

ABSTRACTS

Free Flap Blood Flow Monitoring

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Free Flap Blood Flow Monitoring

The Role of the Implantable Doppler Probe in Free Flap Surgery

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Laryngoscope. 2014;124 (Suppl 1):S1-S12

Objectives/Hypothesis: Free tissue transfer has success rates greater than 95%. Approximately 10% will require reexploration for vascular compromise. Return to the operating room within 48 hours yields the highest rate of successful salvage. Our aim was to determine whether an implantable Doppler used for intraoperative/postoperative monitoring would 1) alter the pattern of detecting flap failure and 2) alter the overall incidence of flap survival.

Study Design: Prospective analysis.

Methods: Generic and study specific data was collected. Note was made at the end of the case if revision of the vascular anastomosis was performed. Data was collected for flap outcomes in the postoperative period.

Results: A total of 1,236 free tissues transfers from 2001 through 2011 were analyzed. Ninety-four were outside the head and neck or the Doppler was not used/inadvertently discontinued. A total of 1,142 flaps make up the study cohort. One hundred thirty-four (11.7%) intraoperative flow problems were detected, all successfully revised. Of these, 15 (11%) required postoperative revision and five (33%) were successfully salvaged, with an overall survival 93%. A total of 1,008 flaps did not require intraoperative revision, 62 required reexploration (6.1%), and 38 (61%) were salvaged. The overall survival was 97.6%. There were eight false positive (no intervention) and 10 false negatives. Sensitivity was 87% with specificity 99%.

Conclusion: Intraoperative Doppler's increase the detection of immediate/incipient vascular problems. Patients requiring revision in the operating room require revision more often in the postoperative period (P 5.03) and are less likely to have successful salvage and a lower flap survival rate (P 5.05).

Implantable Doppler Probes for Postoperatively Monitoring Free Flaps: Efficacy. A Systematic Review and Meta-analysis

Chang TY, Lee TC, Lin YC, et al

Plast Reconstr Glob Open. 2016;4(11):e1099.

Background: Although clinical assessment remains the gold standard for monitoring the circulation of free flaps, several adjunct techniques promote timely salvage by detecting circulation compromise early. The objective of this systematic review was to evaluate the efficacy of an implantable Doppler probe for postoperatively monitoring free flaps.

Materials and Methods: English-language articles evaluating the efficacy of implantable Doppler probes compared with clinical assessment for postoperatively monitoring free flaps were analyzed. The outcome measures were total flap failure rates, salvage rates, sensitivity, false-positive rates, and positive likelihood ratios.

Results: Of the 504 citations identified, 6 comparative studies were included for meta-analysis. An implantable Doppler probe significantly lowered the flap failure rate (risk ratio: 0.40; 95% confidence interval: 0.21–0.75) and raised the successful salvage rate (risk ratio: 1.73; 95% confidence interval: 1.16–2.59). Pooled sensitivity was higher (1.00 vs 0.98), the positive likelihood ratio was lower (72.16 vs 220.48), and the false-positive rate was higher (0.01 vs 0) in the implantable Doppler probe group than in the clinical assessment group.

Conclusion: An implantable Doppler probe is significantly more efficacious than clinical assessment for postoperatively monitoring free flaps.

Evaluation of the Implantable Doppler Probe for Free Flap Monitoring in Lower Limb Reconstruction

Lenz Y, Gross R, Penna V, et al

J Reconstr Microsurg 2018 Mar;34(3):218-226

Background: Timely reexploration and reanastomoses can salvage failing free flaps. The use of the implantable Doppler probe provides direct evidence of vascular impairment of the microvascular anastomoses and allows for postoperative NPWT. The aim of this retrospective study was to compare the Doppler probe to conventional monitoring techniques for free flap monitoring in lower limb reconstruction and to identify risk factors for perfusion disturbance and reexploration.

Methods: All patients receiving free muscle flap reconstruction for lower limb soft tissue defects at our department from 2000 to 2013 were included, and all adverse events, timely detection of perfusion problems, and outcome of revision surgery were assessed by chart analysis.

Results: For lower limb reconstruction, 110 free muscle transfers were performed of which 41 muscle flaps were conventionally monitored and 69 flaps were monitored using the implantable Doppler probe. In 18 cases, the free muscle flaps needed revision because of perfusion disturbances. The salvage rate was 80% with monitoring by the implantable Doppler probe compared with 62.5% using conventional monitoring methods resulting in success rates of 95.7 and 92.7%, respectively.

Conclusion: The use of the implantable Cook-Swartz Doppler probe represents a safe monitoring method for lower limb reconstruction, which allows for the additional use of NPWT. Higher salvage and revision success rates can be attributed to an earlier detection of perfusion impairment. However, a larger patient cohort is necessary to verify superiority over conventional postoperative monitoring.

