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The cost effectiveness of acellular dermal matrix in expander–implant immediate breast reconstruction

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Summary *Background:* Expander–implant breast reconstruction is often supplemented with acellular dermal matrix (ADM). The use of acellular dermal matrix has allowed for faster, less painful expansions and improved aesthetics, but with increased cost. Our goal was to provide the first cost utility analysis of using acellular dermal matrix in two-stage, expander–implant immediate breast reconstruction following mastectomy.
Methods: A comprehensive literature review was conducted to identify complication rates for two-stage, expander–implant immediate breast reconstruction with and without acellular dermal matrix. The probabilities of the most common complications were combined with Medicare Current Procedural Terminology reimbursement codes and expert utility estimates to fit into a decision model. The decision model evaluated the cost effectiveness of acellular dermal matrix relative to reconstructions without it. Retail costs for ADM were derived from the LifeCell 2012 company catalogue for Alloderm.
Results: The overall complication rates were 30% and 34.5% with and without ADM. The decision model revealed a baseline cost increase of $361.96 when acellular dermal matrix is used. The increase in Quality-Adjusted Life Years (QALYs) is 1.37 in the population with acellular dermal matrix. This yields a cost effective incremental cost-utility ratio (ICUR) of $264.20/QALY. Univariate sensitivity analysis confirmed that using acellular dermal matrix is cost effective even when using retail costs for unilateral and bilateral reconstructions.

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Conclusions: Our study shows that, despite an increased cost, acellular dermal matrix is a cost effective technology for patients undergoing two-stage, expander—implant immediate breast reconstruction due to its increased utility in successful procedures.
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Introduction

Implant-based breast reconstructions account for the majority of post-mastectomy breast reconstructions that are performed today.[1] Conventional staged expansion, using either dual-plane or complete submuscular coverage, has been associated with high-riding implants, difficulty with inferior pole expansion, significant post-operative pain, implant migration during expansion, and lack of inferior and lateral pole coverage of the expander/implant.[2] Acellular dermal matrix (ADM) is frequently used in expander-based breast reconstruction due to its ability to provide support to the inferior-lateral pole of the implant and decreased post-operative pain. ADM also facilitates complete implant coverage, faster tissue expansion, and improved aesthetics.[2,3] With significantly increased cost,[4] yet proposed clinical benefit when using acellular dermal matrix,[5] the cost effectiveness of ADM has not previously been assessed in women undergoing two-stage, expander—implant immediate breast reconstruction. Cost utility analysis is a form of economic analysis that uses the patient's quality of life as a metric for the effectiveness of a novel clinical intervention. This study provides the first cost utility analysis of using acellular dermal matrix in staged immediate breast reconstruction.

Patients and methods

As with most novel interventions, the use of acellular dermal matrix is associated with increased cost yet improved clinical efficacy and provides the basis for cost-utility analysis. Cost-utility analysis is comprised of costs, probabilities, and utilities of various health outcomes (health states) that are used to evaluate competing interventions.

Perspective

The perspectives of a third-party payer (government) and the hospital/private practice surgeon were adopted for the decision analysis. Retail costs for the most commonly used acellular dermal matrix (Alloderm, LifeCell, Branchburg, NJ) were used for both unilateral and bilateral placement as part of the sensitivity analysis.

Health states

The relevant surgical literature was explored to properly identify the most clinically relevant and common complications associated with two-stage, expander—implant immediate breast reconstruction in patients who also underwent radiation treatment. These complications included: infection, mastectomy flap necrosis, ex-plantation, seroma, hematoma, and capsular contracture (Table 1). Patients with major infection were admitted to the hospital and were given IV antibiotics. Patients with minor infection had evidence of cellulitis which responded to oral antibiotics. Major infection resulted in implant loss while minor infection responded to antibiotics and implants were salvaged. Localized, self-limiting erythema at the site of ADM was presumed to be from a localized tissue response to the acellular dermal matrix itself and was excluded.[3] Each complication was defined as a distinct "health state" with associated probabilities, costs, and utilities for use in the decision model.

Costs

The costs for two-stage, expander—implant immediate breast reconstruction were based on U.S. Medicare technical and professional reimbursement Current Procedural Terminology (CPT) codes for inpatients corresponding to immediate breast reconstruction with tissue expander and subsequent expansion, insertion of acellular dermal matrix, and replacement of tissue expander with permanent prosthesis.

The increased cost associated with acellular dermal matrix was derived from the LifeCell company 2012 pricing catalogue which listed the Medicare CPT code corresponding to professional reimbursement for inserting acellular dermal matrix as an inpatient procedure. The medical institution receives no other financial reimbursements for the use of acellular dermal matrix. The reimbursement was the same ($214.10) regardless of the size of acellular dermal matrix used and was significantly lower than the actual cost of the material. This was added to the hospital

Table 1 Health state treatment and recovery assumptions in decision model.

Health state	Assumption	Recovery period (months)
Mastectomy flap necrosis	Debrided in main OR and closed/STSG	6
Infection (major)	Implant loss, IV abx	1
Infection (minor)	Implant salvage, oral abx	1
Explantation	Explanted in main OR, IV abx	1
Hematoma/seroma	Drained in main OR	1
Capsular contracture	Capsulectomy/ capsulotomy in main OR	1

STSG, split-thickness skin graft; OR, operating room; IV, intravenous; abx, antibiotics.

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