A Simplified Cost-Utility Analysis of Inpatient Flap Monitoring after Microsurgical Breast Reconstruction and Implications for Hospital Length of Stay

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Background: The number of free flap take-backs and successful salvages following microsurgical breast reconstruction decreases as time from surgery increases. As a result, the cost of extended inpatient monitoring to achieve a successful flap salvage rises rapidly with each postoperative day. This study introduces a simplified cost-utility model of inpatient flap monitoring and identifies when cost-utility exceeds the thresholds established for other medical treatments.

Methods: A retrospective review of a prospectively maintained database was performed of patients who underwent microsurgical breast reconstruction to identify flap take-back and salvage rates by postoperative day. The number of patients and flaps that needed to be kept on an inpatient basis each day for monitoring to salvage a single failing flap was determined. Quality-of-life measures and incremental cost-effectiveness ratios for inpatient flap monitoring following microsurgical breast reconstruction were calculated and plotted against a $100,000/quality-adjusted life-year threshold.

Results: A total of 1813 patients (2847 flaps) were included. Overall flap take-back and salvage rates were 2.4 percent and 52.3 percent, respectively. Of the flaps taken back, the daily take-back and salvage rates were 56.8 and 60.0 percent (postoperative day 0 to 1), 13.6 and 83.3 percent (postoperative day 2), 11.4 and 40.0 percent (postoperative day 3), 9.1 and 25.0 percent (postoperative day 4), and 9.1 and 0.0 percent (>postoperative day 4), respectively. To salvage a single failing flap each day, the number of flaps that needed to be monitored were 121 (postoperative day 0 to 1), 363 (postoperative day 2), 907 (postoperative day 3), 1813 (postoperative day 4), and innumerable for days beyond postoperative day 4. The incremental cost-effectiveness ratio of inpatient flap monitoring begins to exceed a willingness-to-pay threshold of $100,000/quality-adjusted life-year by postoperative day 2.

Conclusion: The health care cost associated with inpatient flap monitoring following microsurgical breast reconstruction begins to rise rapidly after postoperative day 2. (*Plast. Reconstr. Surg.* 144: 540e, 2019.)

Autologous microsurgical breast reconstruction is frequently performed for mastectomy defects and has been associated with greater long-term aesthetic outcomes and decreased complications compared with implant-based reconstruction.[1,2] Vascular thrombosis of the microvascular anastomosis is a dreaded complication that may lead to reoperations in an attempt to salvage the flap. Reported flap reexploration rates for suspected vascular compromise range from 3.1 to 9.1 percent, with salvage rates approaching 60

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to 70 percent. Overall flap failure rates for microsurgical breast reconstruction range from 1.1 to 2.9 percent.[3–5] Studies have suggested that flaps are unlikely to be salvaged after postoperative days 2 to 3,[4–9] yet many institutions keep patients in the hospital significantly longer for flap monitoring protocols, leading to superfluous health care costs and potential nosocomial morbidity.[10–12]

Increased scrutiny of health care spending often relies on cost per quality-adjusted life-year, which provides a quantitative measurement of the impact of a given intervention on a patient's quality of life. Quality of life is graded on a scale from 0 (indicating death) to 1 (indicating a year of perfect health) using patient-reported outcomes. Quality-adjusted life-years are used in cost-utility analysis to allow comparison of dissimilar interventions for dissimilar disease states to optimally allocate resources. Cost per quality-adjusted life-year is a construct denoting the amount of money required for a given intervention to produce a single quality-adjusted life-year.[13] In general, $100,000/quality-adjusted life-year has been considered the threshold for a cost-effective intervention in the United States.[14,15]

With regard to microsurgical breast reconstruction, quality of life attributed to the reconstruction can be estimated using patient-reported outcomes by way of the BREAST-Q questionnaire. The BREAST-Q was developed to assess patient satisfaction and opinions before and after breast reconstruction across a range of quality-of-life parameters (i.e., psychosocial, physical, and sexual well-being) and satisfaction (i.e., breasts aesthetics, surgical outcomes, and overall patient care) domains.[16,17] The measure of quality-adjusted life-years lost following flap failure can therefore be estimated, as can the cost per gain in quality-adjusted life-years given the resources necessary to monitor a flap to prevent such a loss from occurring.

