Introduction

Implantable Dopplers have been promoted to monitor intraoral flaps, buried flaps, and perforator flaps for breast reconstruction. The aim of this study is to evaluate the utility of this device in a series of patients undergoing free flap reconstruction and compare results with other studies.

Methods

A prospective database of all patients monitored with an implantable Doppler was maintained from August 2007 until January 2011. Type of flap, vessels monitored, signal quality, and flap outcome were recorded. A true positive was defined as a loss of signal associated with flap compromise. The sensitivity, specificity, positive predictive value, negative predictive value, false positive rate, and false negative rate were calculated.

Results

There were 53 flaps monitored with 101 implantable Dopplers during the 42 month study period: 43 head & neck flaps, 6 perforator flaps for breast reconstruction, and 4 lower extremity flaps. There were 38 true negatives (viable flaps with good signals). In 2 cases the arterial signal was lost, and exploration revealed thrombosis (2 true positives). In one of these cases clinical signs lagged behind signal loss. In 13 cases the venous signal was lost but flap examination was benign and exploration was aborted without complication (13 false positives). There were no false negatives. The sensitivity was 100%, specificity 75%, positive predictive value 13%, negative predictive value 100%, false positive rate 25%, and false negative rate 0%. The cost of a device is $469.53 for a total cost of $47,422.53 to detect one case of flap compromise that was not obvious clinically. Table I summarizes the findings of other published studies.

Conclusions

In this study of primarily head & neck reconstructions the implantable Doppler has demonstrated high sensitivity but suboptimal specificity, positive predictive value, and false positive rate. Given the high cost of this device, its use should be limited to buried flaps, following technically difficult or complicated microanastomosis, and/or assessing venous outflow during flap inset. It may also be of value early in the learning curve, as a higher flap failure rate will increase the positive predictive value.

Table 1

Study	N = # flaps	Vessel	Flap Failure	TP	TN	FP	FN	Sens	Spec	PPV	NPV	FPR	FNR
Halvorson 2011	53	Both	3.80%	2	38	13	0	100%	75%	13%	100%	25%	0%
Acosta 2010	323	V	10.80%	35	286	2	0	100%	99%	95%	100%	1%	0%
Leon 2010	169	V	2%	19	148	2	0	100%	99%	90%	100%	1%	0%
Yu 2009	16	V	6%	0	10	5	1	0%	67%	0%	91%	33%	100%
Harris 2008	384	A > V	2%	25	340	6	13	66%	98%	81%	96%	2%	34%
Chevray 2006	20	V > A	5%	1	12	7	0	100%	63%	13%	100%	37%	0%
Vasconez 2003	118	Both	1%	8	104	6	0	100%	95%	57%	100%	5%	0%
Kind 1998	147	V	13.60%	20	123	4	0	100%	97%	83%	100%	3%	0%
Swartz 1994	133	V > A	15%	20	108	5	0	100%	96%	80%	100%	4%	0%
Cumulative	1363			130	1169	50	14	90%	96%	72%	99%	4%	10%

TP = True Positive = Absent signal + Poor flow
TN = True Negative = Present signal + Good flow
FP = False Positive = Absent signal + Good flow
FN = False Negative = Present signal + Poor flow
Sens = Sensitivity = TP/(TP+FN)
Spec = Specificity = TN/(TN+FP)
PPV = Positive Predictive Value = TP/(TP+FP)
NPV = Negative Predictive Value = TN/(TN+FN)
FPR = False Positive Rate = FP/(FP+TN)
FNR = False Negative Rate = FN/(FN+TP)