

Individualized Risk of Surgical Complications: An Application of the Breast Reconstruction Risk Assessment (BRA) Score

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Background: Discussion of risk is a central tenet of the dialogue between surgeon and patient. Being able to individualize and quantify risk has been hampered by the lack of robust, multi-institutional databases from which to create appropriate statistical models. In an effort to integrate evidence-based practice into the discussion of patient risk and better manage patient expectations, risk calculators have been recently developed from large multi-institutional databases. Focusing on the comprehensive TOPS database, we endeavored to construct a breast reconstruction risk calculator for plastic surgical outcomes.

Methods: The Tracking Operations and Outcomes for Plastic Surgeons (TOPS) database from 2008-2011 was queried for patients undergoing breast reconstruction. Demographic variables were noted and binary regression models constructed for the following complications: seroma, dehiscence, surgical site infection (SSI), explantation, flap failure, reoperation, and overall complications. Model performance was assessed via Hosmer-Lemeshow (H-L) p-value, c-statistic, and Brier score.

Results: Of 11,992 cases, 5,180 met inclusion criteria. Overall complication rates were 16.5%, with rates of 3.9% for seroma, 4.2% for SSI, 5.8% for dehiscence, 3.8% for explantation, 6.8% for flap failure, and 6.3% for reoperation. Individualized risk models were then developed with acceptable goodness-of-fit, accuracy, and internal validity as demonstrated by H-L statistics, brier scores, and optimism-corrected c-statistics, respectively. Distribution of overall complication risk was broad and asymmetric. This indicates that the majority of patients have a lower risk than the population average indicates, while a subset of patients have a much higher risk. These models were used to create an open-access online version of the risk calculator, available at www.BRAScore.org/TOPS.

Complication	Overall Incidence	Minimum Probability	Maximum Probability
Seroma	3.90%	1.10%	27.97%
SSI	4.20%	1.17%	52.79%
Dehiscence	5.80%	2.17%	45.40%
Flap Failure	6.80%	1.24%	50.57%
Explantation	3.80%	1.14%	52.08%
Reoperation	6.30%	1.82%	24.07%
Overall	16.52%	6.42%	60.39%

Conclusions: Population-based measures of risk may not accurately reflect risk for many individual patients. Statistical models demonstrated a wide distribution of risk around the mean probability of a given complication (Table 1). In this era of increasing emphasis on evidence-based medicine, we have developed a breast reconstruction risk assessment calculator from the robust TOPS database (Figure 1). The BRAScore tool can aid in individualizing--and quantifying--risk to better inform surgical decision-making and better manage patient expectations.

brascor.org/TOPS/risk.html#results

Breast Reconstruction Risk Assessment (BRA) Score

To calculate the estimated risk for postoperative complications in a patient who underwent mastectomy with immediate tissue expander or autologous reconstruction, complete the following worksheet.

Models Abstracted from Participant Use Files of the Tracking Operations and Outcomes for Plastic Surgeons (TOPS) database.

Height: ☐ in ☐ m
 Weight: ☐ lb ☐ kg
 Age:

Have you smoked within the past 30 days? ☐ Yes ☒ No
 If not, did you smoke in the past? ☐ Yes ☒ No
 Bilateral Reconstruction? ☐ Yes ☒ No
 Have you been diagnosed with diabetes mellitus? ☐ Yes ☒ No

American Society of Anesthesiologists (ASA) Physical Status Classification: [View Details](#)

[Calculate Risk](#)

Estimated Risk of Complication:

Category	Tissue Expander	Pedicle Abdominal (TRAM) Flap	Latissimus Flap	Microvascular Reconstruction
Seroma	2.34%	4.65%	7.93%	3.94%
Dehiscence	3.25%	13.20%	3.73%	6.54%
Surgical Site Infection (Superficial Incisional, Deep Incisional, and Organ Space)	2.92%	3.19%	2.72%	1.57%
Flap Loss (Partial or Total)	n/a	16.31%	4.88%	13.56%
Explantation	2.18%	n/a	n/a	n/a

Level of Evidence: Risk, II

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Ethical Approval: This work is based on the Tracking Operations and Outcomes for Plastic Surgeons (TOPS) program, which provides HIPAA-compliant, deidentified databases to members and candidate members of the American Society of Plastic Surgeons (ASPS).