperative imaging data and mastectomy weights were available. (Table 1)
- Cranio-caudal (CC) and Mediastinal Oblique (MLO) views were reviewed and height (H), width (W), radius (R), and compression thickness (C) of each breast were obtained. (Figure 1)
- These parameters were used to calculate a breast volume (BV) using 4 previously obtained. (H = 0.8, (BV) = 1/3πR^2H
- Specimen volumes were calculated using specimen weights (mass) and breast densities (ρ) using the equation volume = mass / density.
- Individual breast densities were obtained using BI-RADS density values.
- Using Pearson R correlation, calculated breast volumes were compared to mastectomy specimen volumes (Table 2), and subgroup analysis was performed by BI-RADS density category and type of mastectomy (Table 3).

Results

- A total of 146 patients, ages 19-82 (median age of 58) were identified who underwent mastectomy with or without a contralateral prophylactic mastectomy for breast cancer from 2005 to 2015, (Table 1)
- Complete mammographic measurements were available for 65 breasts from 45 patients and mammographic BI-RADS density scores were available for 62 patients. (Table 1)
- Among the entire cohort, Equation 4 (BV = 1/3πR^2Hmlo) most closely correlated with breast specimen volumes (R = 0.89, p < 0.0001). (Table 2)
- Equation 1 (BV = 1/3πR^2Hmlo) most closely correlated within the subgroup of prophylactic simple mastectomies (R = 0.91, p < 0.0001). (Table 1)
- On subgroup analysis, Equation 1 (BV = 1/3πR^2Hmlo) best correlated to specimen volumes for BI-RADS A density (R = 0.79, p < 0.0001) while Equation 4 (BV = 1/3πR^2Hmlo) most closely correlated to specimen volumes for BI-RADS B density (R = 0.91, p < 0.0001) and BI-RADS C density (R = 0.90, p < 0.0001) as well as for the non-skin sparing mastectomy specimens (R = 0.90 p < 0.0001). (Table 3)
- Equation 3 (BV = 1/4πRcmloWcmmlo) showed the highest correlation within the subgroup of skin sparing mastectomies (r = 0.92, p < 0.0001). (Table 3)

Conclusions

- Breast volumes can be estimated utilizing 2 or 3 measurements from a routine preoperative mammogram.
- Calculations made using Equations 1 and 4 appear to have the best correlation when compared to the actual breast volumes.
- This study includes a large series of simple mastectomies and utilizes individualized breast densities to approximate the reference specimen weight to breast volume.

References