The aim of this study was to simply generate further inquiry into the cost of inpatient flap monitoring by introducing a conservative cost-utility model of inpatient flap monitoring following microsurgical breast reconstruction from a societal perspective. Given currently published flap take-back, salvage, and failure rates by our institution and others alike, the authors hypothesize that the cost-utility of inpatient flap monitoring may become cost-ineffective as early as the second postoperative day.

PATIENTS AND METHODS

Institutional review board approval was obtained and retrospective analysis of the University of Pennsylvania Division of Plastic Surgery Autologous Breast Reconstruction database was performed. Postoperative flap monitoring protocols were conducted simply by clinical examination and pencil Doppler ultrasonography of externalized skin paddles by in-service acute-care nurses every hour for the first 48 hours and every 4 hours subsequently.[18] A cost-utility model (Fig. 1) was created to assess the financial impact of flap monitoring following microsurgical breast reconstruction using methods set forth by the U.S. Panel on Cost-Effectiveness in Health and Medicine.[19] To estimate the cost-utility of inpatient flap monitoring by postindex operation day, the costs associated with each day of flap monitoring were based on the Henry J. Kaiser Family Foundation's 2015 estimate of hospital adjusted expenses per inpatient day for a nonprofit hospital located in the state of Pennsylvania (approximately $2377/day).[20] The utility of inpatient flap monitoring following microsurgical breast reconstruction was estimated using flap take-back and salvage rates by postoperative day as reported in the University of Pennsylvania Division of Plastic Surgery Autologous Breast Reconstruction database. The quality-adjusted life-year value was set at the currently suggested threshold of $100,000/quality-adjusted life-year.[15]

Inclusion and Exclusion Criteria

Inclusion criteria consisted of any patient undergoing microsurgical breast reconstruction. Flaps that were taken back to the operating room as a salvage attempt for suspected vascular compromise were included. Flaps that were taken back for planned flap removal without an attempt at salvage (i.e., patient request) were excluded. Any late flap loss (i.e., following hospital discharge) or an inability to identify the exact timing of vascular compromise was excluded. For a flap that was taken back on more than one occasion, all take-backs were considered unsuccessful if the flap was ultimately lost. If a flap was ultimately salvaged, only the last take-back was considered successful; all prior take-backs were considered unsuccessful, as they did not result in a successful resolution to the problem. Immediately following a flap take-back, the length of stay for that flap reset the clock to postoperative day 0. Flap failure was defined as either partial or complete, with partial flap loss defined as any flap requiring an eventual return to the operating room for significant contour deformity. Patient demographic factors and clinical-surgical variables were recorded and compared.

Quality-Adjusted Life-Years Gained for Successful Flap Salvage

A quality-adjusted life-year is calculated using the following basic formula:

$$\text{QALY} = \text{Life expectancy (years)} \times \text{Quality of life (0 to 1)},$$

where QALY = quality-adjusted life-year. In a study by Atisha et al., 7619 women recruited from the Army of Women program with a history of breast cancer surgery took an electronically administered BREAST-Q survey to evaluate patient satisfaction following mastectomy with and without breast reconstruction. On average, the BREAST-Q (breast reconstruction module) score within 1 to 5 years following a successful reconstruction was 0.73 for autologous breast reconstruction (n = 657).[21] The decrease in quality of life for an unsuccessful salvage attempt was determined by searching the Cost-Effectiveness Analysis Registry for previously published studies on the loss of quality-adjusted life-years resulting from complete flap loss. Two articles published in the past decade derived utility values for total flap loss in breast cancer patients at a value of 0.51 to 0.53. These values were attained by eliciting expert opinion by means of time tradeoff surveys or visual analogue models.[22,23] Therefore, quality-adjusted life-years gained from having a salvaged flap were estimated by the following equations:

$$\text{QALY}_{\text{flap success}} = \text{Life expectancy} \times \text{Quality of life}_{\text{flap success}}\,(0.73),$$

$$\text{QALY}_{\text{flap loss}} = \text{Life expectancy} \times \text{Quality of life}_{\text{flap loss}}\,(0.52), \text{ and}$$

$$\text{QALY}_{\text{gained from flap salvage}} = \text{QALY}_{\text{flap success}} - \text{QALY}_{\text{flap loss}},$$

where QALY = quality-adjusted life-years. To provide a conservative estimate of benefit, the life expectancy used for the above formulas was determined for an otherwise healthy woman at the average age of a breast cancer diagnosis (i.e., 48 years) undergoing prophylactic surgery with immediate microsurgical breast reconstruction who is expected to live to the average age of 84 years.[24,25] Thus, the life expectancy under such circumstances is 36 years.

