

# Breast reconstruction during the COVID-19 pandemic

## A systematic review

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### Abstract

**Background:** The novel coronavirus disease 2019 (COVID-19) has changed people's way of life and posed great challenges to plastic surgery. Most of plastic surgeries are considered elective surgeries and are recommended to be delayed. But breast reconstruction in plastic surgery is special. Doctors' associations from different countries have different rules on whether breast reconstruction surgery should be delayed. For the controversial topic of immediate breast reconstruction in the COVID-19 pandemic, we conducted this study.

**Methods:** We searched English databases such as PubMed, Cochrane Library, and Embase. The publication time of papers was set to be from the establishment of the databases to February 2021. All studies on immediate breast reconstruction in the COVID-19 pandemic were included in our study.

**Results:** A total of 6 studies were included in this study. Four studies recommended the use of breast implants or tissue expansion for breast reconstruction surgery and had good results in their clinical practice. In addition, 1 study planned to use autologous free tissue transfer for breast reconstruction, and 1 study planned to use microsurgical techniques for breast reconstruction. But these 2 technologies are still in the planning stage and have not yet been implemented.

**Conclusions:** In our opinion, breast cancer surgery belongs to confine operation, and breast reconstruction surgery should be performed immediately after the completion of breast cancer surgery. We recommend the use of breast implants for breast reconstruction surgery during the COVID-19 epidemic. Due to the limitations of the study, our proposed protocol for breast reconstruction surgery during the COVID-19 epidemic needs to be further validated in clinical studies.

**Abbreviations:** COVID-19 = coronavirus disease 2019, SARS-CoV-2 = severe acute respiratory syndrome coronavirus-2.

**Keywords:** breast reconstruction, COVID-19, plastic surgery, SARS-CoV-2

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Data sharing not applicable to this article as no datasets were generated or analyzed during the current study.

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## 1. Introduction

The novel coronavirus disease 2019 (COVID-19), which broke out in December 2019, has spread around the world.<sup>[1]</sup> It has changed people's way of life and posed great challenges to plastic surgery.<sup>[2–4]</sup> Most of plastic surgeries are considered elective surgeries and are recommended to be delayed.<sup>[5]</sup> But breast reconstruction in plastic surgery is special. It is important for the confidence and quality of life of breast cancer patients.<sup>[6]</sup> Doctors' associations from different countries have different rules on whether breast reconstruction surgery should be delayed. American Society of Breast Surgeons had proposed a priority group for breast cancer surgery and suggested immediate breast reconstruction. They recommended that it is best to use a tissue expander or breast prosthesis and postpone breast reconstruction surgery with an autograft. But the Argentine Society of Breastology had recommended postponing all immediate breast reconstruction.<sup>[7]</sup> For the controversial topic of immediate breast reconstruction in the COVID-19 pandemic, we conducted this study. It is hoped that the results of our study can provide a reference for plastic surgeons to conduct immediate breast reconstruction surgery in the COVID-19 pandemic.

## 2. Methods

### 2.1. Search strategy

We searched English databases such as PubMed, Cochrane Library, and Embase. The publication time of papers was set to

be from the establishment of the databases to February 2021. Keywords retrieved were “Severe Acute Respiratory Syndrome Coronavirus-2 (SARS-CoV-2)”, “COVID-19”, “Mammoplasty”, “Breast Reconstruction”, “Plastic Surgery”. There was no language restriction for this search.

## 2.2. Study selection

**2.2.1. Inclusive criteria.** Studies on immediate breast reconstruction in the COVID-19 pandemic. The subjects were patients undergoing immediate breast reconstruction, not animals or cells. Specific measures for immediate breast reconstruction were found in studies.

**2.2.2. Exclusive criteria.** The following were the exclusion criteria: duplicate publications in the databases; no specific measures for immediate breast reconstruction were found in studies; the subjects were not patients undergoing immediate breast reconstruction.

## 2.3. Ethical review

This study is a secondary analysis of published articles, and therefore does not require the approval of the Medical Ethics Committee. This article does not contain any studies with human participants or animals performed by any of the authors. For this type of study informed consent is not required.

## 2.4. Data extraction and data synthesis

Two researchers independently extracted the author’s name, publication time, study area, and specific measures for immediate breast reconstruction. The types of articles included in this study made it impossible to perform a quantitative analysis, and so the findings were pooled and presented in a narrative form and in tables.

