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WORKING PAPER

Comparing the Cost of Delayed and Immediate Autologous Breast Reconstruction in Belgium

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Summary

This study documents the cost of immediate and delayed DIEP flap breast reconstruction. Immediate reconstruction is more attractive from an economic perspective since it only requires one operation, one anaesthetic procedure and one recovery period in hospital. From the perspective of health care budget management, assessing the possible cost savings from immediate reconstruction yields interesting results.

Since charges do not reflect the real costs of providing care, we calculated resource costs using the micro-costing method. About 95 per cent of the initial mastectomy costs could be saved when performing an immediate breast reconstruction. This was about 35 per cent of total standard direct and indirect costs due to mastectomy and delayed breast reconstruction. In a growing cost conscious environment of managed care, the economic evaluation should therefore encourage the trend towards more immediate reconstructions.

Keywords: *Immediate breast reconstruction, Autologous breast reconstruction, DIEP flap, Resource costs, Savings*

Introduction

Mastectomy is still performed in case of large tumour size, tumour recurrence, unfavourable tumour localization, multifocal tumours and patient anxiety.^{1,2} More women than ever are requesting breast reconstruction following a mastectomy to help restore their appearance and self-image. Although the aesthetic result is of paramount importance to the patient, surgeons now practice in a health care environment where cost matters. Determining the value – benefit versus cost – of any given procedure is vitally important to ensure its unrestricted, continued availability.

Immediate breast reconstruction provides a number of advantages over delayed reconstruction. Not only is the final aesthetic result superior,³⁻⁷ it also involves a lower number of surgical procedures, hospitalizations and recovery periods.⁸⁻¹⁰ Other psychosocial factors such as anxiety, depression, self-esteem and confidence, acceptance of the new breast, feelings of femininity and sexuality are also better perceived with immediate reconstruction, which results in a higher quality of life.^{3,11-15}

A recent report of Tran *et al*¹⁶ indicates that early postoperative radiotherapy may deteriorate the aesthetic outcome of autologous reconstruction. In contrast to this, primary reconstruction does not delay the initiation of adjuvant chemotherapy.¹⁷ Shons *et al*¹⁸ argued that delayed reconstruction may be preferable for patients who are not able to make a well-balanced decision at the time of mastectomy due to the overwhelming news of breast cancer diagnosis and the possible treatment options. Therefore, certain patients may prefer to treat the tumour first and think about the reconstruction later.

Breast reconstruction with autologous tissue has become the preferred method of breast reconstruction over the last two decades. The Transverse Rectus Abdominis Myocutaneous (TRAM) flap has been the golden standard. It results in a naturally shaped breast, soft consistency and a permanency of the superior aesthetic results.^{5, 19} The complications of long-term implant failures are also avoided.

Due to significant abdominal wall complications, several surgeons are using the Deep Inferior Epigastric Perforator (DIEP) flap for breast reconstruction. The flap is also harvested from the lower abdominal wall, but both rectus muscles are left intact and functional. The muscle defect following TRAM flap harvest is responsible for loss of function, abdominal bulging, hernias and asymmetry of the umbilicus and the abdominal wall.²⁰ With the DIEP flap, patients maintain their abdominal wall competence, flexing and rotating strength and their ability to continue all their activities of daily life.²¹ With respect to flap survival and postoperative complications, the DIEP flap is rated as safe as the TRAM flap.^{5, 19, 22} The aesthetic results are also comparable.^{20, 23-25} A recent study of Cocquyt *et al*²⁶ even revealed that the cosmetic outcome after skin-sparing mastectomy and immediate DIEP flap reconstruction may yield a better cosmetic outcome than breast conserving treatment.

As experience with the DIEP flap increases, its importance to patients and surgeons is becoming more and more evident. Most of the previous studies that compare immediate and delayed reconstruction deal with the TRAM flap reconstruction. It is however highly probable that the benefits of the other reconstruction options can be applied to this DIEP flap procedure since it is a more sophisticated version of the TRAM flap.^{21, 27}

Method

Immediate reconstruction appeals to be more attractive from an economic perspective than the delayed procedure since it only requires one operation and one anaesthetic procedure, followed by one recovery period in the hospital.⁸⁻¹⁰ From the perspective of health care budget management, assessing the possible cost savings from immediate construction can yield interesting results.

Previous results

Some existing studies focus on cost savings. Hang-Fu *et al*²⁸ used charges for their cost calculations and concluded that immediate reconstruction decreased hospital costs compared to the delayed procedure. A study of Elkowitz *et al*⁸ based on hospital bills came to the same conclusion. Another study of Desch *et al*²⁹ examined the costs of immediate versus delayed reconstruction by adding up all claims between 45 days before diagnosis and 745 days after diagnosis. They also concluded that performing immediate reconstruction was less expensive than the delayed procedure.