Flap Take-Back and Salvage Rates per Hospital Day

Flap take-back and salvage rates for each postoperative day were obtained from our institution's Autologous Breast Reconstruction database. Based on these findings, the number of flaps that would need to be monitored each postoperative day to yield one additional successful flap salvage was determined using a numbers-needed-to-treat model. Because our method of flap monitoring relies on clinical examination alone without the aid of costly devices, the health care costs associated with inpatient flap monitoring was estimated by multiplying the average inpatient stay expenditure for our institution ($2377/day) by the number of flaps that would need to be monitored each hospital day to salvage just one failing flap. The costs of additional interventions and extended hospital stays associated with flap salvage attempts were not included in the analysis to provide a conservative estimate of costs.

Incremental Cost-Effectiveness Ratios of Inpatient Flap Monitoring following Microsurgical Breast Reconstruction

The incremental cost-effectiveness ratio is the ratio of the interventional (i.e., inpatient flap monitoring) costs to the incremental quality-adjusted life-year benefits of the therapeutic intervention or treatment (i.e., successful flap salvage). This was calculated for each postoperative day of flap monitoring using the following formula:

$$\text{ICER} = \text{Total average inpatient care costs} / \text{QALY}_{\text{gained from flap salvage}},$$

where ICER = incremental cost-effectiveness ratio and QALY = quality-adjusted life-years. The suggested cost of inpatient flap monitoring for each postoperative day was plotted against the $100,000/quality-adjusted life-year threshold (i.e., society's willingness to pay). Society's willingness to pay represents the maximum amount of money society is willing to spend on an intervention for 1 additional year of perfect health, empirically stated as less than or equal to $100,000/quality-adjusted life-year for developed countries. An intervention is considered "cost-effective" when the calculated cost-utility ratio is greater than 0 and less than the society's willingness-to-pay threshold.[13–15]

Categorical variables were analyzed using Pearson chi-square tests and continuous variables were analyzed using t tests. All statistical tests were two-sided, and a value of $p \leq 0.05$ was used to determine statistical significance. All statistical analyses were performed using Stata Release 15 (StataCorp LLC, College Station, Texas).

