

# Cryoablation for Breast Implant-Associated Desmoid Tumors

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<b>Background</b>	Desmoid tumors are benign tumors of musculoaponeurotic structures that are locally aggressive and highly recurrent. Rarely, desmoids associated with breast implants have been diagnosed in the breast or chest wall. In the literature, fewer than forty reported cases of desmoids in the breast or chest wall are associated with breast implants. We reviewed each, weighing risks, benefits, and outcomes. Historically, desmoid tumors of the breast were treated with a combination of surgery, radiotherapy, and hormone therapy. CT-guided percutaneous cryoablation is a minimally invasive treatment option for extra-abdominal desmoids.
<b>Summary</b>	We report a case of a chest wall desmoid posterior to a silicone gel implant treated with percutaneous cryoablation. The choice was made to proceed with CT-guided percutaneous cryoablation. Tumor regression was noted without any complication to the implant.
<b>Conclusion</b>	Cryoablation is a safe and effective management option for desmoid tumors associated with silicone breast implants.
<b>Key Words</b>	desmoid tumor; breast implant; cryotherapy; cryoablation; saline implant; silicone implant

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## Case Description

Desmoid tumors are uncommon, benign tumors of musculoaponeurotic structures with high rates of local recurrence.<sup>1,2</sup> While the true etiology of desmoid tumors is unknown, they are thought to arise from a somatic beta-catenin activating mutation.<sup>3</sup> Desmoids are estimated to comprise 0.2% of all breast tumors.<sup>4</sup> In the breast, desmoids may result from surgical tissue trauma and implants.<sup>4</sup> Historically, extra-abdominal desmoid tumors have been managed with surgical resection, with local recurrence rates as high as 89%.<sup>1</sup> Cryoablation is a minimally invasive option that may reduce the need for aggressive surgical resections and radiation or systemic therapy.<sup>5</sup> We report a case of a chest wall desmoid associated with a silicone breast implant treated with CT-guided percutaneous cryoablation.

A 41-year-old female in good health was referred to our institution with a breast-implant-associated mass causing chest pressure for four months. Five years prior, she underwent bilateral breast augmentation with sub-pectoral placement of textured Allergan Natrelle 410 silicone implants. Initial MRI imaging showed a large, well-defined tumor located behind the right subpectoral implant, with minimal invasion into at least one of the intercostal muscles (Figure 1). CT-guided core biopsy revealed spindle cell proliferation positive for beta-catenin, consistent with a desmoid tumor diagnosis.

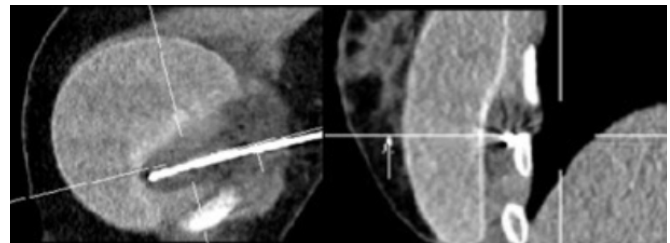
**Figure 1.** MRI at Presentation, Five Months Pre-cryoablation. Published with Permission



The image demonstrates a circumscribed tumor measuring 2.7 × 9.9 × 10.2 cm located posterior to the right subpectoral implant. Evidence of intercostal muscle invasion is present.