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Retrospective evaluation of diagnostic accuracy of free flap monitoring with the Cook-Swartz-Doppler probe in head and neck reconstruction

Leibig N, Ha-Phuoc A, Stark GB, et al

J Craniomaxillofac Surg 2019 Dec;47(12):1973-1979.

Abstract: The Cook-Swartz-Doppler probe is an easy to handle and reliable tool for free flap monitoring. In the head and neck region different confounders can affect the read out. We therefore analyzed the use of the Doppler probe regarding these potential difficulties and to compare the diagnostic accuracy in arterial or venous monitoring of free flaps in the head and neck region. A retrospective study was performed in which all patients were included who underwent free flap surgery in the head and neck region in the Department of Plastic Surgery and the Department of Maxillofacial Surgery of our institution between 2010 and 2018 and were monitored with an implanted Doppler probe. 147 free tissue transfers were included. No significance was found for arterial and venous placement of the Doppler probe for sensitivity (artery 83.3%; vein 84.6%; $p = 0.87$), specificity (artery 89.2%; vein 96.1%; $p = 0.17$) and negative predictive value (artery 96.7%; vein 94.2%; $p = 0.55$). A better positive predictive value for placing the Doppler probe around the artery (82.7%) than the vein (61.1%) was found in our study ($p = 0.056$). The better positive predictive value in arterial monitoring suggests that this is the more reliable measuring method to assess flap perfusion in the head and neck region.

Use of Near-infrared Spectroscopy and Implantable Doppler for Postoperative Monitoring of Free Tissue Transfer for Breast Reconstruction: A Systematic Review and Meta-analysis

Berthelot M, Ashcroft J, Boshier P, Hunter J et al

Plast Reconstr Surg Glob Open 2019 Oct 29;7(10)

Background: Failure to accurately assess the perfusion of free tissue transfer (FTT) in the early postoperative period may contribute to failure, which is a source of major patient morbidity and healthcare costs. This systematic review and meta-analysis aim to evaluate and appraise current evidence for the use of near-infrared spectroscopy (NIRS) and/or implantable Doppler (ID) devices compared with conventional clinical assessment (CCA) for postoperative monitoring of FTT in reconstructive breast surgery.

Methods: A systematic literature search was performed in accordance with the preferred reporting items for systematic reviews guidelines. Studies in human subjects published within the last decade relevant to the review question were identified. Meta-analysis using random-effects models of FTT failure rate and STARD scoring was then performed on the retrieved publications.

Results: Nineteen studies met the inclusions criteria. For NIRS and ID, the mean sensitivity for the detection of FTT failure is 99.36% and 100% respectively, with average specificity of 99.36% and 97.63%, respectively. From studies with sufficient reported data, meta-analysis results demonstrated that both

NIRS [OR = 0.09 (0.02-0.36); $P < 0.001$] and ID [OR = 0.39 (0.27-0.95); $P = 0.04$] were associated with significant reduction of FTT failure rates compared with CCA.

Conclusions: The use of ID and NIRS provided equivalent outcomes in detecting FTT failure and were superior to CCA. The ability to acquire continuous objective physiological data regarding tissue perfusion is a perceived advantage of these techniques. Reduced clinical staff workload and minimized hospital costs are also perceived as positive consequences of their use.

Implantable Doppler monitoring of buried free flaps during vascularized lymph node transfer

Teven CM, Ooi ASH, Inbal A, et al.

J Surg Oncol. 2017 Sep;116(3):371-377.

Background and objectives: Reliable flap monitoring is crucial to the success of free tissue transfer, including vascularized lymph node transfer (VLNT). However, no large-scale study has examined implantable Doppler monitoring in VLNT. We aimed to determine whether an implantable Doppler system can reliably monitor flap perfusion during VLNT and also to calculate the sensitivity and specificity of this system for detecting compromise in the monitored vessel.

Methods: An analysis of prospectively collected data of patients who underwent buried VLNT with implantable Doppler monitoring between 2014 and 2015 was performed.

Results: A consecutive series of 100 patients underwent VLNT with implantable Doppler monitoring. Five cases required return to the operating room for flap exploration due to a change in Doppler signal quality. All compromised flaps were salvaged. The sensitivity of the implantable Doppler system for flap monitoring was 100%, the specificity was 97.9%, the positive predictive value was 60%, and the negative predictive value was 100%. The false-positive rate was 2%.

Conclusions: This is the largest reported series of implantable Doppler monitoring of free flap perfusion during VLNT. Our experience suggests that this is a safe and effective technique for postoperative monitoring of VLNT.