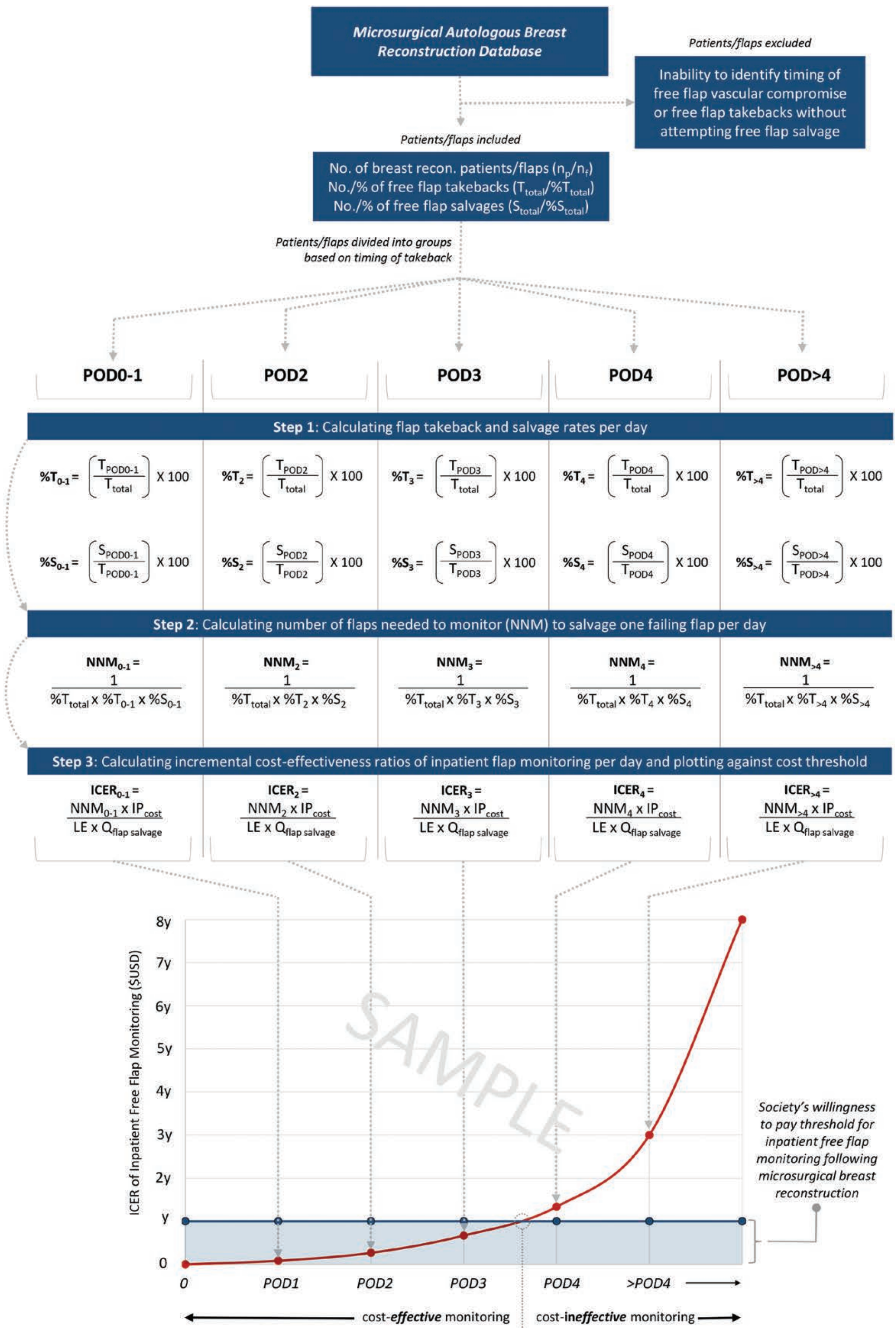

Fig. 1. Cost-utility model of inpatient free flap monitoring following microsurgical breast reconstruction designed to identify time at which inpatient monitoring becomes cost-inefficient. *T*, takeback; *S*, salvage; *POD*, postoperative

RESULTS

A total of 1813 patients (2847 flaps) were identified from the University of Pennsylvania Division of Plastic Surgery Autologous Breast Reconstruction database as having undergone microsurgical breast reconstruction between January of 2005 and January of 2016. Forty-two patients (42 flaps) were taken back to the operating room to explore a flap with suspected vascular compromise. Two flaps were taken back twice. The times to first take-back were recorded, and both were considered failures while resetting the clock to day 0. The times to the second take-back were recorded and results reported accordingly. Thus, the overall take-back rates per patient and per flap were 2.4 and 1.5 percent, respectively. Of the flaps taken back, 23 (52.3 percent) were successfully salvaged. There were no significant differences in baseline characteristics between uneventful, take-backs, salvaged, and failed flaps except for smoking status (Table 1). A majority (97.6 percent) of flaps performed were from the abdomen (i.e., muscle-sparing free transverse abdominis myocutaneous flaps type 1 and type 2, deep inferior epigastric artery perforator, and superficial inferior epigastric artery) (Table 2). Take-back and salvage rates per postoperative day were 56.8 and 60.0 percent (postoperative day 0 to 1), 13.6 and 83.3 percent (postoperative day 2), 11.4 and 40.0 percent (postoperative day 3), 9.1 and 25.0 percent (postoperative day 4), and 9.1 and 0 percent (greater than postoperative day 4), respectively (Fig. 2).

Based on these findings, the number of flaps that would need to be monitored each postoperative day to salvage just one failing flap and the associated health care costs of inpatient monitoring would be 121 and $287,617 (postoperative day 0 to 1), 363 and $861,900 (postoperative day 2), 907 and $2,154,751 (postoperative day 3), and 1813 and $4,309,501 (postoperative day 4), respectively. For length of stays beyond postoperative day 4, the number of flaps that would need to be monitored to salvage just one failing flap is innumerable (Table 3).