But as Elkowitz *et al*⁸ already mentioned in their study, charges do not reflect the real costs of providing care. If we want to know the cost implications from the hospital's point of view, resource costs have to be calculated. As far as we know, only Khoo *et al*⁹ estimated the difference between immediate and delayed reconstruction on the basis of resource costs, which were defined as the costs to the institution required to provide the services being studied. As they mentioned, this is a better way than using charges since

the latter are arbitrary and vary over time. This means that they can change due to administrative decisions without a change in real resource cost.

Standard costs

An economic evaluation without correct cost information cannot provide reliable results. Unfortunately, detailed real cost data for specific diagnostic or treatment options are not available in Belgium. What patients pay or what hospitals receive from health care budgets for specific services is relatively easy to find out but does not reflect real costs. As stated by Cramer *et al*³⁰, a persistent relation between hospital charges to patients for products or services and the actual costs of those products or services is not existing. We therefore opt to work with real standard costs for the average patient.

Direct and indirect costs

To calculate the possible cost savings through immediate breast reconstruction we first had to calculate the costs for mastectomy and DIEP flap separately. Afterwards we calculated the cost for mastectomy followed by immediate breast reconstruction.

The main direct cost-drivers were the use of personnel, material, equipment and hospital-stay costs. Indirect costs made for sterilisation of material and maintenance of equipment were also taken into account. General overhead costs and costs linked to research activities were disregarded since they are in the first place related to a specific department and not to a specific treatment option. Costs caused by complications were not interpreted as standard costs and therefore not taken into account. In other words, the real costs are

higher than our calculated standard costs and they only reflect a part of total department expenditures.

The personnel, material and equipment costs were calculated directly by using the *bottom-up* or *micro-costing* method in which the costs are calculated by directly tracing resources. The personnel costs were estimated by multiplying the time different people were involved by their average labour cost. The costs of disposable materials were based on the standard amounts used, multiplied by their unit prices. The costs for reusable material were divided over the number of times it was reused. Equipment costs were calculated by using a distributive key. Investment costs were distributed over the estimated years an apparatus would be used. This amount was then divided over the estimated number of times a year the equipment was used. If the equipment was used for different treatment options, the amount of hours it was used was taken as distributive key. Besides investment costs, maintenance costs were also taken into account. Other cost-drivers such as anaesthetic costs and costs for sterilising instruments were also included using the micro-costing method.

The costs for hospital-stay were estimated indirectly by *top-down* calculation. We started by subdividing the hospital-stay price into its different components. To avoid double counting we adjusted this hospital-stay price by subtracting those parts already taken into account in a direct way, such as the personnel costs.

We calculated these costs for a university hospital, located in the northern part of Belgium. In what follows, we present the standard treatment costs. All data were drawn up, put together and checked in close collaboration with specialists of this hospital during 2003, reflecting the situation of 2001-2002.

Results

Costs concerning the initial removal of the cancer with mastectomy are presented in *Table 1*. Mastectomy could be performed in combination with the sentinel procedure or the removal of the axillary nodes. The latter was the case in about 60 per cent. Total standard mastectomy costs varied between € 2,566.55 and € 2,678.53 depending on which surgical option was taken. Hospital-stay costs represented about 80% of total costs. Apparatus costs were very low since the equipment was used for a long time and over a large number of operations.

Table 1: breast surgery costs

	Mastectomy	Mastectomy and sentinel	Mastectomy and removal axillary nodes	Secondary reconstruction (DIEP flap)
Total	€ 2,566.55	€ 2,598.11	€ 2,678.53	€ 4,366.97
Personnel	€ 199.28	€ 217.40	€ 271.78	€ 1,213.19
Material	€ 69.52	€ 76.95	€ 84.97	€ 611.42
Apparatus	€ 14.91	€ 16.15	€ 19.88	€ 61.62
Anaesthetics	€ 138.50	€ 143.26	€ 157.56	€ 317.73
Sterilization	€ 17.38	€ 17.38	€ 17.38	€ 36.06
Hospital-stay	€ 2,126.96	€ 2,126.96	€ 2,126.96	€ 2,126.96

Table 1 also presents the costs for DIEP flap breast reconstruction, which were much higher in comparison with the initial mastectomy, i.e. € 4,366.97. First of all, personnel costs were about five times as high due to a combination of a higher need of personnel and the longer operation time. Secondly, input of material was much higher and more instruments had to be sterilised. Next, the apparatus costs more than tripled due to the longer operation time. Anaesthetic costs also increased since the initial anaesthesia had to be remained for a longer period. Finally, the hospital-stay costs were equal in comparison to the initial surgery.

The purpose of our study was to calculate cost savings through immediate breast reconstruction in comparison with the delayed procedure. When the reconstruction was delayed, calculated costs for initial breast surgery and reconstruction could be added up. When the procedures were performed simultaneously, adding up would lead to double counting. Some costs had to be subtracted to avoid this.