## 3. Results

After searching databases, a total of 86 related articles were retrieved. Two researchers screened the studies by reading abstracts and full texts, and a total of 6 articles<sup>[8–13]</sup> were included in this study. The study selection flow is shown in Figure 1. We summarized the 6 included studies, as shown in Table 1.

In Sanchez et al’s protocol,<sup>[8]</sup> physicians assessed patients’ risk of COVID-19 infection by phone prior to admission. Upon arrival to the hospital, patients underwent severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) blood quick testing. Patients with a negative test received a nasopharyngeal swab (real-time reverse transcription-polymerase chain reaction assay). Patients infected with SARS-CoV-2 were treated in isolation. Patients who were not infected with SARS-CoV-2 were observed for at least 4 days and swabs were repeated every 48 hours. If 2 consecutive swabs resulted negative with the patient asymptomatic, surgical treatment was delivered. Reconstruction was preferentially performed with a pre-pectoral implant or a tissue expander. After the patients were discharged from hospital, they continued to restrict contact with their families. Postoperative visits were scheduled in a special area of the hospital with direct external access, to limit risk of COVID-19 exposure. An emergency helpline was established that patients could promptly access for any postoperative need.

Lisa et al<sup>[9]</sup> and Perez-Alvarez et al’s protocols<sup>[10]</sup> were for physicians to examine patients pre-operatively for SARS-CoV-2 infection. Reconstructive breast surgery was performed for patients who met the surgical requirements. Patients were subjected to strict anesthesia and pain control during the operation. Reconstruction was performed with a pre-pectoral implant. Postoperative remote medical guidance was given to every patient. They called this protocol the sameday surgery program.

Specht et al’s protocol<sup>[11]</sup> involved patients communicating with oncologists and plastic surgeons via video conferencing before surgery. Doctors used the Internet to make specific treatment plans for their patients. Patients were treated with a strict total intravenous anesthesia regimen during the operation to maximize patient comfort and avoid postoperative nausea and vomiting. Reconstructions were performed with pre-pectoral implants. After all patients were discharged from hospital, the plastic surgeons kept in touch with the patients through the network and dealt with the patients’ problems. Patients’ travel should be minimized and nosocomial exposure to SARS-CoV-2 should be limited.

Masud et al’s protocol<sup>[12]</sup> involved low-risk patients attending pre-operative virtual forum consultations with surgeons, specialist nurses, and physical therapists. The diagnosis and treatment plans can be formulated through virtual forum consultation to shorten the time of face-to-face consultation. Patients who met the surgical requirements were operated on by autologous free tissue transfer for breast reconstruction. After breast reconstruction surgery, the virtual breast reconstruction forum can be fully played to provide follow-up services for patients.

Ali et al’s protocol<sup>[13]</sup> was for patients to discuss via the Internet with a multidisciplinary breast team consisting of oncologists, breast teams, and radiologists. After 2 weeks of self-isolation, the patient was admitted to the hospital for COVID-19 screening, and the patient underwent breast reconstruction surgery after 2 days of hospital isolation observation. The procedure was immediate microsurgical breast reconstruction. All drainage tubes were removed on the second day after surgery and discharged on the third day after surgery. Postoperative guidance was conducted by telephone.

## 4. Discussion

The COVID-19 has lasted for more than a year, and more than 100 million people worldwide have been SARS-CoV-2 infected. Medical systems in many countries and regions have been severely affected.<sup>[14]</sup> In order to treat COVID-19 patients, many plastic surgery procedures have been postponed. However, breast reconstruction surgery is carried out immediately after radical breast cancer surgery, which has an important impact on the quality of life and mental health of breast cancer patients.<sup>[15]</sup> Doctors around the world have debated the safety of breast reconstruction surgery during the COVID-19 pandemic. In our opinion, breast cancer surgery belongs to confine operation, and breast reconstruction surgery should be performed immediately after the completion of breast cancer surgery on the premise that patients are protected from SARS-CoV-2 infection.