Utilities for successful (0.73) and unsuccessful (0.52) flap salvage attempts were obtained from previously published values quantified by the BREAST-Q (breast reconstruction module) questionnaire and through elicitation of expert opinion. For an otherwise healthy female patient undergoing prophylactic surgery with immediate microsurgical breast reconstruction who is expected to live another 36 years, the quality-adjusted life-years gained from a successfully salvaged flap equates to 7.6. Therefore, the incremental cost-effectiveness ratio of inpatient flap monitoring per postoperative day are $38,045 (postoperative day 0 to 1), $114,008 (postoperative day 2), $285,020 (postoperative day 3), and $570,040 (postoperative day 4). When plotted against the currently accepted cost per quality-adjusted life-year threshold of $100,000, the suggested target day of discharge falls just short of postoperative day 2 (Fig. 3).

Fig. 1. (*Continued*) day; *NNM*, numbers needed to monitor; ratio *ICER*, incremental cost-effectiveness ratio; *IP*, inpatient; *LE*, life-expectancy; $Q_{flap\ salvage}$, quality-adjusted life-years gained from successful free flap salvage.

DISCUSSION

Using available outcomes data and utility estimates, this is the first study to conservatively analyze the health care costs associated with inpatient flap monitoring following microsurgical breast reconstruction. Our results confirm that as the time from surgery increases, flap take-backs become increasingly rare and salvage attempts become exceedingly futile. As a result, the associated inpatient flap monitoring costs to support successful salvages of failing flaps rises rapidly with each day following surgery. Our simplified model suggests that the cost-utility of keeping patients beyond postoperative day 2 for inpatient flap monitoring far exceeds society's willingness-to-pay threshold of $100,000/quality-adjusted life-year. Currently, the average length of stay for microsurgical breast reconstruction in the United States is almost 5 days.[26]

Although there may be varying reasons to keep a patient in the hospital for more than 2 days (e.g., postoperative complications, poor oral intake, inability to control pain with oral medications), flap monitoring is unlikely to yield significant benefit after 2 days in the vast majority of patients and therefore may be considered a goal for enhanced recovery protocols.

Zoccali et al. recently performed a systematic literature review to determine whether long-term inpatient postoperative monitoring of flaps continues to be necessary for microsurgical breast reconstruction and for other forms of microsurgical reconstruction. The review demonstrated a progressive reduction in flap salvage rates with each succeeding postoperative day, with a significant correlation between the times of complication onset and flap salvage rates up to the third postoperative day. The results of their study suggest that intense postoperative flap monitoring

Table 1. Patient Demographics

	All	Uneventful Flaps vs. Take-Backs			Take-Backs		
		Uneventful	Take-Backs	*p*	Salvaged	Failed	*p*
No. of patients	1813	1771	42*		23	21	
No. of flaps	2847	2805	42*		23	21	
Mean age ± SD, yr	51 ± 10	51 ± 10	51 ± 8	0.8114	50 ± 7	50 ± 8	0.7244
Mean ASA classification	2.1 ± 0.4	2.1 ± 0.4	2.2 ± 0.4	0.6137	2.2 ± 0.4	2.2 ± 0.4	0.937
Mean BMI, kg/m²	28.7 ± 5.9	28.7 ± 5.9	28.9 ± 6.0	0.7868	27.8 ± 6.0	29.9 ± 6.4	0.324
Comorbidities							
None	861 (47.5)	841 (47.5)	22 (52.4)	0.53	12 (52.2)	10 (52.6)	0.976
1–3	909 (50.2)	891 (50.3)	18 (42.9)	0.34	11 (47.8)	7 (36.8)	0.474
>3	41 (2.3)	39 (2.2)	2 (4.8)	0.27	0 (0.0)	2 (10.5)	0.111
Smoking							
Never	1142 (63)	1125 (63.5)	17 (40.5)	0.002	10 (43.5)	7 (36.8)	0.663
Former	499 (27.5)	483 (27.3)	16 (38.1)	0.121	10 (43.5)	6 (31.6)	0.429
Current	172 (9.5)	163 (9.2)	9 (21.4)	0.008	3 (13.0)	6 (31.6)	0.145

ASA, American Society of Anesthesiologists; BMI, body mass index.
*Forty-two patients were taken back to the operating room for suspected venous compromise of their flaps. Two patients were taken back to the operating room twice for the same flap.