In *Table 2* we represent the costs for mastectomy and primary or secondary DIEP flap reconstruction. As mentioned in previous studies, the operating time of delayed breast reconstruction and mastectomy followed by immediate reconstruction are not significantly different. As a result, the mastectomy operating time is saved.⁴ Surgeons and residents in training worked simultaneously when mastectomy and reconstruction were performed together. For these persons, no cost savings were obtained. With respect to the anaesthetist, the anaesthesiology nurse and scrub nurse the personnel costs for the mastectomy intervention was saved. With exception of the material needed for the sentinel procedure, consumable and reusable materials for the initial mastectomy were economised. The necessary material was included in the package for breast

reconstruction. Sets and instruments for the separate surgery options were all put at the team's disposal when performing the procedures simultaneously. With respect to equipment, the same input of apparatus was used for both initial breast surgery and reconstruction. Since the time needed for mastectomy was saved through immediate reconstruction, these equipment costs were also saved. As for the use of apparatus, anaesthesia cost were economized since the initial anaesthetics only had to be administered once and the anaesthetic condition had to be maintained for the longest procedure. Further, the saved reusable material also resulted in less sterilisation costs. Finally, the recovery period for DIEP flap alone or in combination with immediate reconstruction was not different. Therefore, hospital stay-costs due to the initial mastectomy procedure were eliminated.

Table 2: total costs for mastectomy and primary or secondary DIEP flap reconstruction

	Secondary reconstruction: DIEP flap +			Primary reconstruction: DIEP flap +		
	Mast.	Mast. + sentinel	Mast. + axilla	Mast.	Mast. + sentinel	Mast. + axilla
Total	€ 6,933.52	€ 6,965.08	€ 7,045.5	€ 4,486.01	€ 4,497.22	€ 4,522.41
Personnel	€ 1,412.47	€ 1,430.59	€ 1,484.97	€ 1,304.2	€ 1,313.3	€ 1,340.61
Material	€ 680.94	€ 688.37	€ 696.39	€ 637.84	€ 639.96	€ 637.84
Apparatus	€ 76.53	€ 77.77	€ 81.5	€ 61.62	€ 61.62	€ 61.62
Anaesthetics	€ 456.23	€ 460.99	€ 475.29	€ 317.73	€ 317.73	€ 317.73
Sterilization	€ 53.44	€ 53.44	€ 53.44	€ 37.66	€ 37.66	€ 37.66
Hospital-stay	€ 4,253.92	€ 4,253.92	€ 4,253.92	€ 2,126.96	€ 2,126.96	€ 2,126.96

All these cost savings together ranged from € 2,447.51 to € 2,523.09 depending on the kind of mastectomy. In other words, about 95 per cent of the initial mastectomy costs could be saved when performing an immediate breast reconstruction. This was about 35 per cent of total standard direct and indirect costs due to mastectomy and delayed breast reconstruction which could be saved through immediate reconstruction.

Discussion

Reconstruction with autologous tissue has become the preferred method of breast reconstruction for many surgeons over the last few years. The deep inferior epigastric artery perforator (DIEP) flap emerged as a refinement of the conventional myocutaneous flap of the lower abdominal wall and limits the surgical damage to the rectus abdominis muscle. Patients maintain their abdominal wall competence, flexing and rotating strength and their ability to continue all their normal activities of daily living.²¹

The debate over delayed and immediate breast reconstruction continues. Delayed reconstruction may be preferable for patients who are not able to make a well-balanced decision at the time of their mastectomy.¹⁸ It also gives a women the opportunity to appreciate her breast reconstruction.³¹ The incidence of partial necrosis of the chest wall flaps is lower and long-term differences support delaying reconstruction until radiotherapy is completed.^{4, 16}

Many authors however, do not accept these arguments. Almost all patients who opt for immediate reconstruction are subsequently pleased with their decision.^{3, 13} There is also a general consensus that the aesthetic results are superior.³⁻⁷ The inframammary fold and

other landmarks are preserved, the remaining breast tissues are soft, the skin easily assumes the normal breast contour once the volume is restored and only skin that has to be removed during the mastectomy needs to be replaced.⁴ Immediate reconstruction is also beneficial to patients from a psychosocial viewpoint. Patients report less psychological distress and more readily accept their new body image.³²⁻³⁵ The timing of reconstruction has no significant implications for the detection of local recurrence of cancer or the rate of local recurrence after 5 years.³⁶⁻³⁹ In addition, immediate reconstruction is oncologically safe and does not inhibit the treatment of recurrence.⁴⁰

In a health care environment where cost matters, it is interesting to make an economic comparison of immediate and delayed reconstruction. Standard cost calculations from the hospital's point of view indicated that about one third of direct and indirect hospital costs could be saved through mastectomy in combination with immediate reconstruction in comparison with the delayed procedure. Complications and long-term effects were not included in our study. The initial cost savings can only increase since immediate reconstruction results in better cosmetic outcomes and fewer revisional and contralateral procedures to improve symmetry are necessary.⁴¹ These data confirm the growing consensus that immediate breast reconstruction is cost effective in comparison with delayed reconstruction.

Selecting a procedure merely on costs would be wrong. Immediate reconstruction however yields the greatest patients benefit. In a growing cost conscious environment of managed care, the economic evaluation should therefore encourage the trend towards more immediate reconstructions.

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