Through the review of the included literature, we found that the similarities of the breast reconstruction surgery plans developed by the authors during the COVID-19 epidemic were as follows: Pre-operative consultations of patients were conducted through the Internet, and comprehensive treatment plans

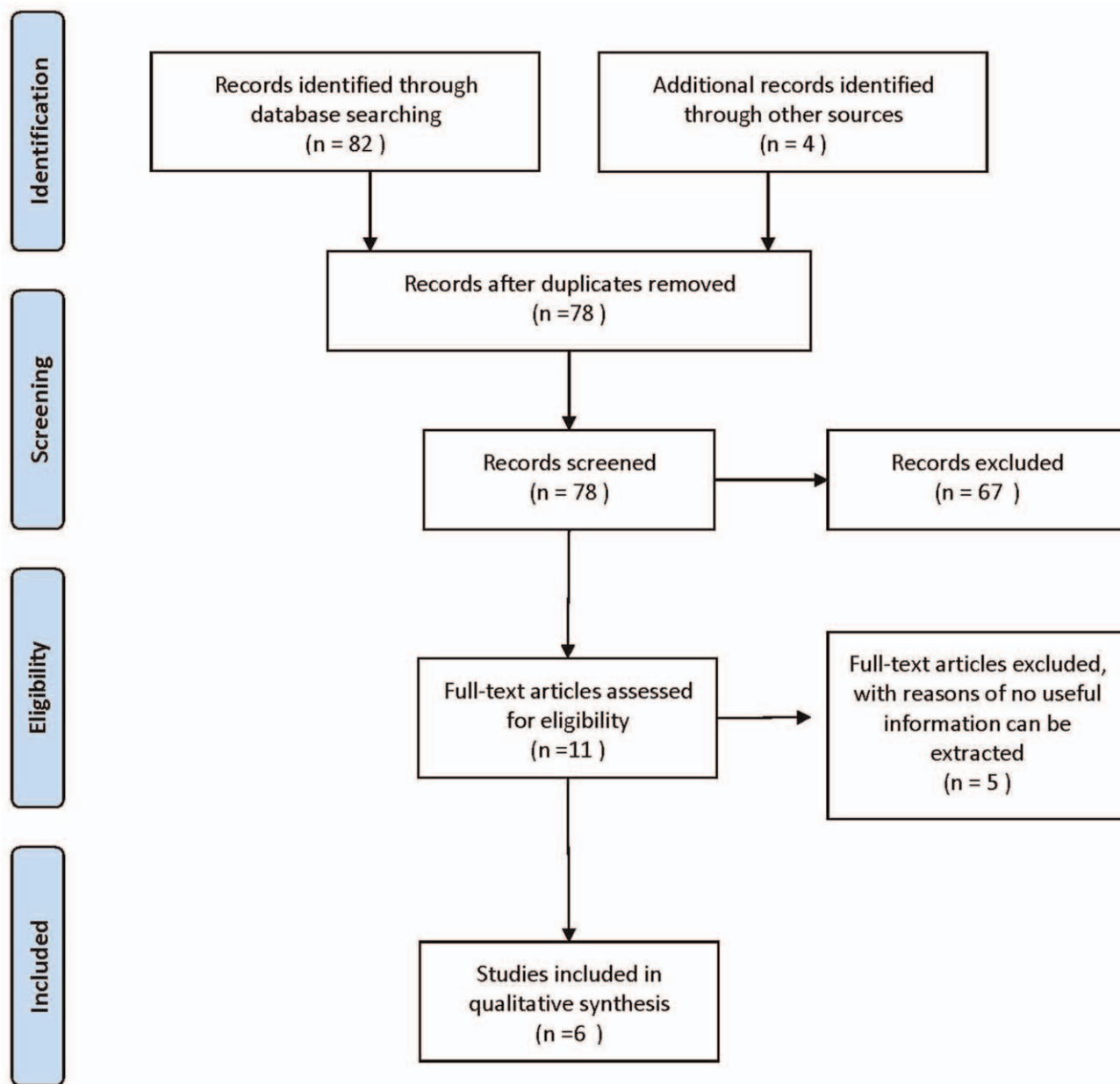


Figure 1. PRISMA flow diagram.

were developed for patients through multidisciplinary cooperation. Patients were rigorously screened for COVID-19 pre-operatively to ensure that they were not infected with SARS-CoV-2. Breast reconstruction should be performed with implants as far as possible to reduce the operative time and postoperative recovery time. Strict anesthesia and pain control should be carried out to make the patients recover from the anesthesia as soon as possible, and the pain should be the minimum level to ensure the patients' early discharge from hospital. Postoperative medical services should be carried out through the Internet or telephone to reduce the face-to-face contact between medical staff and patients. In conclusion, 3 key points should be noted in breast reconstruction surgery during the COVID-19 epidemic: Strict screening to ensure that patients were not infected with SARS-

CoV-2 before admission; Minimize contact time between medical staff and patients; Minimize the length of hospital stay and recovery time of patients.

