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

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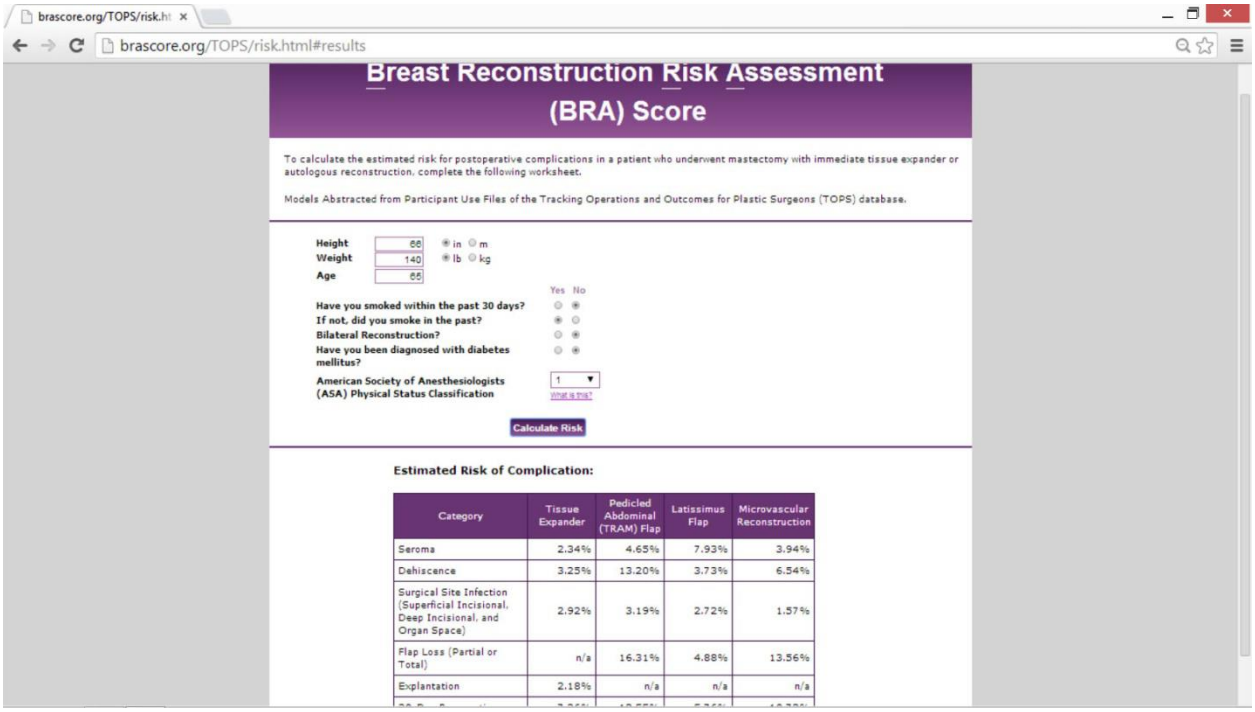
Background: Discussion of risk is a central tenet of the dialogue between surgeon and patient. Being able to individualize and quantify risk has been hampered by the lack of robust, multi-institutional databases from which to create appropriate statistical models. In an effort to integrate evidence-based 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.



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).