Table 2. Clinical and Surgical Variables

	All	Uneventful Flaps vs. Take-Back			Take-Back		
		Uneventful (%)	Take-Back (%)	*p*	Salvaged (%)	Failed (%)	*p*
No. of patients	1813	1771 (97.6)	42* (2.4)		23 (52.3)	21 (47.7)	
No. of flaps	2847	2805 (98.5)	42* (1.5)		23 (52.3)	21 (47.7)	
Chemotherapy							
Yes	740 (40.8)	726 (98.1)	14 (1.9)		5 (35.7)	9 (64.3)	
No	1073 (59.2)	1045 (97.3)	28 (2.7)	0.32	17 (60.7)	11 (39.3)	0.08
Radiotherapy							
Yes	558 (30.8)	545 (97.7)	13 (2.3)		6 (46.2)	7 (53.8)	
No	1255 (69.2)	1226 (97.7)	29 (2.3)	0.98	16 (55.2)	13 (44.8)	0.16
Laterality							
Unilateral	777 (42.9)	762 (98.1)	15 (1.9)		7 (46.7)	8 (53.3)	
Bilateral	1036 (57.1)	1009 (97.4)	27 (2.6)	0.80	15 (56.6)	12 (44.4)	0.63
Type of flap							
MS-1, MS-2	1953 (68.6)	1929 (98.8)	24 (1.2)		11 (45.8)	13 (54.2)	
DIEP	693 (24.3)	683 (98.6)	10 (1.4)		6 (60)	4 (40)	
SIEA	133 (4.7)	130 (97.7)	3 (2.3)		2 (66.7)	1 (33.3)	
Other (TUG/IGAP/SGAP)	68 (2.4)	63 (92.6)	5 (7.4)		4 (80)	1 (20)	

MS-1, muscle-sparing free transverse abdominis myocutaneous type 1; MS-2, muscle-sparing free transverse abdominis myocutaneous type 2; DIEP, deep inferior epigastric artery perforator; SIEA, superficial inferior epigastric artery; TUG, transverse upper gracilis; IGAP, inferior gluteal artery perforator; SGAP, superior gluteal artery perforator.
*Forty-two patients were taken back to the operating room for suspected venous compromise of their flaps. Two patients were taken back to the operating room twice for the same flap.

need not be continued beyond 48 hours postoperatively, as flap salvage appears to be affected by the time to detection and the duration of time until reexploration within the 48-hour window.[27] These findings are consistent with our results and previous reports.[4–9,28–32]

Understanding that flaps performed for microsurgical breast reconstruction are significantly less likely to be salvaged when vascular compromise ensues beyond 48 hours and considering that our results demonstrate climbing costs associated with continued inpatient flap monitoring thereafter, it begs the question, "If patients undergoing microsurgical breast reconstruction meet general discharge criteria such as adequate oral intake, ambulation, and pain control, can they be safely discharged by postoperative day 2?" Since 2014, the senior author (M.L.S.) has implemented a multimodal pain-management protocol that has allowed routine hospital discharge of patients who have undergone abdominally based microsurgical breast reconstruction by postoperative day 2. Performing intraoperative transversus abdominis plane blocks with liposomal bupivacaine injections in conjunction with a nonnarcotic postoperative pain regimen allowed patients to ambulate and resume a normal diet within 24 hours and to be safely discharged to home within 48 hours after

