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Cost-effectiveness of monitoring free flaps☆

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Abstract

Methods of free flap monitoring have become more sophisticated and expensive. This study aims to determine the cost of free flap monitoring and examine its cost effectiveness.

We examined a group of patients who had had free flaps to the head and neck over a two-year period, and combined these results with costs obtained from business managers and staff. There were 132 free flaps with a success rate of 99%. The cost of monitoring was Aus $193/flap. Clinical monitoring during this time period cost Aus$25 476 and did not lead to the salvage of any free flaps. Cost equivalence is reached between monitoring and not monitoring only at a failure rate of 15.8%. This is to our knowledge the first study to calculate the cost of clinical monitoring of free flaps, and to examine its cost-effectiveness.

Keywords: Free flap; Monitoring; Cost effectiveness; Success

Introduction

Free tissue reconstruction is widely accepted as a reliable surgical technique with success rates in excess of 95%.[1–4] Since its implementation, several methods of postoperative monitoring have been used to detect and manage complications, with varying degrees of success.[1,2,5–7] The purpose of monitoring is to permit early detection of failure and a prompt return to theatre to salvage the flap if possible.[8] Failure of the salvage procedure will require removal of the dead flap and its replacement with a second flap, or an alternative reconstructive measure.

Where free tissue transfer is used it has become accepted practice to institute a method of monitoring. There is, however, no completely reliable technique that has been adopted universally.[1,2,5,6,9] The ideal technique is safe, allows early detection of failure, is precise and reliable, and is applicable to all free flaps; all health care professionals should also be able to use it.

Techniques of monitoring can be either invasive or non-invasive. Non-invasive techniques include: clinical assessment, monitoring of surface temperature, cutaneous Doppler, microlight guided spectrophotometry, colour Doppler sonography, and laser Doppler flowmetry.[1] The invasive techniques include: implantable Doppler, venous Doppler, contrast-enhanced Doppler, invasive monitoring of temperature, monitoring of oxygen tension, tissue pH, and microdialysis.[2] It should be noted that with the exception of clinical monitoring, every other form of flap monitoring requires additional equipment or expertise with subsequent increases in the cost of monitoring. Implantable Doppler probes have been costed at between $250-600 per probe in various publications.[5,6]

The only universal form of monitoring is clinical observation.[5,9,10] All types of monitoring have failings in

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either sensitivity or specificity, and clinical monitoring in particular is prone to subjective variability depending on the training and experience of the staff who make the observations. These problems can be exacerbated particularly in head and neck reconstruction where flaps are often intraoral, and sometimes completely buried. Buried flaps may be monitored clinically with windows or externalised segments,[11] but these do not provide a good view of the entire reconstruction.

As flap survival has improved, so to have the complexity and costs of tests of detecting failures, and there have been a number of studies that compared the sensitivity, specificity, and cost of various techniques.[5–7] To our knowledge there have been no studies that questioned whether the practice of monitoring flaps is cost-effective compared with no monitoring.

The aims of this paper are twofold. Firstly to calculate the actual cost of clinical monitoring of a flap, and secondly to assess the cost-effectiveness of monitoring flaps compared with not monitoring, depending on the failure rate.

Material and Methods

We undertook a retrospective cohort study from January 2012 to January 2014 to examine all cases of free flap reconstruction of the head and neck done in either the Department of Oral and Maxillofacial Surgery or the Department of Plastic and Reconstructive Surgery. The study was approved by the hospital ethics review committee. Information from this group of patients, together with costs supplied by nursing employment awards, medical employment awards, theatre coordinators, and business managers allowed us to calculate the cost of monitoring free flaps. It also allowed us to calculate the cost of salvage and replacement of flaps which must be considered as part of the cost effectiveness of monitoring.

The following variables were included in the costs, being rounded to the nearest dollar. Amounts are expressed in Australian dollars, and one Aus$ was worth roughly £0.51 and US$ 0.726 at the time of going to press.

Clinical observation by nursing staff

Nursing staff are responsible for observations of free flaps on a dedicated head and neck ward. They were observed over 10 sets of observations and a mean time calculated to make observations of a non-buried flap.

Recall of registrar

Nursing staff call a doctor to review a free flap if they are concerned about it. When this occurs out of hours it requires recall of a training registrar, who is then paid a recall rate.

Clinical consumables in monitoring

The cost of these (for example, wooden tongue depressors, torches, needles, and swabs) is measured in cents only, and was rounded to zero. No other monitoring devices were used with the exception of a hand-held external acoustic pencil Doppler, which costs about $1300 and has a lifespan of many thousands of uses, so the cost/flap also is negligible.

Costs of salvage and replacement of a flap

Salvage or replacement of a free flap requires a return to the operating theatre, and was calculated using the hourly running cost of the theatre obtained from the business manager of the division of surgery. It includes nursing staff, medical staff, running costs, and disposables. It does not include depreciation of medical equipment or sterilisation.

Results

During the 24-month period from January 2012 to January 2014, 132 free flaps were done for reconstructions of the head and neck. One free flap (radial forearm) failed, was identified, and returned to theatre on postoperative day five. It was deemed unsalvageable and was replaced. No other patient was returned to theatre for salvage or attempted salvage during the study period. Five were returned to theatre within 24 hours of operation for drainage of the operative site or haematomas of the neck without revision of the anastomoses. These haematomas were identified as swelling at the operative site. The overall free flap survival was therefore 99.3%.

Costs

Observation by nursing staff: the standard protocol that we use is hourly clinical monitoring of free flaps for 48 hours followed by four-hourly monitoring until day 7 (78 sets of observations). These observations were undertaken by nursing staff in addition to routine medical rounds, and were completed in 278 seconds for a full set of observations on a visible flap. The usual hourly wage for clinical nursing staff was $30, leading to a cost of $180 for clinical observations by nursing staff/flap.

Recall of registrar: when nursing staff were concerned about the clinical findings, they called a training registrar. Recall after hours is paid at 1.5 times the hourly rate with a minimum paid period of two hours. Based on a usual salary of $50/hour for training registrars, the recall rate is therefore $150/incident. During the study period registrars were recalled 12 times (for 132 flaps), so a total of $1800 was spent in total,which equates to $13/free flap.

The overall cost of clinical monitoring of each flap (excluding low cost consumables) was therefore $193/flap.