Of the 6 included studies, 4 studies<sup>[8-11]</sup> recommended the use of breast implants or tissue expansion for breast reconstruction surgery and had good results in their clinical practice. In addition, 1 study<sup>[12]</sup> planned to use autologous free tissue transfer for breast reconstruction, and 1 study<sup>[13]</sup> planned to use microsurgical techniques for breast reconstruction. But these 2 technologies are still in the planning stage and have not yet been implemented. Therefore, the specific effects of these 2 technologies need to be observed and studied. After a systematic review of the included articles, we recommend the use of breast implants for breast reconstruction surgery during the COVID-19 epidemic. This

**Table 1****Summary table of included studies.**

Study	Year	Country	Surgical method	Specific measures
Sanchez et al <sup>[8]</sup>	2020	Italy	Reconstruction was preferentially performed with a pre-pectoral implant or a tissue expander	<ol style="list-style-type: none"> <li>1. Prior to hospitalization surgical candidates were contacted by phone to assess if they had experienced any symptom related to a COVID-19 infection or had contacts with anyone known or suspected to have COVID-19 in the last 14 days.</li> <li>2. Upon arrival to the hospital, patients underwent SARS-CoV-2 blood quick testing. Patients with a negative test received a nasopharyngeal swab (real-time RT-PCR assay). If the swab resulted negative, patients were admitted to the ward to complete pre-operative routine assessments.</li> <li>3. If SARS-CoV-2 quick testing was positive, patients were confined in a dedicated unit. An initial swab was performed and if SARS-CoV-2 disease was confirmed, surgical treatment for breast cancer was temporarily suspended.</li> <li>4. If the initial swab was negative, the patient remained in observation for at least 4 days, repeating swabs every 48 hours. If 2 consecutive swabs resulted negative with the patient asymptomatic, surgical treatment was delivered.</li> <li>5. Patients were discharged with drainages still in place, properly instructed on how to manage them at home. They were also instructed to limit contacts with relatives at home, wear surgical face masks, wash hands frequently, and measure body temperature daily. Postoperative visits were scheduled in a special area of the hospital with direct external access, to limit risk of COVID-19 exposure. An emergency helpline was established that patients could promptly access for any postoperative need.</li> </ol>
Lisa et al <sup>[9]</sup>	2020	Italy	Implant breast reconstruction using implants, either 2-stage expander/implant or direct to implant	<ol style="list-style-type: none"> <li>1. Pre-operative recommendations: subdivision of plastic surgery team in subgroups; double-step screening for detection of any positive case before surgery.</li> <li>2. Anesthesia and pain control: proper protection of anesthesiology team and nurses; videolaryngoscopy instead of classical tracheal intubation, which adopts laryngoscope; intercostal blocks, thoracic paravertebral blocks, and the interfascial blocks of the pectoral region to reduce postoperative pain and help fast dismiss.</li> <li>3. Intraoperative recommendations: proper protection of the operators; immediate breast reconstruction adopting implants (tissue expanders or breast prosthesis); symmetrization of contralateral healthy breast postponed; pedicled flaps or microsurgical flaps postponed.</li> <li>4. Postoperative recommendations: reduction of postoperative consultations; tutoring patients with telemedicine to avoid access to the hospital.</li> </ol>
Perez-Alvarez et al <sup>[10]</sup>	2020	America	Pre-pectoral implant reconstruction	<ol style="list-style-type: none"> <li>1. The protocol incorporates both enhanced recovery after anesthesia pathway and intraoperative liposomal bupivacaine field blocks. The majority of patients receive pre-pectoral implant reconstruction, which is associated with significantly less pain than when the pectoralis muscle is manipulated.</li> <li>2. Initiating a standard sameday surgery program where patients have the opportunity to safely recover at home with a direct point of contact for issues has the potential for improved outcomes on many aspects. Notably, patients have improved psychological well-being, avoid exposure to nosocomial infections, alleviate health care system burden, and provide cost savings.</li> </ol>
Specht et al <sup>[11]</sup>	2020	America	Tissue expander or direct-to-implant breast reconstruction	<ol style="list-style-type: none"> <li>1. Pre-operative: many patients underwent surgical oncology and plastic surgery consultation via video conferencing with patient pictures viewed by the plastic surgeon. Patients were provided educational materials newly created by the multidisciplinary team to limit the need for in-person postoperative visits, including access to online videos to review wound and drain care.</li> <li>2. Intraoperative: once in the operating room, the planned surgical procedures were performed by the surgical oncologist and plastic surgery teams. Anesthetic was administered using a strict total intravenous anesthesia protocol along with administration of at least 2 anti-emetics in order to maximize patient comfort and avoid postoperative nausea and vomiting.</li> </ol>