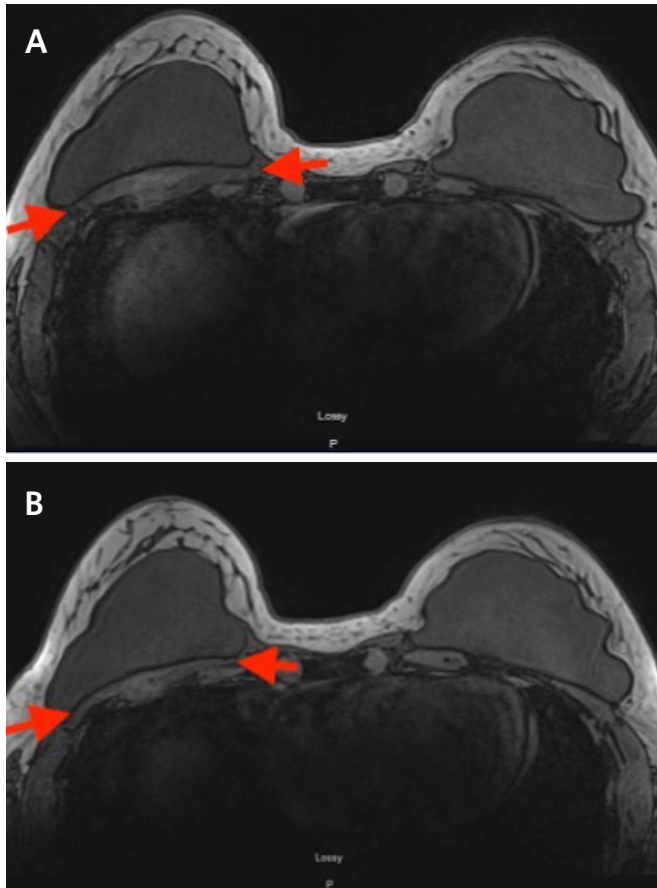
While surgical resection offered definitive removal of the tumor, it necessitated sacrificing intercostal muscle and ribs to achieve clear margins. Instead, we proposed an alternative minimally invasive approach through percutaneous cryoablation. Due to the pandemic, the patient received one session of CT-guided percutaneous cryoablation five months after her initial presentation (Figure 2), which was delayed.

**Figure 2.** Procedural CT Images. Published with Permission

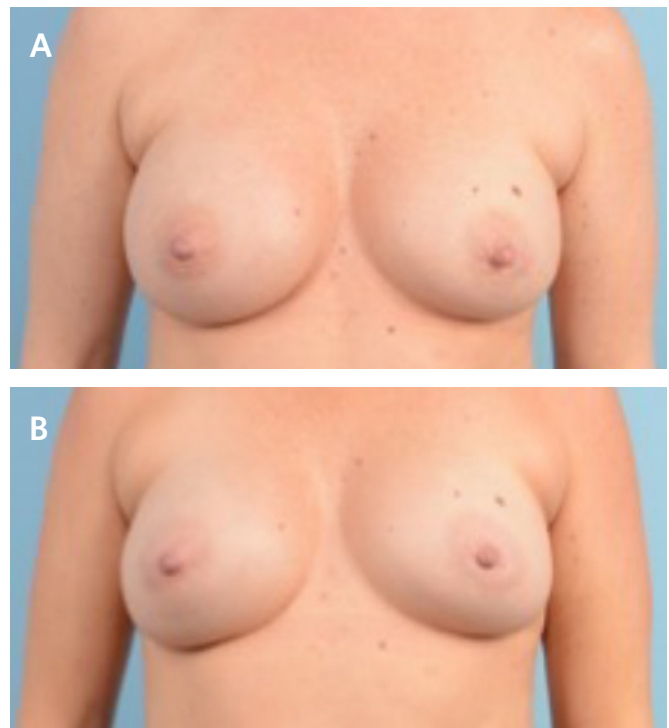


Retro-implant cryoablation probe (\*) positioned under CT guidance to predominantly treat the portion of the desmoid that had invaded the chest wall

Cryotherapy was performed on the patient's desmoid tumor without complications. Eight weeks later, a significant reduction in tumor size was observed at the follow-up appointment (Figure 3A). Since the patient was asymptomatic, the decision was made to adopt a watchful waiting approach and forego further ablation. Monitoring continued, and after five months, imaging showed ongoing tumor involution, although a small segment of the pedicle remained between the ribs and intercostal muscle (Figure 3B and Figure 4). Given the initial tumor size, complete regression was not expected. A plan was established for regular MRI surveillance and yearly clinical follow-up as long as the patient remained free of symptoms. Unfortunately, the patient has not returned for repeat imaging or scheduled appointments.

**Figure 3.** MRI Two Months Postcryoablation. Published with Permission

A) Axial T2-weighted MRI scan at two months post-cryoablation shows a decrease in size of the desmoid tumor to 8.9 × 8.2 × 1.9 cm. B) Scan at five months post-cryoablation demonstrates further involution to 8.5 × 7.8 × 1.3 cm.