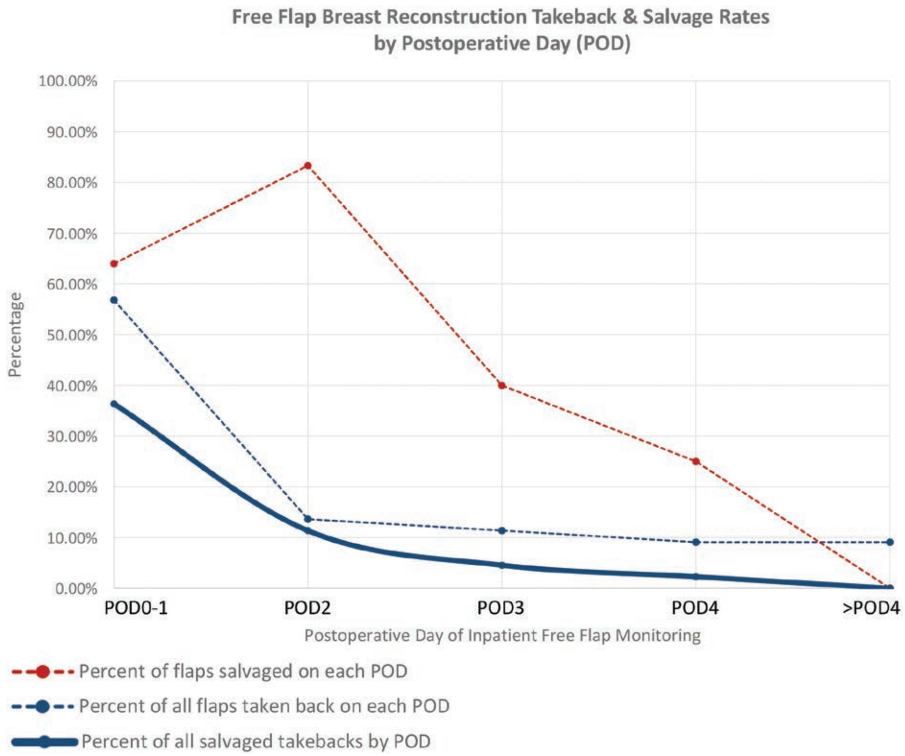

Fig. 2. Free flap breast reconstruction take-back and salvage rates by postoperative day. *POD*, postoperative day.

Table 3. Numbers Needed to Monitor, Inpatient Costs, and Incremental Cost-Effectiveness Ratios per Postoperative Day*

	No. of Flaps Needed to Monitor to Save One Flap	Total Average IP Care Costs†	QALYs†			ICER
			Salvage	Loss	Difference	
POD 0–1	121	$287,617	26.3	18.7	7.6	$38,045
POD 2	363	$861,900	26.3	18.7	7.6	$114,008
POD 3	907	$2,154,751	26.3	18.7	7.6	$285,020
POD 4	1813	$4,309,501	26.3	18.7	7.6	$570,040
>POD 4§	—	—	26.3	18.7	7.6	—

QALY, quality-adjusted life-years; IP inpatient; ICER, incremental cost-effectiveness ratio; POD, postoperative day.
*The numbers of flaps needed to monitor to salvage a single failing free-flap were determined for each postoperative day. ICERs were calculated from the ratio of total average inpatient monitoring costs to the quality-adjusted life-years gained from the successful salvage of a failing free-flap.
†Determined for an otherwise healthy woman at the average age of a breast cancer diagnosis (i.e., 48 yr) undergoing prophylactic surgery with immediate microsurgical breast reconstruction who is expected to live to the average age of 84 yr.
‡Average inpatient costs per were $2377/day for a nonprofit hospital in our state.
§Because no flaps were salvaged beyond postoperative day 4, the numbers of flaps needed to monitor is innumerable; thus, the associated health care costs and cost-utility ratios are incalculable.

surgery, without significant differences in 30-day readmissions or flap losses.[33] Kaoutzanis and colleagues recently described the implementation of an enhanced recovery pathway following microsurgical breast reconstruction at their institution that also allows patients to be discharged as early as postoperative day 2 (average, postoperative day 3; range, postoperative days 2 to 5) without a significant change in flap loss or 45-day major complication rates.[34]

Since the early 1990s, researchers have used cost-utility analyses to either support or denounce particular investments in medical technologies and health programs. In truth, it is impossible to find a single threshold to represent society's willingness to pay for quality-adjusted life-years gained, because different approaches yield different values, each of which is based on different assumptions, inferences, and contexts.[15] Most organizations that use cost-utility analyses