Intraoperative Utility of the Implantable Doppler in Lower Extremity Reconstruction: A Matched Case-control Study

Salma A Abdou, Banafsheh Sharif-Askary, Elizabeth G. Zolper, Karen K. Evans.

Plast Reconstr Surg Glob Open. 2020 Nov 25;8(11)

Background: Patients with diabetes mellitus and peripheral vascular disease have high rates of thrombogenic vessels. The implantable (Cook) Doppler in lower extremity reconstruction can optimize microsurgical outcomes in this population.

Methods: Patients undergoing lower extremity free flap reconstruction who did not have an implantable Doppler probe

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placed were matched with patients who received an implantable Doppler probe. Groups were matched based on wound location, history of peripheral vascular disease, number of vessel runoffs, and number of venous anastomoses and postoperative outcomes compared.

Results: Thirty patients were included: 15 in the control group and 15 in the implantable Doppler group. Mean age was 60.2 ± 10.2 years, and mean BMI was 28.7 ± 5.0 kg/m². There was a high prevalence of diabetes mellitus (13; 43.3%) and peripheral vascular disease (4; 13.3%). Takebacks due to vascular compromise were significantly higher in the control than in the implantable Doppler group (26.7% versus 0.0%, P = 0.032). Among flaps that required takeback to the operating room, the majority were muscle-based without a skin paddle (75.0%). Vascular compromise was due to arterial insufficiency in 2 cases and venous thrombosis in 1 case. The salvage rate among the takebacks of the non-implantable Doppler group was 0.0%, resulting in a 26.7% flap failure rate in the non-implantable Doppler group when compared with 0.0% flap loss in the implantable Doppler group (P = 0.032).

Conclusion: The implantable Doppler probe optimizes flap inset intraoperatively in lower extremity free flap reconstruction and can significantly decrease takebacks due to vascular complications, thereby increasing flap success.

Rationale for the use of the implantable Doppler probe based on 7 years' experience

Ho MW, Cassidy C, Brown JS, et al

Br J Oral Maxillofac Surg. 2014;52(6):530-534

In head and neck microvascular reconstruction, a proportion of patients are at a higher risk of flap failure. These include salvage surgery after chemoradiotherapy, reconstruction for osteoradionecrosis and when difficulty is encountered in achieving flap perfusion intraoperatively. Several studies have shown that the Cook-Swartz Doppler (Cook Medical Inc, Bloomington, USA) enabled earlier detection of a compromised flap. We retrospectively reviewed microvascular reconstructions monitored with the Cook-Swartz implantable Doppler (2006-2012) and included patients' characteristics, comorbidity (American Society of Anesthesiologists' (ASA) grade), indication for operation, type of reconstruction, and indication for implantable Doppler. We also included details of surgical exploration, free flap salvage, and outcomes of flap salvage. These outcomes were compared with a group of low-risk patients (2005-2009) whose flaps were monitored clinically. A total of 75 free flaps in 73 patients were monitored with the implantable Doppler: 40 (53%) were in cases which required reconstruction following previous surgery/radiotherapy or flap perfusion difficulties, 10 (13%) buried flaps, 13 (17%) as routine flap monitors and 12 (17%) for other indications. The false negative rate was 5%, sensitivity 67%, the false positive rate was 25%, and specificity was 95%. Higher risk flaps monitored with the doppler had a higher return to theatre rate, 21% compared with 4% (p<0.001) and flap failure rate, 7% compared with 1% (p=0.002). Salvage rates for free flaps were similar in both groups (62% compared with 60%, p=1.0). There is not enough evidence to suggest that the implantable doppler reduces the rate of failed flaps in routine low-risk cases, and its value in monitoring high-risk reconstructions require evaluation

in a prospective randomised study.

Implantable Doppler in monitoring free flaps: a cost-effectiveness analysis based on a systematic review of the literature

Poder TG, Fortier PH.

Eur Ann Otorhinolaryngol Head Neck Dis 2013 Apr;130(2):79-85.

Objective: The purpose of this paper is to evaluate the efficacy and cost-effectiveness of the implantable Doppler system based on the analysis of the available scientific literature and clinical and cost data available in our hospital. The results of this system are compared to those of conventional free flap monitoring methods.

Materials and methods: The literature published between 1991 and 2011 was systematically reviewed. All available cost data were collected and several simulations were performed. A retrospective assessment of the efficacy of conventional methods in our hospital was also conducted.

Results and conclusion: The implantable Doppler system is more effective than the conventional methods used to monitor free flap perfusion. The mean flap salvage rate with the implantable Doppler was 21 percentage points higher (81.4 vs. 60.4). The excess cost compared to conventional methods was about CAD 120 per patient (about EUR 94). However, this excess cost can be compensated or even reversed, depending on the initial flap salvage rate in the health facility and the type of free flap (buried vs. non-buried).