**Figure 4.** Frontal Views A) Before and (B) After Cryotherapy. Published with Permission

Panel B shows improved chest wall symmetry following tumor ablation, with no evidence of external scarring.

## Discussion

A review of the literature reveals less than forty documented cases of desmoid tumors associated with breast implants.<sup>5-33</sup> These tumors have been found with both saline and silicone implants in both reconstruction and cosmetic breast procedures. According to the literature, the mean interval between implant placement and desmoid development is approximately 4.7 years, ranging from 1.6 to 20 years. Historically, treatment of symptomatic extra-abdominal desmoids has involved a combination of expectant management, surgery, radiotherapy, chemotherapy, and hormonal therapy.

Surgical resection remains the mainstay of treatment for desmoid tumors arising in association with breast implants. Achieving negative margins often necessitates aggressive resections, followed by reconstructive procedures. However, recurrence rates following surgical excision can be substantial, as evidenced by six documented cases.<sup>17,19,21,23,26,28</sup>

Radiation therapy is often used as an adjuvant to surgical resection and can also be used as the primary treatment for progressive desmoids.<sup>3,34</sup> However, its long-term effects, such as soft tissue fibrosis, lymphedema, and capsular contracture of the breast implant, pose significant limitations. Chemotherapy has proven useful as adjuvant therapy or for local control rather than as a curative option.<sup>10,34,35</sup> Anti-estrogen therapy has also been explored due to the suspected link between estrogen and desmoid tumor development.<sup>3,34</sup>

As our understanding of desmoid tumors evolves, concerns regarding surgical risks and recurrence rates have prompted the exploration of alternative treatments. Cryoablation emerges as a promising method for the treatment of extra-abdominal desmoid tumors, functioning as either a primary or salvage therapy. This process involves freeze-thaw-freeze cycles to induce cellular injury. Water movement in and out of cells during these cycles causes irreversible damage, while intracellular ice crystal formation further damages organelles, triggering apoptosis.<sup>36</sup> Early data is encouraging, with clinical response rates of 90% and disease-free survival rates of up to 82.3% (range: 59.1-82.3%) at 24 months post-procedure.<sup>5,35,37</sup> Cryoablation offers additional benefits, including significant symptomatic relief even in cases of recurrence or partial ablation.<sup>5,9,35,37,38</sup> Furthermore, it can often be performed as an outpatient procedure under local anesthesia. Image guidance (ultrasound, CT, or MRI) minimizes complication risks, resulting in less scarring compared to surgery or radiation therapy.<sup>37</sup> Nerve injury, the most common complication, occurs in approximately 7% of patients based on our institutional data.<sup>33</sup> When performing cryoablation near the chest wall in the breast, intercostal nerves are most susceptible to damage.

Recently, Kulkarni et al. reported successful cryoablation for a recurrent breast-implant-associated desmoid after discontinuing a tyrosine kinase inhibitor.<sup>9</sup> After undergoing two sessions of cryoablation, the patient remained disease-free and asymptomatic at her nine-month follow-up with no implant complications.<sup>9</sup> We present the first case of cryoablation as a first-line therapy for this condition. This aligns with the 2021 NCCN Guidelines endorsing ablation for extra-abdominal desmoids.<sup>39</sup> While our patient did not achieve complete tumor ablation, she achieved a significant clinical response without implant issues. Surgical resection would have caused a large soft tissue and rib defect requiring reconstruction. Cryoablation offered a minimally invasive alternative with a low complication profile.

## Conclusion

Despite the exceptional rarity of implant-associated breast desmoids, timely diagnosis and intervention are crucial for optimizing patient well-being. Cryotherapy, a well-established treatment for extra-abdominal desmoid tumors, offers a safe and effective approach in this context while preserving breast implant integrity, making it a valuable option.

## Lessons Learned

This case emphasizes considering alternative treatments due to the high-risk nature of surgery and desmoid tumor recurrence. Cryoablation offers several advantages. Firstly, it is an outpatient procedure that minimizes complications and scarring compared to traditional surgery. Secondly, image guidance during the procedure enhances its safety and effectiveness. While nerve injury remains a potential concern, careful procedural planning and execution can mitigate this risk.

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