*(continued)*

**Table 1**  
(continued).

Study	Year	Country	Surgical method	Specific measures
Masud et al <sup>[12]</sup>	2020	England	Autologous free tissue transfer for breast reconstruction	<ol style="list-style-type: none"> <li>3. Postoperative: all patients were contacted through virtual patient portal by the plastic surgery clinic 1 day after discharge to ensure that the patient was doing well and to answer any questions. During the crisis, in an effort to minimize patient travel and limit nosocomial viral exposure, these visits were converted to virtual with visiting nurses performing drain removal at the patient's home or local hospital.</li> <li>1. With limited resources and time available, it was important to prioritize patients and maintain discussion of reconstruction on a trust director level agenda.</li> <li>2. Low risk patients attend a pre-operative virtual forum consultation with surgeons, specialist nurses, and physio-therapists. This is where most information is provided, in order to reduce the length of the subsequent face-to-face consultation. The enhanced recovery protocol includes patient discharge on day 2.</li> <li>3. Initially they booked low-risk patients whom were accepting of the additional hazard of COVID-19. A powerful tool for resuming reconstruction was the reconstruction forum to discuss cases for immediate autologous reconstruction. They were closely monitoring our service, and depending on the future epidemiology of COVID-19, they will continue to adapt our pathway.</li> </ol>
Ali et al <sup>[13]</sup>	2020	England	Immediate microsurgical breast reconstruction	<ol style="list-style-type: none"> <li>1. Perioperative pathway: all patients were discussed in breast multidisciplinary teams with oncology, breast team, and radiology. Breast reconstruction webinar via Microsoft teams. Limited face to face consultation with social distancing measures and appropriate personal protective equipment, discuss reconstructive options that the patient is considering. COVID-19 screen as per hospital guidelines, self isolation currently 2 weeks prior to admission and COVID-19 screen 2 days prior to admission.</li> <li>2. Enhanced recovery after surgery pathway: admission on day of surgery, temperature check and screening routine, cancelled if any symptoms related to COVID-19. Total intravenous anesthesia protocol. Early nutrition. Day 1, breast drain out. Day 2, all remaining drains to be removed. Day 3, telephone consultation in AM with breast reconstruction clinical nurse specialist. Day 7, dressing clinic review for wound review.</li> </ol>

COVID-19 = coronavirus disease 2019, RT-PCR = reverse transcription-polymerase chain reaction.

surgical approach is more conducive to patient recovery, is less prone to postoperative complications, and can ensure the safety of patients during the COVID-19 epidemic as much as possible.

This systematic review included 6 studies, from Italy, the United States, and the United Kingdom. Most of the studies included in this study were experience introductions and lack of relatively objective clinical data, so data combination and meta-analysis cannot be carried out. This study conducted a systematic review of the relevant treatment options of breast reconstruction surgery performed by various research teams during the COVID-19 epidemic, and the conclusions were limited. Since the COVID-19 epidemic situation was different in different countries and regions, the conclusion of this study only provided a certain reference for doctors in different countries to perform breast reconstruction surgery during the COVID-19 epidemic. Our proposed protocol for breast reconstruction surgery during the COVID-19 epidemic needs to be further validated in clinical studies.

### Author contributions

**Conceptualization:** Pengfei Sun, Xia Cai.

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**Writing – review & editing:** Pengfei Sun, Di Xu, Xia Cai.

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