Direct comparison of postoperative monitoring of free flaps with microdialysis, implantable cook-swartz Doppler probe, and clinical monitoring in 20 consecutive patients

Frost MW, Niumsawatt V, Rozen WM, et al

Microsurgery. 2015;35(4):262-271

Background: There is an increasing demand for successful free tissue transfer, with postoperative monitoring of flaps a key to early salvage. Monitoring methods have ranged from clinical techniques to invasive options, of which two are particularly applicable to buried flaps (Cook-Swartz Doppler probe and microdialysis). The evidence for these options has been represented largely in separate cohort studies, with no single study comparing these three techniques. We aim to perform this comparison in a single cohort of patients.

Methods: A prospective, consecutive cohort study comparing clinical monitoring, microdialysis and the implantable Doppler probe was undertaken. In 20 patients receiving 22 flaps, 21 flaps were monitored with microdialysis, 18 flaps with clinical observation, and 21 flaps with the Cook-Swartz Implantable Doppler probe. Exclusion was based on applicability and availability intra-operatively. Efficacy was assessed through sensitivity, specificity, positive, and negative predictive values.

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Results: Nineteen of 22 flaps had no suspected anastomotic problems; 3 of 22 flaps were explored for anastomotic problems, with two salvaged and one lost. The implantable Doppler and microdialysis were found to detect flap statistically earlier than clinical assessment, with microdialysis better at detecting flap compromise: 100% specificity (confidence interval 31-100%) when compared to the implantable probe and clinical assessment (67%: 13-98% and 33%: 2-87%, respectively).

Conclusions: Each of the Cook-Swartz Doppler probe, microdialysis and clinical assessment was found suitable for monitoring in free tissue transfer. The implantable Doppler and microdialysis offer the potential for earlier detection of flap compromise.

Eight-year experience of the Cook-Swartz Doppler in free-flap operations: microsurgical and reexploration results with regard to a wide spectrum of surgeries

Schulder A, Gur E, Zaretski A

Microsurgery 2011 Jan;31(1):1-6.

Background: Microvascular free flap has become an increasingly popular useful method of reconstruction over the past few decades. Minimizing failure rates in these operations is a primary goal in every microsurgical unit that can be accomplished by early recognition.

Methods: In this retrospective study, we tracked the admission of the implantable Doppler in the microsurgical unit (2000-2007) and evaluated parameters measured from 473 consecutive patients who underwent a total of 548 microsurgical procedures (489 primary surgeries and 59 reexplorations). The effectiveness of the Cook-Swartz Doppler (Cook Medical®) was examined in juxtapose general and subspecialty's aspects: in each microsurgical subspecialty, we compared the overall success and failure rates of the group with the implantable Doppler (n = 259) with the control group monitored by clinical means (n = 289). We also examined the duration, outcomes, and the effectiveness of this device in reexploration operations.

Results: Overall, success rates were improved by using the implantable Doppler contrary to clinical assessment (96.14% vs. 89.27%) with a statistical significant (P < 0.005). The device was most effective in ENT (94.6% vs. 84%), breast reconstructive surgeries (97.3% vs. 82.36%), and orthopedic oncology (97.37% vs. 83.72%), whereas with reanimation operations and trauma/orthopedics subspecialties, it showed no necessity. In neurosurgery and in other/esthetic surgeries, the study was too small to draw definite deductions.

Conclusions: We recommend the usage of the implantable Doppler probe as an effective monitoring system for free-flap surgeries, with emphasis on subspecialties where the device demonstrated better results than traditional monitoring methods. ry goal in every microsurgical unit that can be accomplished by early recognition.

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The Cook Doppler – Monitoring you can trust.



Cook-Swartz Blood Flow Monitor

- Easy to use - Continuous Blood Flow Monitoring
- Clear Audio - Lighted LED display
- Rechargeable battery - Dual channels



The Doppler monitor provides the surgeon with both audible (primary) and visual (secondary) feedback of blood flow when connected to the implantable Cook-Swartz Doppler Probes and extension cables.

The system is very flexible, allowing for the effective monitoring via arteries and/or veins, end to end or end to side, proximal or distal to the anastomosis.

Another benefit of the device is its mobility, the system can be used in theatres and then moved with the patient into recovery and the ward. This enables constant monitoring and by allowing the team to see and hear the presence or absence of blood flow, the Doppler system can alert them to flap failure in time to perform a salvage procedure.

For further information and access to videos please visit www.CCMed.co.uk or scan the QR code