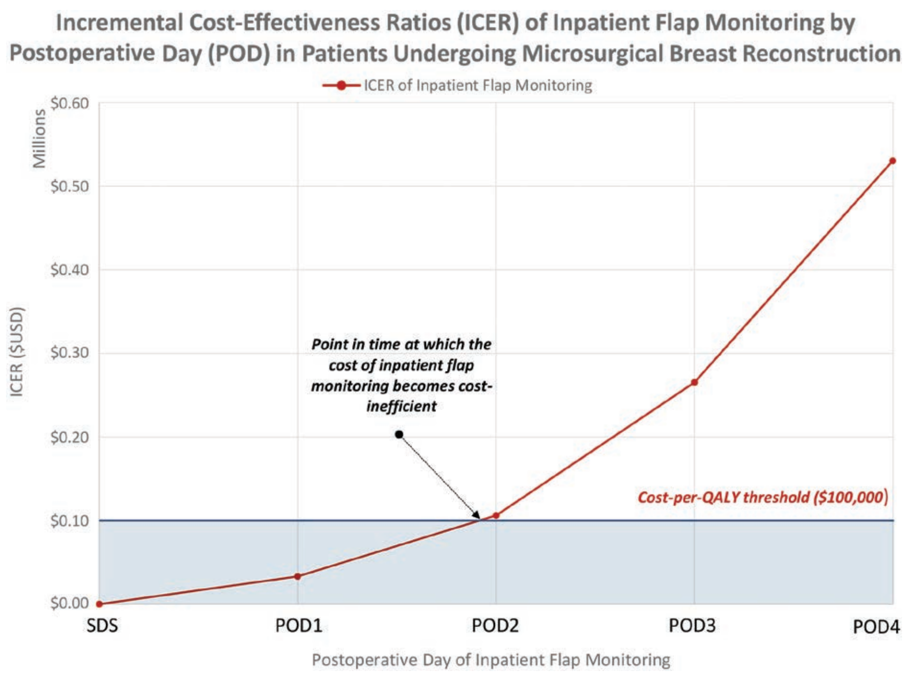

Fig. 3. Incremental cost-effectiveness of inpatient free flap monitoring by postoperative day in patients undergoing microsurgical breast reconstruction plotted against society's willingness-to-pay threshold of $100,000/quality-adjusted life-year. The intersection of the two lines identifies a time between postoperative day 1 and postoperative day 2 at which inpatient free flap monitoring starts to become cost-inefficient. *POD*, postoperative day; *QALY*, quality-adjusted life-year.

consider medical interventions costing less than $50,000/quality-adjusted life-year to be of high cost-effectiveness, whereas those costing more than $150,000/quality-adjusted life-year are of low cost-effectiveness.[35] Despite its problems, the cost per quality-adjusted life-year threshold chosen in our cost-utility model serves as a useful tool for organizing evidence and to encourage resource allocation discussions regarding microsurgical breast reconstruction.

Although a sensitivity analysis was not performed as part of our study, we suspect that longer inpatient free-flap monitoring protocols could be deemed cost-effective for centers with higher late take-back and salvage rates, lower utility values for free-flap loss, and less costly average inpatient hospital stays.

There are limitations to this study outside the known realm of a retrospective chart review. We chose to forgo inclusion of potential additional costs associated with varying surgical outcomes. Including these costs would add to the complexity of our analysis and would likely left-shift our cost-utility curve, suggesting an even earlier day of discharge following microsurgical breast reconstruction. The use of quality-adjusted life-years in general is limited by the ability to fully assess an intervention's utility. Utility scores may also have discrepancies based on the methods used to assess utility. For example, patients' perceptions of utility gained are not necessarily the same as their perceptions of utility lost, and the assessment of the utility of a state before a change occurs may differ greatly from its assessment after the fact.[36] We acknowledge that the utility of flap loss used from previously published expert opinions is not ideal but serves as a surrogate until patient-reported outcomes data confirm this value. Certain variables used to perform this study (i.e., the quality of life for flap breast reconstruction, flap loss, life-expectancy, and hospital costs) are averages that may vary significantly among individuals and institutions that may yield differing results. In addition, cost-utility studies may fail to fully account for an individual's value to society and may favor societal interests over the interest of the individual.[36] This study may actually underestimate the cost of prolonged monitoring of flaps, as prolonged monitoring would be expected to increase the number of failed take-backs, leading to increased length of stay, operating room use, and nosocomial infections, the costs of which were purposely excluded from this analysis. Despite these limitations, the study clearly demonstrates the rapidly shrinking utility and increasing costs of inpatient flap monitoring over time for patients undergoing microsurgical breast reconstruction at our institution and for others alike.

CONCLUSIONS

This is the first study to provide clinicians a cost-utility framework to guide decisions about appropriate duration for inpatient flap monitoring after microsurgical breast reconstruction. In the setting of fixed resources, understanding the relationship between the cost and benefit of various interventions can better determine the optimal use of those resources. Based on a currently accepted estimate of society's willingness-to-pay threshold of $100,000/quality-adjusted life-year, the study suggests that keeping patients in the hospital solely for flap monitoring exceeds this threshold at 2 days after surgery.

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