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Review

# 'Reconstruction: Before or after postmastectomy radiotherapy?' A systematic review of the literature

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**Abstract** ***Objective:*** The aim of this review is to investigate the effect of timing of the reconstruction and radiotherapy, with respect to complication rate and cosmetic outcome, with a special focus on the timing of the placement of the definite implant.
***Methods:*** PubMed was searched for publications between January 2000 and December 2012. Of 37 eligible studies, timing of reconstruction, type, and incidence of complications were recorded. First, we calculated the weighted mean including confidence intervals for complications and cosmetic outcome overall, and for the following subgroups: (1) Autologous reconstruction after radiotherapy; (2) Definite implant reconstruction after radiotherapy; (3) Autologous reconstruction before radiotherapy; (4) Definite implant reconstruction before radiotherapy. A second analysis was performed using only studies that directly compared group 1 versus 3 and 2 versus 4.
***Results:*** A large variation in complication rates (8.7–70.0%) and in acceptable cosmetic outcome (41.4–93.3%) was reported. The first analysis showed more complications and a higher revision rate if an implant reconstruction was performed after radiotherapy; for autologous reconstruction fibrosis occurred more often if reconstruction was applied first. The second analysis showed no significant differences in total complication rate. Only implant failure occurred more often if applied after radiotherapy (odds ratio (OR) 3.03 [1.59–5.77]). No differences were found in both patient and physician satisfaction.

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***Conclusions:*** A definite implant reconstruction placed before radiotherapy limits the rate of complications. For autologous reconstruction, less fibrosis is seen if reconstruction is performed after radiotherapy, but timing had no significant impact on total complication rate.


## 1. Introduction

Breast cancer is the most common type of cancer in women and the leading cause of cancer related mortality in women [1]. In general, surgical treatment of breast cancer can be divided into breast-conserving therapy or mastectomy, with equal survival rates in early breast cancer patients [2]. Due to the introduction of magnetic resonance imaging (MRI) [3–5], screening for BRCA-1 and BRCA-2 gene mutations [5,6], in addition to technical surgical improvements, mastectomy followed by reconstruction is increasingly being chosen as a preferred treatment option. In the case of mastectomy with reconstruction, a choice has to be made between autologous reconstruction or implant reconstruction. Both types of reconstructions can be performed immediately after mastectomy or delayed. Patients with immediate reconstruction have reported better quality of life compared to patients with a delayed breast reconstruction [7,8]. However, in some high-risk cases postmastectomy radiotherapy is indicated [9], which increases the complication rate of any reconstruction [10–15]. Hard evidence about the optimal sequence of radiotherapy and reconstruction, for different types of reconstruction is lacking. Most guidelines nowadays however, recommend delaying reconstruction, if it is preoperatively known that post-operative radiotherapy is indicated. However, in some situations, the indication for post-mastectomy radiotherapy only becomes clear after mastectomy. In that case, four situations can be discriminated, with subsequent practical clinical questions:

1) An immediate reconstruction has already been started by placing a tissue expander:
   A) Should the definite implant be placed before or after radiotherapy?

2) No reconstruction has yet been performed:
   A) Since implant reconstruction is not feasible if no tissue expanders have been placed, only an autologous reconstruction is possible. Should this be done before or after radiotherapy?

3) An autologous reconstruction has been performed:
   A) What is the effect of radiotherapy on the complication rate and cosmetic outcome?
   B) Is this effect different than if the reconstruction would have been performed after radiotherapy?

4) A complete immediate implant reconstruction has been performed:
   A) What is the effect of radiotherapy on the complication rate and cosmetic outcome?

Recently, five other reviews [16–20] on reconstruction and radiotherapy have been published. All these papers only dealt with part of our questions, or different questions.

The aim of the current study was therefore, to investigate the effect of timing of the reconstruction and radiotherapy, with respect to the complication rate and cosmetic outcome, with specific attention to the optimal timing of a definite implant in relation to the radiotherapy.

## 2. Methods

The PUBMED database was searched for the period between January 2000 and December 2012. The following search strategy was used: (((((((((breast cancer)) OR (breast tumour)) OR (breast tumour)) OR (breast neoplasms)) OR ('Breast Neoplasms'[Mesh]))) AND ((((radiotherapy)) OR (radiation therapy)) OR ('Radiotherapy'[Mesh]))) AND ((((ablative surgery)) OR (mastectomy)) OR ('Mastectomy'[Mesh]))) AND ((((breast reconstruction)) OR ('Mammaplasty'[Mesh])) OR (mammaplasty)). Further, references from selected articles were searched as well.

### 2.1. Selection criteria of the studies

#### 2.1.1. Design of studies and study population

Articles had to be written in English or Dutch and were only included if they reported over at least 20 patients. Due to the lack of randomised trials, all study designs apart from case reports were included. We also included part of a study population if only that part fulfilled the selection criteria. We only included studies of patients with primary breast cancer. Studies concerning patients treated for recurrence or secondary breast cancer were excluded, since previous radiotherapy and/or surgery could bias the results.

#### 2.1.2. Types of interventions

Articles had to report the type of reconstruction and were divided into the category autologous or implant reconstruction. A reconstruction made with both